How Computers Entered the Classroom, 1960–2000

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How Computers Entered the Classroom, 1960–2000

Historical Perspectives

Edited by
Carmen Flury and Michael Geiss

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Carmen Flury, Michael Geiss

Computers in Europe's Classrooms: An Introduction

Abstract: As new information technology became more prevalent in more sectors of society and industry during the 1970s and 1980s, people were confronted with new skill requirements in their professional as well as their personal lives. The concept of computer literacy as the basic skills and knowledge needed by everyone to participate fully in society and the economy became increasingly relevant to governments, educational policy makers and educators across Europe. However, historical sources point to a plethora of different understandings and wordings of computer education and computer literacy, as well as an abundance of different pedagogical approaches to the introduction of computers into the classroom. Similarly, existing literature highlights the involvement of various interest groups in the introduction of computers in schools, including students, parents, teachers, educators and policy makers, as well as manufacturers and vendors of computer technology. Exploring the history of how computers have entered the classroom in Europe through national and transnational case studies can shed light on the different facets and dynamics of the introduction of computer technology in education and, in particular, how different stakeholders and coalitions have negotiated and shaped this process.

Keywords: computer education; Europe; case studies; national; transnational; history

Towards the end of the 20th century, electronic computers became steadily smaller, more affordable, more powerful, and increasingly connected.[1] More people gained access to digital devices and computers could be used for more tasks in business

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1 Thomas Haigh and Paul E. Ceruzzi, *A New History of Modern Computing* (Cambridge, MA: MIT Press, 2021); Kevin Driscoll, *The Modem World* (New Haven: Yale University Press, 2022); Gleb J. Albert, "Der vergessene ‚Brotkasten'. Neue Forschungen zur Sozial- und Kulturgeschichte des Heimcomputers," *Archiv für Sozialgeschichte* 59 (2019): 495–530.

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and everyday life, albeit this democratization of computer technology was neither a linear nor a smooth process.[2] Digital technologies gradually permeated interactions within the spheres of home, work, education, and leisure. This transformation of the computer into a mass consumer product also saw the rise of a budding home computing culture. A growing body of literature is concerned with how people formed communities of hobbyists and hackers where knowledge of computing was formed and circulated.[3] Early hobby computer users in the 1970s were often self-taught and built their own simple home computers from "computer kits", containing a printed circuit board and the necessary electronic components, following the instructions shared in electronics hobbyists' magazines or within their own communities.[4] Only the availability of pre-assembled microcomputers at an affordable price, and the increase in user-friendly software during the 1980s allowed for computers to become less intimidating to a growing number of consumers.[5]

Computers and Education

As the use of new information technology became widespread across more spheres of society and industry, people were confronted with new skill demands not just in the workplace, but also in their private lives. To be able to operate a

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2 Frank Bösch, "Wege in die Digitale Gesellschaft. Computer als Gegenstand der Zeitgeschichtsforschung," in *Wege in die Digitale Gesellschaft: Computernutzung in der Bundesrepublik 1955–1990*, ed. Frank Bösch (Göttingen: Wallstein, 2018), 7–36; Martin Campbell-Kelly et al., *Computer: A History of the Information Machine* (Boulder, CO: Westview Press, 2014), 229–305; Thomas Haigh, *Finding a Story for the History of Computing* (Siegen: Universität Siegen, 2018), https://doi.org/10.25969/mediarep/3796; Malte Thießen, "NRW 2.0: Zur Digitalgeschichte eines Landes von 1960 bis heute," *Geschichte im Westen* 34 (2019): 65–94.

3 e. g., Benjamin Thierry, "'Révolution 0.1'. Utilisateurs et communautés d'utilisateurs au premier âge de l'informatique personnelle et des réseaux grand public (1978–1990)," *Le Temps des Médias* 18 (2012): 54–64; Gerard Alberts and Ruth Oldenziel, eds., *Hacking Europe: from computer cultures to demoscenes* (New York: Springer, 2014); Zbigniew Stachniak, "Red Clones: The Soviet Computer Hobby Movement of the 1980s," *IEEE Annals of the History of Computing* 37 (2015): 12–23, https://doi.org/10.1109/MAHC.2015.11; Jaroslav Švelch, *Gaming the Iron Curtain: How Teenagers and Amateurs in Communist Czechoslovakia Claimed the Medium of Computer Games* (Cambridge, MA: MIT Press, 2018); Julia Gül Erdogan, *Avantgarde der Computernutzung. Hackerkulturen der Bundesrepublik und der DDR* (Göttingen: Wallstein, 2021).

4 Haigh and Ceruzzi, *New History*, 172–173.

5 Victoria E. M. Cain, *Schools and Screens: A Watchful History* (Cambridge, MA: The MIT Press, 2021), 144–145.

computer at all, a certain degree of technical skill was required.[6] The advent of the microcomputer, thus, triggered the spillover from computer technology education into higher to vocational education and training, and finally into general education for all. The early discussions in Europe in the 1960s and 1970s on computer education were directly related to developments in universities and the computer industry, but also to broader trends in society. As soon as professional careers could be pursued in the computer industry, computer-related jobs also became relevant in terms of educational policy. While the first curricula had been very technical, the advocates of computer education in schools now pursued broader approaches. However, even in the 1970s, computer education remained very much centred on machines.[7] In the late 1960s, the Organisation for Economic Co-operation and Development (OECD) turned its attention to computer education. This was in line with the OECD's longstanding commitment to promoting educational technology as a critical means to future-oriented education. The computer was seen in the context of other educational media that were intended to make learning more stimulating and efficient. In particular, the OECD's Centre for Educational Research and Innovation (CERI) gave a decisive boost to the discussion of computer education.[8]

Over the course of the 1980s, computers became more widely considered as a promising technology in education,[9] which prompted governments across Europe to introduce computer literacy programmes. The notion of computer literacy as a basic set of skills and knowledge required by everyone to fully participate in society and economy became more pertinent to educators and educational policymakers. Computer education, in one form or another, was subsequently introduced as part of general schooling in many industrialized countries, either included in regular subject area courses, as a subject in its own right, or as an elective course. However, computers were introduced into schools not only to teach pupils how

6 Laine Nooney, Kevin Driscoll and Keira Allen, "From Programming to Products: Softalk Magazine and the Rise of the Personal Computer User," *Information and Culture* 55 (2020): 108, https://doi.org/10.7560/IC55201.

7 Richard Capel, "Social Histories of Computer Education: Missed Opportunities?," in *Technological Literacy and the Curriculum*, ed. John Beynon and Hughie Mackay (London: The Falmer Press, 1991), 38–65.

8 Barbara Hof and Regula Bürgi, "The OECD as an Arena for Debate on the Future Uses of Computers in Schools," *Globalisation, Societies and Education* 19, no. 2 (2021): 154–166, https://doi.org/10.1080/14767724.2021.1878015.

9 Neil Selwyn, "Learning to Love the Micro: The discursive construction of 'educational' computing in the UK, 1979–89," *British Journal of Sociology of Education* 23 (2002): 427–443, https://doi.org/10.1080/0142569022000015454; Tom Lean, "Mediating the microcomputer: The educational character of the 1980s British popular computing boom," *Public Understanding of Science* 22 (2012): 546–558, https://doi.org/10.1177/0963662512457904.

to use them for their future careers and private lives, but also to reimagine and transform the ways children learned and teachers taught.

The examination of historical sources from different countries and origins reveals a wealth of different understandings and wordings of computer education. Informatics, computer science, information and communication technology education, or computer instruction are just a few examples. At times, the same terms are used with different meanings; in other cases, different words are used in diverse contexts to refer to the same – or at least similar – idea or concept. Thus, the fuzzy terms used by historical actors are inherently problematic, as they do not help to clearly distinguish and define various pedagogical approaches in introducing computers into classrooms. Rather, it is necessary to carefully assess each case and examine what historical actors conceived or implemented under the guise of these various concepts.

As a general distinction, approaches to introducing computers into classrooms can be distinguished into two broad categories. On the one hand, computer-aided instruction or learning (CAI/CAL) describes efforts to bring computer technology into schools with the aim of making education more effective and transform teaching and learning. CAI/CAL approaches focus on computers as an educational technology: a means of teaching and learning in a variety of subjects. ICT or computer education on the other hand refers to the introduction of computers as an object of learning, that is, teaching and learning *about* computer technology. ICT or computer education is aimed at preparing future generations to shape, contribute to, and thrive in the digital society and economy.

During the 1970s and 1980s, the concept of "computer literacy" crept into the language of educational debates and programmes.[10] The term was closely aligned with the traditional concept of literacy, referring to the cultural techniques of reading, writing, and arithmetic. The concept of computer literacy insinuated a contemporary perception of computing as a new addition to the basic sets of ideas, beliefs, and methods of communication in society. However, while there was widespread agreement that some level of computer literacy ought to be part of a modern education in the "information society", it seemed less clear exactly what this would entail.[11] Numerous labels for introductory forms of computer education were brought forward, such as computer awareness, computer appreciation, computer

10 Norbert M. Seel and Nancy C. Casey, "Changing Conceptions of Technological Literacy," in *Disadvantaged Teens and Computer Technologies*, ed. Norbert M. Seel and Paul Attewell (Münster: Waxmann, 2003), 36.

11 Peter Kelman, "Computer Literacy: A critical Re-examination," *Computers in the Schools* 1, no. 2 (1984): 3, https://doi.org/10.1300/J025v01n02_02; Seel and Casey, "Changing Conceptions," 40.

initiation, computer familiarization or computer fluency.[12] Similarly, computer literacy curricula differed widely in terms of their aims and contents. Occasionally, the variety of different conceptions and associations of the term is reflected in the literature by using the plural form of "computer literacies".

On the one hand, concepts for computer literacy can take on a more "socially-oriented" form that focuses on the digital transformation of society and the economy and how it can be shaped by the people, covering topics such as data privacy, automation of jobs, and changing conditions of working and living in a digital society. On the other hand, computer literacy approaches may also take a more "technically-oriented" form, focused on the functioning and use of computer technology, aimed at training skilled soft- and hardware users, as well as teaching programming and algorithmic thinking.

As the case studies in this edited volume illustrate, concepts of bringing computers into the classroom are seldom that clear-cut, and often serve a variety of different goals and stakeholders' priorities. Different actors involved in the introduction of computers into education advocated for diverse concepts and approaches, and both national and local policies and curricula shifted in priorities over time.

Actors, Interests, and Coalitions

In his groundbreaking study on the implementation of new information technologies in Silicon Valley schools, Larry Cuban, almost twenty years ago, impressively demonstrated the importance of a historical perspective for understanding the digital present.[13] Cuban distinguishes three different goals that were associated with the introduction of computers in schools. First, computers were intended to make school teaching more efficient and effective. Here, computers were in line with the longer history of teaching machines, as recently traced by Audrey Watters.[14] They were seen as an educational tool in the hands of teachers and administrators. Second, the exponents of increased computer use had a progressive education agenda and wanted to use the new devices to make teaching more stimulating and learn-

12 Tjeerd Plomp and Jan Van de Wolde, "New Information Technologies in Education: Lessons Learned and Trends Observed," *European Journal of Education* 20, No. 2/3 (1985): 243, https://doi.org/10.2307/1502953.

13 Larry Cuban, Oversold and Underused: *Computers in the Classroom* (Cambridge, MA: Harvard University Press, 2001).

14 Audrey Watters, *Teaching Machines: The History of Personalized Learning* (Cambridge, Massachusetts: The MIT Press, 2021).

ing closer to the real world. In this case, they were perpetuating a history that Katie Day Good has recently described for media use in classrooms in the first half of the 20th century.[15] Third, proponents of introducing computer education were concerned with preparing students for the future world of work. In this respect, the computer euphoria differed from earlier waves of technological transformation of the classroom. While teaching machines, slide projectors, school television, and language labs were thought of as more efficient and stimulating teaching tools, the computer in the classroom seemed to be a representative of future society. It was not just a means to an end, but already part of an emerging digital society.

Victoria Cain recently added an important perspective to Cuban's case study findings. In her historical analysis of computer education in the US in the last third of the 20th century, she argues that PC's as educational tools, unlike school television and other earlier media, were radically focused on personalization. The focus was no longer on providing shared educational experiences, but on individualized educational programmes on the computer, tailored to the needs of a particular social group. Since computers could still not be afforded by everyone, early computer education primarily addressed an affluent middle-class clientele. The internet then promised a new balance between personalization and more community-based approaches in the 1990s, but this was not realized.[16]

Cuban's history of introducing computers into Silicon Valley classrooms already attempted to answer who was backing the American computer education agenda. He identifies a "loosely tied national coalition of public officials, corporate executives, vendors, policymakers, and parents" for new technologies for schools in the 1980s. Cain sees a similarly wild coalition of school administrators, computer scientists, disability rights activists, parents, and concerned citizens behind the computer education agenda in the US.[17]

Joy Lisi Rankin puts a slightly different focus in her study of computer use in the 1960s and 1970s in the United States. She emphasizes the grassroots nature behind the many efforts to make greater use of computers in education. She pays particular attention to teachers and lecturers who built computer networks between schools or colleges – and to creative use by students.[18] This is in line with findings

15 Katie Day Good, "Making Do with Media: Teachers, Technology, and Tactics of Media Use in American Classrooms, 1919–1946," *Communication and Critical/Cultural Studies* 13, no. 1 (2016): 75–92, https://doi.org/10.1080/14791420.2015.1092203.

16 Cain, *Schools and Screens*, 141–173.

17 Cain, *Schools and Screens*, 145.

18 Joy Lisi Rankin, *A People's History of Computing in the United States* (Cambridge, MA: Harvard University Press, 2018).

of historical research that emphasize the role of Swedish teachers as early adopters in computer education.[19] Thus, there are two opposing readings here: early computerization as the result of a bottom-up grassroots movement or as the result of an ad-hoc coalition between powerful allies (such as state authorities, companies, pressure groups and university professors). These different narratives are also accompanied by different historical foci. Those who emphasize the grassroots character of early computer education tend to paint a picture of decline.

But no matter which historical narrative is invoked, private technology providers play an important role in all accounts. It almost goes without saying that computer manufacturers and distributors had a vested interest in seeing schools use more computers. In Rankin's account, it was Digital Equipment Corporation that not only promoted its minicomputers as educational devices, but also published a successful BASIC manual. In Cain's account, it was Apple that targeted schools early and aggressively. For all the grassroots activism and commitment of dedicated math or physics teachers, it should not be forgotten that the hardware, at least in capitalist countries, often came from private companies that wanted to sell their products and get future customers acquainted with their system environments from a young age. This was countered by attempts, particularly in Europe, to produce government or nonprofit solutions and their own school computers instead.[20]

How Computers Entered Europe's Classrooms

In research on the history of education in Europe, the question of how computers found their way into classrooms has so far been largely neglected. A few historical studies on individual national cases have been published, mostly by historians of technology. The edited volume by Plomp, Anderson, and Kontogiannopoulou-Polydorides is an early example of the attempt to collect national accounts of how computers were introduced into educational systems around the world.[21] Two edited

19 Lennart Rolandsson, "Teacher Pioneers in the Introduction of Computing Technology in the Swedish Upper Secondary School," in *History of Nordic Computing 3,* ed. John Impagliazzo, Per Lundin and Benkt Wangler (Berlin and Heidelberg: Springer, 2011), 159–167.

20 Gerard Alberts and Ruth Oldenziel, "Introduction: How European Players Captured the Computer and Created the Scenes," in *Hacking Europe: From Computer Cultures to Demoscenes*, ed. Gerard Alberts and Ruth Oldenziel (London: Springer, 2014), 9; Sytze van Herck, "Re/Constructing Computing Experiences. From 'Punch Girls' in the 1940s to 'Computer Boys' in the 1980s" (PhD diss., University of Luxembourg, 2022), 221–341.

21 Tjeerd Plomp, Ronald E. Anderson and Georgia Kontogiannopoulou-Polydorides, eds., *Cross National Policies and Practices on Computers in Education* (Dordrecht: Springer, 1996).

volumes by Arthur Tatnall, both entitled "Reflections on the History of Computers in Education", were published in 2012 and 2014.[22] Their aim was to write both a history of technology and a social history of computing in education, drawing upon the memories and reflections of the authors who were themselves involved in bringing computers into schools. The case of the UK and the introduction of the BBC Micro has been the focus of publications by Tom Lean, Tilly Blyth and Neil Selwyn.[23] Scholarly work on the historical roots of computer education in Southern Europe is particularly scarce but could offer valuable insights for regional comparisons across Europe, and sheds light on transnational entanglements, as demonstrated by studies on the cases of Spain and Greece.[24] However, for many European countries, the histories of national policies and local initiatives for the introduction of computers into education are yet to be explored and written down. Especially from the perspective of the history of education, such case studies are urgently needed to historically embed current debates and developments regarding the digital change in education.

As Neil Selwyn points out, current critical scholarship around EdTech is preoccupied with the allure of "sociotechnical imaginaries" and speculative "education futures" and remains largely disconnected from the histories of computers

22 Arthur Tatnall, ed., *Reflections on the History of Computers in Education. Preserving Memories and Sharing Stories* (Berlin and Heidelberg: Springer, 2012); Arthur Tatnall and Bill Davey, eds., *Reflections on the History of Computers in Education. Early Use of Computers and Teaching about Computing in Schools* (Berlin and Heidelberg: Springer, 2014).

23 Tom Lean, *Electronic Dreams. How 1980s Britain Learned to Love the Computer* (London, New York: Bloomsbury Sigma, 2016); Lean, "Mediating the microcomputer"; Tilly Blyth, "Computing for the Masses? Constructing a British Culture of Computing in the Home," in *Reflections on the History of Computing*, ed. Arthur Tatnall (Berlin and Heidelberg: Springer, 2012), 231–242; Tilly Blyth, *The Legacy of the BBC Micro. Effecting Change in the UK's Cultures of Computing* (London: Nesta, 2012); Selwyn, "Learning to Love the Micro"; Neil Selwyn, "Making the most of the 'micro': revisiting the social shaping of microcomputing in UK schools," *Oxford Review of Education* 40 (2014): 170–188, https://doi.org/10.1080/03054985.2014.889601.

24 On the case of Spain: Cristian Machado Trujillo, "Education and historical evolution of information and communication technologies: Background, international influences and their development in Spain in the 1980s" (PhD diss., University of La Laguna, 2021); Ramon Puigjaner, "Evolution of Computer Education in Spain: From Early Times to the Implementation of the Bologna Agreement," in *Reflections on the History of Computers in Education: Preserving Memories and Sharing Stories*, ed. Arthur Tatnall and Bill Davey (Berlin and Heidelberg: Springer, 2012), 143–165; Javier Osorio and Julia Nieves, "The Beginnings of Computer Use in Primary and Secondary Education in Spain," in *Reflections on the History of Computers in Education: Early Use of Computers and Teaching about Computing in Schools*, ed. Arthur Tatnall and Bill Davey (Berlin and Heidelberg: Springer, 2014), 121–130. On the case of Greece: Agapi Vavouraki, "The Introduction of Computers into Education as a State Directed Initiative: A Case Study of the Greek Policies Between the Years 1985 and 2000," *Educational media International* 41 (2004): 145–156.

in education.[25] But the historical perspective is useful, if not indispensable, to attend to the important issues of social, economic, and political contexts. Narrating the histories of the computers' entry into the classroom involves being mindful of economics and government policy as shaping forces in the introduction of computers into education, as well as the messy social realities of classroom life.

This edited volume addresses this gap in the historiography of education by asking how computers were introduced into classrooms in different transnational or national, political, and economic settings across Europe. The contributions shed light on the computerization of general education from a historical perspective, by attending closely to the different actors involved – such as politicians, computer manufacturers, teachers, and students –, political rationales and ideologies, as well as financial, political, or organizational structures and relations.

The case studies explore how the educational challenge of new information technology has been addressed since the 1960s in Europe. The volume highlights differences in political and economic power, as well as in ideological reasoning and the priorities set by different stakeholders in introducing computers into education. However, the contributions also suggest that simple cold war narratives fail to capture the complex dynamics and entanglements in the history of computers as an educational technology and a subject taught in schools. The national case studies show striking similarities between very different political and economic systems with regard to rationales and educational strategies, as well as the hopes and promises, challenges and issues that accompanied the advent of new information technology in education. Furthermore, the case studies point to different paths in bringing computers into the classroom, for example, regarding the division of responsibilities in hard- and software procurement and financing.

The introduction of computers into education often started out with local initiatives by teachers, parents and students, followed by efforts of government or coordinating bodies to harmonize and boost efforts, e. g., through active national programmes.[26] Centralized governance, such as in the case of France or Sweden, seems to have led to more standardization in computer education. Local or regional responsibility and decentralized approaches, as in West Germany and Switzerland, led to more heterogeneous approaches on the ground.

This edited volume comprises, on the one hand, studies that follow the historical developments from a top-down perspective, focusing on political strategies, in-

25 Neil Selwyn, "The 'wonderful usefulness' of historical perspectives on EdTech," *Ed Tech Key Issues* 4 (2022), https://criticaledtech.com/2022/03/03/the-wonderful-usefulness-of-historical-perspectives-on-edtech/.

26 Bob L. Taylor and Monika M. Strauss, "Computer Education in Western European Secondary Schools," *The High School Journal* 71 (1987): 51–56.

itiatives, and realities on transnational and national levels. Some contributions, on the other hand, consider the perspectives of teachers and students in the classrooms. They tell the story of how computer technology unfolded in the specific social sphere of the classroom, from which new peer groups of computer pioneers and enthusiasts among students and teachers emerged. In addition, several case studies also point to the involvement of private industry, in particular hard- and software providers. Their offers of assistance in the development of curricula, teaching aids, educational software, and teacher training programmes complemented or even partially replaced the state-mandated development of school computers and software, often helped by the efforts of teachers who developed their own instructional software.

The contributions in this book focus on different national cases. They also emphasize different facets of the introduction of computers into the classroom. The variety of aspects covered by the different case studies highlights how the history of computers in education is a history of power, money, technology, and emotions. In the process of introducing computer technology into schools, excitement over novel approaches, the pride of being considered a pioneer, the concerns over lagging behind the international competition and both the hopes and fears in face of a new and yet unfamiliar technology in the classroom have been driving forces behind the actions of politicians, teachers, pupils, and parents. This edited volume strives to provide these missing narratives to understand and make sense of the historical role of the computer in education and its entanglements, as this new technology entered the classrooms of emerging digital societies in Europe.

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Part I: **Case Studies**

Clémence Cardon-Quint

Informatique pour tous, France 1985: Pedagogy, Industry and Politics

Abstract: The *Plan Informatique pour tous* (IPT) was a large-scale government operation that took place in France in 1985. It encompassed the installation of 14,000 *nano-réseaux* and more than 100,000 workstations in schools, mainly primary schools, as well as the training of teachers. IPT shares several characteristics with similar previous experiences, but its magnitude and the haste with which it was implemented were unprecedented. Drawing on a vast array of public archives, pedagogical journals and budgetary documents, this chapter presents the legacy of previous experiences dating back to the 1970s. It sheds light on the political expectations that led the socialist government to suddenly accelerate the process of equipping schools with computers. Finally, it explores the industrial stakes as well as the pedagogical aspects of an operation that can be considered both as a milestone and a failure.

Keywords: France; industrial policy; teacher training; computers; 1980s; Informatique pour tous

In 1981, for the first time since the beginning of the 5th Republic (1958-…), a socialist – François Mitterrand – was elected president of the French Republic and communists entered the government. This government had to tackle an economic crisis and rising unemployment while fulfilling its electoral promises. The economic measures that were announced included a vast program of nationalizations that also concerned the computer industry, and a proclaimed return of the planning process as a tool in direct investments and the economy. Regarding schools, the most heated topic was the unification of the French school system, or more exactly the reinforced integration of publicly subsidized private schools within the public education service (the so-called "SPULEN": *Service public unifié et laïque de l'Éducation nationale*). After a short honeymoon period, difficulties started to pile up for the socialist president. The nationalizations, combined with a stimulus policy, were not sufficient to solve the economic issues and the government was forced to turn back to austerity, just like its right-leaning predecessors.[1] During the summer of

1 For a recent overview of the so-called "tournant de la rigueur", its timeline and interpretation, Florence Descamps and Laure Quennouëlle-Corre, "1983, un tournant libéral ?," *Vingtième Siècle.*

https://doi.org/10.1515/9783110780147-002

1984, the SPULEN project was abandoned once and for all after massive demonstrations that led to the resignation of the prime minister and a complete ministerial reshuffle. In this gloomy context, the new government of Laurent Fabius held the public launch of the *Plan informatique pour tous* (IPT) in January 1985.[2] This gigantic operation involved the installation of 14,000 *nano-réseaux* (professional computers linked to workstations) and more than 100,000 workstations in schools, mainly primary schools, as well as the training of teachers; all within a very tight schedule (less than a year).

The operation has already attracted the interest of researchers as a milestone in the development of new technologies in schools[3] and the actors involved directly in the process – Georges-Louis Baron, Jacques Beaudé – have played a leading role in writing this history. Logically, they have emphasized the pedagogical aspects of the project. However, current research on the French education budget has revealed a surprising fact: the huge amount of public money lavished on this project, as opposed to the budget restrictions that were holding back other teaching reforms at the same time, for example. Considering the state of French public finance, the economic policy mix adopted by the government, and the rigor applied while negotiating the education budget, we might doubt whether the official pedagogical purpose was the main reason for spending so much money, thus providing a strong incentive to question the political and economic implications of IPT. The abundant bibliography addressing Mitterrand's first presidency has scrutinized the multiple challenges faced by the President at the end of 1984.[4] However, polit-

Revue d'histoire, no. 138 (2018), http://www.cairn.info/revue-vingtieme-siecle-revue-d-histoire-2018-2.htm.

2 All quotes in the article have been translated by the author.

3 Georges-Louis Baron and Alex Blanchet, *L'ordinateur à l'école : de l'introduction à l'intégration*, edited by Luc-Olivier Pochon and Alex Blanchet (Neuchâtel: IRDP, 1997); Michelle Harrari, "Informatique et enseignement élémentaire 1975–1996. Contribution à l'étude des enjeux et des acteurs" (PhD diss., Paris Descartes University, 2000); Bernard Dimet, *Informatique: son introduction dans l'enseignement obligatoire, 1980–1997* (Paris: L'Harmattan, 2003); Jacques Baudé, "Le plan ›Informatique pour tous‹," *Bulletin de la société informatique de France*, no. 5 (2015): 95–108; Margarita Boenig-Liptsin, "Making Citizens of the Information Age: A Comparative Study of the First Computer Literacy Programs for Children in the United States, France, and the Soviet Union, 1970–1990" (Cambridge, MA, Harvard University Press, 2015). Philippe Barret mentions IPT in his study on Jean-Pierre Chevènement's education policy, Philippe Barret, "La politique éducative du gouvernement de la France de juillet 1984 à mars 1986: le ministère de Jean-Pierre Chevènement" (PhD diss., Paris 8 University Vincennes-Saint-Denis, 1988), 359–380.

4 *Mars 1986, la drôle de défaite de la gauche* (Paris: PUF, 1986); Pierre Favier and Michel Martin-Roland, *La décennie Mitterrand. 2. Les épreuves : 1984–1988* (Paris: Ed. du Seuil, 1995); Georges Saunier, ed., *François Mitterrand, les années d'alternances : 1984–1986 et 1986–1988* (Paris: Nouveau monde éditions, 2019).

ical historians have not paid attention to the role that IPT was supposed to play in securing the French electorate for the forthcoming general elections of 1986. Economists or economic historians have studied the history of the computing industry and its relations with the State but have not specifically explored the role played by IPT, or more generally by public procurement in this policy.[5]

To address the multiple ramifications of the IPT Plan, this chapter draws on a vast array of public archives (cabinets of the Prime Minister and of the President; relevant directorates in the Ministry of Education, the Ministry of Industry and the Ministry of Telecommunications; oral archives) as well as on pedagogical journals[6] and budget documents. The money voluntarily spent by the French State on computers on this occasion, and the circuits it followed, serve here as a thread to identify the various networks of actors, and the institutional circuits that both shaped and were reshaped by this atypical operation.

This historical contribution thus draws on the French tradition of public policy analysis with an emphasis on the concepts, instruments, and practices of high-ranking civil servants and interest groups, that contribute in the medium and long term to the shaping of public policies.[7] It also draws on other academic tra-

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5 Jean-Pierre Brulé, *L'informatique malade de l'État: du Plan calcul à Bull nationalisée, un fiasco de 40 milliards* (Paris: Les Belles lettres, 1993); Jocelyne Barreau and Abdelaziz Mouline, *L'Industrie électronique française : 29 ans de relations État-groupes industriels : 1958–1986* (Paris: Librairie générale de droit et de jurisprudence, 1987), https://gallica.bnf.fr/ark:/12148/bpt6k3332161s; Jocelyne Barreau, Jean Le Nay, and Abdelaziz Mouline, *La filière électronique française: miracle ou mirage ?*, Profil 1018 Société (Paris: Hatier, 1986); Jocelyne Barreau, ed., *L'Etat entrepreneur : nationalisations, gestion du secteur public concurrentiel, construction européenne 1982–1993*, Logiques économiques (Paris: L'Harmattan, 1990); Patrick Fridenson, "De la diversification au recentrage : le groupe Thomson (1976–1989)," *Entreprises et histoire* 1, no. 1 (1992): 26, https://doi.org/10.3917/eh.001.0026; Patrick Fridenson ans Pascal Griset, ed., *Entreprises de haute technologie, État et souveraineté depuis 1945 : Colloque des 8 et 9 février 2010*, Histoire économique et financière – XIXe–XXe (Vincennes: Institut de la gestion publique et du développement économique, 2013), http://books.openedition.org/igpde/1595; Pascal Griset, "Au coeur du numérique. La France et ses politiques face aux mutations technologiques des années 1980," in *François Mitterrand, les années d'alternances : 1984–1986 et 1986–1988*, ed. Georges Saunier (Paris: Nouveau monde éditions, 2019), 537–573.

6 The Association Enseignement public et Informatique, founded in 1971 to accompany the first experiences of computers in classrooms, publishes online various historical documents, including excerpts from its own magazine, the *Bulletin de l'EPI*, https://www.epi.asso.fr.

7 Patrick Hassenteufel and Andy Smith, "Essoufflement ou second souffle ? L'analyse des politiques publiques ‹à la française›," *Revue française de science politique* 52, no. 1 (2002): 53–73, https://doi.org/10.3917/rfsp.521.0053; Laurie Boussaguet et al., *Une French touch dans l'analyse des politiques publiques?*, (Paris: Presses de Sciences Po, 2015), https://www.cairn.info/une-french-touch-dans-l-analyse-des-politiques-pub-9782724616453.htm.

ditions as it seeks to connect public policy choices to electoral strategies in a methodical manner.[8] All in all, this article presents a story "from above". Of course, IPT would not have been possible without a wider network of grass-roots computer activists who approved of this operation and tried their best to make it a success. However, the singularity of the operation – a sudden acceleration of an ongoing process, with a significant impact on the State Budget – resulted from decisions taken at the highest level, on which we have chosen to focus.

IPT shares several characteristics with similar previous experiences which are sketched briefly in the first section. However, its magnitude and the haste with which it was implemented were unprecedented. The second section describes the strong political commitment and the great expectations placed on this project at the highest level of the State. The third section analyses the respective roles of economic and pedagogic considerations in the choice of the material and questions the immediate consequences of the Plan.

Computers at Schools: The Complex Legacy of Previous Experiences

Computers at Schools: A Small Component of a Larger Industrial Policy?

The IT industry has been a focus of the French public authorities' attention since 1962. There had been successive strategic shifts; while De Gaulle – president of the Republic from 1958 to 1969 – favored the prospect of a large French industry, covering all sectors of production, Valéry Giscard d'Estaing, elected in 1974, thought a relative specialization would be more adapted to the sector, and favored a liberal approach to the market[9]. These shifts also coincided with changes in the political governance of the sector. Under the presidencies of De Gaulle and Pompidou (1969–1974), State intervention relied on an inter-ministerial structure called the Délégation à l'informatique, created in 1966, reporting directly to the Prime Minister. In 1974, Giscard d'Estaing scrapped this structure and replaced it with a new

8 For stimulating attempts to relate policy and politics and their various sources of inspiration, see Isabelle Guinaudeau and Simon Persico, "Tenir promesse. Les conditions de réalisation des programmes électoraux," *Revue française de science politique* 68, no. 2 (2018): 215–237.

9 Pierre Mounier-Kuhn, *L'informatique en France de la Seconde guerre mondiale au Plan Calcul : l'émergence d'une science*, (Paris: PUPS, 2010); Fridenson, "De la diversification au recentrage," 26; Brulé, *L'informatique malade de l'État.*

directorate – the Direction des industries électroniques et de l'informatique (DIELI) – reporting to the Direction Générale de l'Industrie of the Ministry of Industry. The DIELI had broader competencies, as it supervised not only the computing but also the electronics industry. Reporting to the DIELI, the Mission à l'informatique had an inter-ministerial advisory role in the use of IT in administrations.[10] The election of 1981 marked a new turning point in industrial policy. François Mitterrand, the newly elected socialist president, carried out a vast program of nationalizations which also concerned the computer industry (Thomson and Bull – formerly Compagnie internationale pour l'informatique [CII] and Honeywell Bull). It was proclaimed as a comeback of the planning process as a tool for guiding investments and the economy.[11] In the 9th Plan (1984–1988), the potential of the computer industry was stressed both as a dynamic economic sector (compared to old decaying industries) and as a source of modernization for all types of economic activities. Regardless of the direction taken by successive presidents, regular relations and government intervention in industrial choices, including decisions on recapitalization and crossed holdings, were a constant. The fact that public procurement also had to play a role in this industrial policy was obvious, even if this did not imply an exclusive preference for French hardware.[12]

In the existing literature, it is quite common for authors to point to the coincidences and convergences between the industrial policy led by governments in the computer sector and the various initiatives taken to introduce computers into schools. At the Ministry of National Education, the Mission à l'informatique,[13]

10 The Mission informatique was originally a department of the Délégation à l'informatique. With the disappearance of this Delegation, replaced by the DIELI, this service became an Inter-ministerial Mission – whose denomination has changed several times –directly reporting first to the Director General of Industry, and then, after 1978, to the DIELI. In 1983, the Mission informatique left the Ministry of Industry to join the Ministry of PTT.

11 Investment planning (public and private) began in France in the aftermath of the Second World War. The establishment of the European Customs Union and the economic crisis marginalized the role of the Commissariat Général du Plan in French economic policy in the 1970s.

12 See the testimony of Wladimir Mercouroff, in charge of computer science at the Ministry of National Education from 1970 to 1974: "My game was to get as much as possible from the other manufacturers (Univac, IBM, Bull Control Data, later DEC) as the Compagnie Internationale pour l'Informatique (CII) was the national champion, and then to challenge the CII to do at least as well technically and financially. Given the state of the CII, this game was often quite cruel, but it seemed indispensable if one ever wanted to have a competitive industry; although heavily subsidized, it was struggling on the technical level". Wladimir Mercouroff, "Témoignage : l'informatique dans l'enseignement et au CNRS au début des années soixante-dix," *Histoire de la recherche contemporaine. La revue du Comité pour l'histoire du CNRS* IV, no. 2 (2015): 180–185.

13 This Mission à l'informatique, internal to the French Ministry of Education, should not be confused with the structure of the same name, created in 1978 at the Ministry of Industry.

created in 1970, worked hand in hand with the inter-ministerial Délegation à l'Informatique. The mission was responsible for the teaching of informatics at all levels of education, including university and research, the introduction of informatics in the management of National Education, the use of computers for teaching and research, as well as the management of the hardware stock.[14] It supervised the introduction of computers in secondary schools (*lycées classiques et modernes)*, which was implemented between 1972 and 1976, an operation prepared with intensive training for the teachers of the 58 secondary schools involved.[15]

Its brutal interruption in 1976 followed the dismantling of the Délégation à l'Informatique decided by Valéry Giscard d'Estaing in 1974, but also the administrative separation between Universities and National Education (and the disappearance of the Mission à l'informatique, which previously had powers over both schools and universities), and the re-organization, in 1976, of the short-lived Office Français des techniques modernes d'éducation, since called the Centre national de documentation pédagogique. Following this administrative reshuffle, a new operation called "10,000 micros" was initiated in 1978. There was a clear break between this experience and the preceding one, whose evaluation was still not published when it started. It was first and foremost a component of a broader industrial policy aimed at the "computerization of society"[16] and involving all the administrations.[17]

Once again, the political change of 1981 led to an abrupt interruption of the operation. However, the introduction of computers within schools resumed rapidly, following the report by Claude Pair and Yves Le Corre.[18] The first operation, launched in January 1983, aimed at equipping schools (primary schools, middle schools and technical schools) with non-professional micro-computers (6,000 computers). A new target was set in the 9th Plan, adopted in 1983 for the period 1984–1988: 100,000 computers; 100,000 teachers trained.[19] The IPT Plan of 1985 marked a sudden and unexpected acceleration of this strategy.

14 Mercouroff, "Témoignage".

15 Institut national de recherche et de documentation pédagogiques, "Dix ans d'informatique dans l'enseignement secondaire: 1970–1980," *Recherches pédagogiques*, no. 113 (1981).

16 Simon Nora et Alain Minc, *L'informatisation de la société: rapport à M. le Président de la République* (Paris: La Documentation française, 1978).

17 Record of decision of the Committee on the Development of IT Applications, presided by the First Minister, November 23, 1978, Archives nationales [AN], 19870355/15.

18 Claude Pair and Yves Le Corre, *L'Introduction de l'informatique dans l'Éducation nationale* (Paris: Ministère de l'éducation nationale, Service de l'information, 1981).

19 Commissariat général du Plan, *Neuvième plan de développement économique, social et culturel (1984–1988)* (Paris: La Documentation française. Journaux officiels, 1983), https://www.strategie.gouv.fr/actualites/huitieme-plan-de-developpement-economique-social.

This stop-and-go pattern of the plans to introduce computers at schools, and the fact that they did not coincide with changes in the Ministers of Education suggest that these policies were not fully driven by the Education Ministry but rather relied on political decisions taken at the highest level of government where inter-ministerial stakes take precedence over educational views. The ability to document the autonomy or dependence of the Ministry of Education when it comes to the choice of hardware is of paramount importance in confirming this hypothesis. For the period 1970–1974, Wladimir Mercouroff gives an interesting but enigmatic insight into the policy of purchasing computers at the Ministry of National Education: the representative of the Délégation à l'informatique had a "veto power, which he used in favor of the national industry rather than the coherence of the project, but he could not always use this veto".[20] However, we may assume that the first operation – "58 lycées" – was probably small enough to let the Ministry of National Education decide: this first operation did indeed involve CII, but also IBM and Honeywell. On the contrary, the role of the Minister of Industry in the decision-making process can be clearly documented for the "10,000 micros".[21] The transition from an experimental process to widespread use probably implied a relative loss of autonomy in terms of purchasing policy. The Ministry of Education did not have much to say about the equipment for the IPT plan, but we do not have sufficient evidence for the purchases decided on in 1983 and 1984.[22]

Computerization Rate Understood through Budgetary Data

The structure, evolution, and discussions raised by the Education budget from 1970 to 1985 also reveal interesting aspects of the introduction of computers in the sphere of the Education Ministry.

They primarily show, the significant time lag between the early introduction of "administrative computing" (*informatique de gestion)*, electronic classes and computer equipment in universities, and the late stabilization of a budget line dedicated to "educational computing" equipment (*informatique pédagogique).* Back in the

20 Mercouroff, "Témoignage".

21 For the "10,000 micros", the decision can be tracked back to the "Conseil restreint du 22 novembre 1978", AN 19870355/15. See also Michel Biju Duval, direction des affaires financières du ministère de l'Éducation nationale, "Incidence sur le budget de l'Éducation de textes législatifs ou de décisions gouvernementales," ca. March 1979, AN 19930646/2.

22 Xavier Greffe, Head of the New Technologies Mission of the French Ministry of Education, in charge of the "Computers for All" Plan in 1984–1985. Interview with Xavier Greffe, May 22, 2002, *Archives orales du Service d'histoire de l'éducation*, AN 20180010/178.

1960s (at least 1967), annual budget documents (*Services votés. Mesures nouvelles*) submitted to Parliament mention the additional appropriations allocated each year – through capital expenditures, or current expenditures, including the recruitment of "Programmeurs" – to the *électronique de gestion*, renamed in 1971 the *informatique de gestion.* That same year, the administration created a *Bulletin d'informatique de gestion du Ministère de l'Éducation nationale.* These appropriations first benefited the central administration, but as early as 1969, Grenoble and Toulouse were chosen as pilot education authorities to test the use of computers and information systems to enhance the management of educational resources at the local level. After 1972, some of the appropriations for the *Informatique de gestion* were clearly earmarked for local school administrations. While the history of the *informatique de gestion* is more complex than this brief sketch suggests, there is nonetheless a clear, ongoing trend made possible by explicit and coherent budgetary decisions.[23]

This is not the case with the introduction of computers in classrooms in the school system (universities excluded). Before 1980, the corresponding expenditure was practically invisible in the budget documents. Although computers did enter classrooms before 1980, this introduction was financed through various budget lines, reflecting the variety of aims pursued (a pedagogical auxiliary, a new technical discipline, a part of a modern culture, etc.) as well as the diversity of structures involved. Contrary to the *Informatique de gestion*, there was apparently no political need to isolate these appropriations in the description of the *mesures nouvelles.* In 1972, the socialist senator Robert Schwint inquired about the share of the national education budget devoted to teaching materials (audio-visual materials, programmed teaching, computer-assisted teaching, etc.) by type of equipment, by educational cycle, and by origin of acquisition. The tortuous answer from the Minister gives a fair idea of the difficulty in grasping and isolating the introduction of computers in the classroom from larger operations involving other types of devices.[24]

Consequently, the first budget that clearly isolates, in its *mesures nouvelles*, the financial efforts made to introduce computers within classrooms is that of 1980, which mentions, in relation to the "10,000 micros" operation, the allocation of

23 Ministère de l'éducation, Service des études informatiques et statistiques, *Schéma directeur de l'informatisation de la gestion au Ministère de l'éducation* (Paris: SEIS, 1977), 131; Pierre Champagne et al., "Les processus de modernisation dans l'administration de l'Éducation nationale," *Politiques et Management Public* 11, no. 1 (1993), 87–109.

24 Réponse à la question écrite du sénateur Robert Schwint (Question du 14 décembre 1971), *Journal Officiel de la République française. Sénat*, annexe au compte rendu de la séance du 4 avril 1972, 135.

7,000,000 Francs to the "*sensibilisation à l'informatique d'élèves des établissements scolaires du second degré*".[25] After 1980, and for a few years, it became possible to isolate the credits effectively targeted at the introduction of computers, or "modern technologies" within classrooms. In 1985, a new line ("chapitre 56–37") was created in the budget to isolate the appropriations devoted to "*Dépenses pédagogiques-technologies nouvelles : premier équipement en matériels spécialisés des établissements scolaires : rénovation des enseignements*". Why this change? At that time, the government was planning to devolve a series of current and capital expenditures to local authorities, as part of a huge decentralization process. However, according to the law, "pedagogical expenditure" would still be supported by the state.[26] The creation of a new *chapitre* allowed the government to track appropriations earmarked for educational capital expenditure; those that the state would still control once the devolution process was over.

The table below documents the rapid rise of the expenditure targeted to *informatique pédagogique* between 1980 and 1985, but it also reveals the much bigger sums allocated to other special pedagogical equipment, which includes, in particular, the machine-tools used in technical schools, by far the biggest item of expenditure in this category. The machine-tools raised questions that were also relevant for computers: how to fund and organize maintenance, manage breakdowns, and keep track of the stock of these special machines within schools? All these questions were far from resolved in 1982. The actors were at least conscious of the problems that could be posed by a stock of technical machines dispersed over the territory.[27]

25 *Annexe au projet de loi de finances. Éducation. Services votés, mesures nouvelles*, 1980.
26 Laws of January 7 and July 22, 1983. The discussions raised in 1984 by the funding of pedagogical expenditure are documented in the archives of the Minister of the Interior, AN 19860676/31. The decree was finally signed on February 25, 1985.
27 In 1978, the Ministry of Education launched a "RCB study" (*étude de rationalisation des choix budgétaires*) to address the maintenance of machine-tools. However, the RCB experiment was interrupted in 1982, and the study thus stopped, but various intermediary reports are available in the archives, AN 19910282/1.

Table 1: New appropriations for computer equipment and «modern technologies», according to the budgetary documents Chapter 56–35 (1980–1984) and 56–37 (1985) – In francs unless otherwise specified. *NB. Chapter 56–35 is entitled «Établissements d'enseignement du second degré établissements scolaires spécialisés, centres d'information et d'orientation et formation des personnels. Équipement en matériel». The Chapter 56–37, created in 1985, is entitled «Dépenses pédagogiques-technologies nouvelles : premier équipement en matériels spécialisés des établissements scolaires : rénovation des enseignements»*

	Écoles normales primaires	Collèges	Lycées	Global amount of appropriations for chapter 56–35	Budget voté – Ministry of Education (enseignement scolaire)
1980			7 million – «Sensibilisation à l'informatique d'élèves des établissements scolaires du second degré»	270 million	89,020 million *[€38,801 million 2020]*
1981		1.9 million «sensibilisation à l'informatique des élèves du second degré»	26 million «sensibilisation à l'informatique des élèves du second degré»	294.1 million	101,700 million *[€39,088 million 2020]*
1982		6 million «technologies modernes»	55 million «technologies modernes»	511.026 million	122,074 million *[€41,959 million 2020)*
1983		12.5 million «technologies modernes» [écoles nationales de perfectionnement] 19.5 million «technologies modernes» [collèges]	48 million «technologies modernes»	635 million	138,608 million *[€43,461 million 2020]*
1984	32 million «technologies modernes»	55 million «technologies modernes»	80 million «technologies modernes» 38 million «filière électronique»	796.1 million	150,460 million *[€43,925 million 2020]*

Table 1: New appropriations for computer equipment and «modern technologies», according to the budgetary documents Chapter 56 – 35 (1980 – 1984) and 56 – 37 (1985) – In francs unless otherwise specified. *NB. Chapter 56 – 35 is entitled «Établissements d'enseignement du second degré établissements scolaires spécialisés, centres d'information et d'orientation et formation des personnels. Équipement en matériel». The Chapter 56 – 37, created in 1985, is entitled «Dépenses pédagogiques-technologies nouvelles : premier équipement en matériels spécialisés des établissements scolaires : rénovation des enseignements» (suite)*

	Écoles normales primaires	**Collèges**	**Lycées**	**Global amount of appropriations for chapter 56–35**	**Budget voté – Ministry of Education (enseignement scolaire)**
1985 [56–37]	48 million «informatique pédagogique»	103 million «informatique pédagogique – audiovisuel»	137 million «informatique pédagogique – audiovisuel» 40 million «filière électronique»	679.5 million [56–37]	158,402 million *[€43,702 million 2020]*

NB: the data recorded by the Budget Directorate of the Ministry of Economy and Finance, in 1984, for «informatique pédagogique» are coherent but slightly different, with a starting point at 7 million in 1980, and a global amount of 288 in 1985; direction du Budget «Dossiers perspectives 1985», Centre des archives économiques et financières [CAEF], PH041_90_art3.

From the “Ateliers de Pratique Informatique” to “Informatique pour tous”: A Political Coup

Informatique pour tous was in a certain way a sharp acceleration of the strategy announced in the 9th Plan for the introduction of computers into schools. However, this analysis gives a very partial view of the process, as the first version of this program, called *Ateliers de pratique informatique*, only used schools as a setting. This program had political stakes that went far beyond the mere introduction of computers into classrooms. These political stakes influenced the choices ultimately made.

From the “Ateliers de Pratique Informatique” to “Informatique pour tous”: A Political Coup led at a Higher Level

“Informatique pour tous” started in 1984, with three initiators who, for various reasons, felt that the time had come for a vast and ambitious project. Jean-Jacques Servan-Schreiber was trained as an elite engineer (at the Ecole Polytechnique). This totally atypical character became highly successful as a journalist and press owner in the 1950s and 1960s (with the *Express Magazine*), then, in the 1970s, he bankrupted himself in political campaigns (in the center of the political game). In the 1980s, he still had an audience as a visionary man: the *Défi Mondial*, published in 1980, reached a large audience just as the *Défi américain* had done thirteen years earlier.[28] Fascinated by new technologies, he was convinced that computers would change the economy and society. He acted as a shadow advisor to President François Mitterrand, who created for him the short-lived “Global center for IT”. His purpose was to “convince the president that computers [were] not a ‘futurist dream’ but ‘the instrument of the necessary work’”.[29]

The second initiator was Gaston Defferre, a close friend of both François Mitterrand and Servan Schreiber. From the beginning of the socialist presidency, he also tried to convince the president of the extraordinary potential of IT. As a Minister of the Interior of the first government, he had overseen the huge process of

28 Jean-Jacques Servan-Schreiber, *Le défi mondial* (Paris: Fayard, 1980); Jean-Jacques Servan-Schreiber, *Le défi américain* (Paris: Denoël, 1967).
29 Jean-Jacques Servan-Schreiber, *Passions 2. Les fossoyeurs* (Paris: Le Grand livre du mois, 1993), 255.

French decentralization giving more power to local authorities. In the ministerial reshuffle of July 1984, he lost the Interior Ministry and became Minister for Territorial Planning. For him, computers were a tool that would make decentralization more effective and efficient. In 1984, he advocated the idea of "popular computer labs"; his aim was for "each district of each city, each village, each canton of each department, [to have] its own practice workshop, within everyone's reach".[30]

The third personality concerned was François Mitterrand, the socialist President of the Republic, elected in 1981. Contrary to the other two, at the beginning of his presidency he was rather skeptical about computers. Though he created the Global center for IT, the budget was too small to make a real change. However, he had political reasons for taking up the project, as revealed by the sentence attributed to him by Defferre in one of his letters to the Prime Minister: "We have at most one year left for a new climate to be created, a momentum for the future, a return to confidence…".[31]

Elections for the National Assembly were planned for March 1986 and his presidency was failing. On the economic front, the expansionist strategy had failed, and he had to endorse the decision to turn to austerity.[32] Politically, the reform of the private school system, a symbol for the socialists, had been thwarted by monster demonstrations in July 1984, leading to the nomination of a new government, headed by Laurent Fabius. Consequently, the risk of an electoral defeat was real, and something needed to be done to save his presidency.

Various notes exchanged in the fall of 1984 between the Prime Minister, Defferre, Jean-Jacques Servan Schreiber, the cabinet of the President, and the SNI-PEGC (Syndicat national des instituteurs- Professeurs d'enseignement general des collèges) reveal the options considered at that time. In Defferre's project, schools were more a setting than a target, the main stake being to make computers available for all citizens, whatever their age, in the most remote regions of France. One of his letters explicitly states: "I asked Chevènement (Minister of Education) not to oppose the use of schools".[33] Why schools? Decentralization laws had devolved the construction and maintenance of school buildings to local authorities and opened up the possibility for municipalities to use these buildings for other purposes: these workshops would have given a first example of this local reappro-

30 Gaston Defferre, "Le déploiement du réseau national d'ateliers informatiques," ca. September 1984, AN 19960290/6.

31 Quotation of François Mitterrand, inserted in a letter addressed by Gaston Defferre to Laurent Fabius, September 24, 1984, AN 19960290/6.

32 Descamps and Quennouëlle-Corre, "1983, un tournant libéral ?".

33 G. Defferre to L. Fabius, September 27, 1984, AN 19960290/6. On Chevènement's point of view, Barret, "La politique éducative," 374–379.

priation of schools. The second characteristic of this first draft was the preference given to Apple and its brand-new Macintosh, given the technological advance (three years) of the Macintosh compared to similar products. The idea was to produce a Macintosh under a French brand, thanks to a joint venture with French industrialists and the setup of a new plant on French territory.[34]

The person who was in a position to lead such an ambitious project within the government was not Defferre, but the Prime Minister himself, the young Laurent Fabius. He officially presented the operation to the press on 25 January 1985 (at a press conference), introducing its new name *Informatique pour tous.* It was not just a communication issue; Laurent Fabius and his cabinet took control of the operation, which was led by a delegate reporting to his cabinet, Gilbert Trigano. This coincided with the marginalization of Servan-Schreiber and Defferre in the process, and with several changes to the initial project. In his official presentation, education and pupils were clearly at the forefront; access for all citizens was the second aspect, and teacher training the third. But industrial policy was looming in the background, as clearly shown by this excerpt from the minutes of an inter-ministerial meeting held on 17 January "*Le matériel informatique : –* ***il sera français***"[35] [emphasis in the original document]. The project had also been significantly scaled down with regards to the number of workshops (from 50,000 to around 10,000), the number of computers to be installed (from 250,000 to 100,000), and the total cost (from 8 billion to 2 billion Francs). This scaling-down was not primarily due to financial considerations. The various stakeholders – both in the French IT industry and in the Ministries, including the Ministry of Education – pointed out that the scale of the first project was unrealistic in terms of (French) industrial capacity, of teacher training and of logistics.[36] In January 1985, the die was cast for the futuristic dream of the super-modern Apple hardware being accessible to every inhabitant in each French village. It was clear, at that time, that *Informatique pour tous* would be a matter of French industrial policy as well as a political coup with a strong pedagogical dimension.

34 G. Defferre to L. Fabius, December 7, 1984, AN 19960290/6.
35 Minutes of the inter-ministerial meeting held on January 17, 1985 (the minutes date from January 21, 1985), AN 2018098/2.
36 Daniel Gras, technical advisor, to the Minister of Education, Jean-Pierre Chevènement, "50 000 ateliers de pratique informatique – Rencontre avec M. Gaston Deferre, Ministre d'État," December 6, 1984, AN 19870028/11.

A Financial Maze: When Political Will Breaches the Administrative Order

At the same time, the government had to find money to finance this huge investment. An amount of 1.890 billion, 1.263 billion in equipment; the rest in furniture, teacher training, and software. How much did this weigh on public finances? Not much compared to the state budget of 1985, which was 999 billion Francs, or to the whole budget of the Ministry of Education for primary, secondary, and technical schools (Universities excluded), which was 158 billion. More relevant is the comparison with the amount of really "new measures" – those that allow for new policies, once the amount corresponding to mere adjustments is taken out – that had been painstakingly negotiated by the Ministry of Education during the summer of 1984, for the budget year 1985: 1.121 billion Francs for universities and "enseignement scolaire".[37]

Moreover, this sum had to be provided for in a totally abnormal calendar. This operation had been decided on after the vote of the 1985 finance bill, and it was to be implemented in 1985. They had to find innovative solutions. The main contributor was not the Ministry of Education, but the annex budget of the Post and Telecommunications (PTT) Office. Since 1923, the resources and expenditures of Post and Telecommunications were no longer included in the general budget of the State but had been the subject of an annexed budget. This provision should in principle have given greater financial autonomy to this sector and allowed its managers, in particular, to use operating surpluses for investment.[38] Faced with budgetary restrictions, the government had already chosen, in the fall of 1984 (for the 1985 budget), to transfer spending on the modernization of the "computer industry" (*filière électronique*) to this budget, which had significant surpluses.[39] The door was thus open for another transfer.

However, whatever its resources, the budget of the PTT was already fixed for 1985, and there was no easy way to redirect the planned expenditure. The Ministry of the PTT came up with a providential (but complicated) solution: a leasing con-

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37 Letter addressed by the Prime Minister to the Minister of National Education, July 27, 1984, "Plafond de dépenses pour 1985," AN 19930646/4.

38 Pierre Musso, "Aux origines de ›l'autonomie‹ des télécommunications françaises, la loi de 1923," *Réseaux. Communication – Technologie – Société* 12, no. 66 (1994): 99–117, https://doi.org/10.3406/reso.1994.2544.

39 Sénat, "Rapport fait au nom de la Commission des finances, du contrôle budgétaire et des comptes économiques de la nation sur le projet de loi adopté par l'Assemblée nationale portant règlement définitif du budget de 1984," *JORF. Sénat*, doc. No. 301, appendix to the minutes, session of the June 19, 1987, 79–82.

tract (*credit bail*).[40] There would be a four-part convention signed between the UGAP,[41] the PTT, the Ministry of Education, and the leasing company. The bulk of the equipment was thus to be paid from 1986 onwards (the franchise and the progressive repayments to the lender). Given the budgetary legislation and the use of public money, this solution was considered heterodox and costly, and was severely criticized by the Cour des Comptes (the supreme body for auditing the use of public funds) afterwards.[42]

Moreover, this financial operation led to a recentralization of the school computerization process. The strategy of the Ministry of Education had previously been to contract with local authorities: this was the strategy that should have been followed for the 9th plan. If the local authorities were ready to pay part of the sum, the state would subsidize the operation. This process was certainly slower, and the shared exercise of competence was not fully in line with the aim of a "coherent block of competences" officially pursued through the decentralization process. However, so far, it had allowed for a real mobilization of local teams (operation *Micro-ordinateur grand public*), and it weighed less heavily on state finances. IPT broke this dynamic and even created some discontent among local authorities that had been pioneers in equipping their schools as they were not a priority target to receive IPT endowments. The most motivated teams were frustrated by the process. Lastly, the opening to the public, which would have involved added financial charges for the local authorities, encountered such difficulties that the results in this field seem very limited.[43]

This financial heterodoxy attests to the high political stakes associated with the experiment.

40 12 février 1985, note from Jean-Claude Hirel, cabinet director of the PTT minister to Louis Schweitzer, cabinet director of the Prime Minister, AN 19860179/5.

41 The *Union des groupements d'achats publics (UGAP)* is a service responsible for the supply of material and equipment to administrations.

42 Cour des comptes, "Les conditions d'approvisionnement du ministère de l'Éducation nationale en matériels et logiciels micro-informatique," *rapport à fin de décision*, 86–146, January 31, 1986, AN 20160541/276.

43 François Roussely, cabinet director of the Minister of the Interior, to the Prime Minister (addressed to Christian Bècle, technical advisor), "Plan informatique pour tous," November 20, 1985, AN 19870028/11.

Industrial Meccano or Pedagogical Experiment?

If the political wager was compatible with the industrial Meccano, the haste of the process obviously affected its pedagogical relevance.

Arming the French Computer Industry for Global Competition

The constant involvement of the DIELI in the setting up and implementation of the Plan attests to the fact that that IPT was a piece of an industrial Meccano set. The history of the IPT plan is linked with that of the *filière électronique*, the new label chosen by the French government in 1982 to encompass the initiatives taken in order to promote the French electronics and computer industry.[44]

The nationalizations carried out by the socialists in 1982 had further tightened the links between the computer industry and the government. These nationalizations were primarily an ideological choice: this policy was not specific to the electronics or computer industry. Nonetheless, major players in the computer industry – Thomson and Bull – were included in the pack. Unhappily, the government very soon discovered that Thomson was not the expected "goose that lays the golden egg"; the financial results were below expectations.[45] This highlights the strong voluntarism of the so-called *Programme d'action pour la filière électronique*, launched on 28 July 1982 by Chevènement, who was then Minister of Research and industry. This program was first and foremost a brand, a communication tool.[46] It also encompassed a multitude of subsidies, contracts, direct investments, etc., for a total (promised) amount of 140 billion Francs, with 55 billion to be paid by the State (11 billion per year, public procurement not included). This promise was eventually compromised by the rigorous fiscal policy officially adopted after March 1983: as usual for these highly publicized announcements, it is hard to know what was really spent on it. Considering the global amount announced, *Informatique pour tous* and its 2 billion Francs looks like a tiny drop in the ocean compared to the money spent lavishly on the *filière électronique.* However, it

44 Barreau and Mouline, *L'Industrie électronique française*, 6–8.

45 Budget Directorate, "Collectif 1982. Demandes de dotations budgétaires pour les entreprises nationalées," April 27, 1982, CAEF, PH 170/94, carton 5.

46 This was also the defense line adopted to avoid criticism from the European Commission. Comité interministériel pour les Questions de coopération économique européenne. Secrétariat général, "Filière électronique et aide à la recherche," May 16, 1986, AN 19890634/9.

was enough to focus attention and guide technical choices and public contracts. Numerous archives from the Cabinet of Edith Cresson (Minister of Industrial Redeployment and Foreign Trade) bear witness to IPT's industrial vision.[47]

The first challenge of IPT was to stimulate supply and demand: "Contribute to the financing of the modernization and extension of the productive apparatus and therefore of supply".[48] Correspondence with Thomson and Exelvision shows that the contracts were large enough to make a difference in terms of production and industrial capacity; those companies needed to open new production lines to meet the targets set by the government. The archives also reflect the hopes that this operation would eventually stimulate private demand for computers, both because the price of each unit would fall, and because people using computers in computer labs would eventually buy a computer.

The second challenge was to strengthen and restructure the French sector in the face of international competition. Priority was given to French players over IBM, whose dominance on the French market needed to be countered, but also for the Prime Minister over Apple, whose success would have been a direct threat to Bull and its professional computers. The purpose for the Minister of the Industry was clearly to favor French actors, but which ones? The French IT sector – both professional computers and domestic computers – encompassed big companies and small challengers. There were many discussions about how to divide the "IPT" cake between French companies able to provide both types of computers (table 1).

Table 2: French IT companies (1985)

Professional computers	Domestic computers
– Bull	– Thomson
– SMT-Goupil	– Exelvision
– Logabax	– Matra
– Leonord	– MTB
– Matra	(Matériel technique de Boulogne)

47 The archives of Christian Mitjavile, then Technical Adviser to the Minister of Industry and Telecommunications for electronics, information technologies and telecommunications industries, keep a precise record of these discussions, AN 19860179/5.

48 D. 1344. MEG. November 13, 1984. "Équipement des établissements d'éducation et de formation en micro-ordinateurs. Rapport de présentation au comité directeur du FIM," AN 19860179/5.

Clearly, this was not fair competition for the actors, and there were rather questionable public contract procedures considering the French rules, European rules, as well as those set by the General Agreement on Tariffs and Trade.[49] This organization was seized upon by the Americans, dissatisfied with the process.[50] Practically, the authorities exploited the existence of the contracts signed in July 1984 for the implementation of the 9th Plan. The procedure of the amendments to initial contracts gave them a certain freedom to choose suppliers when the quantities would in principle have justified a new call for tenders.[51]

There were also technological reasons for choosing French equipment. These technological aspects are multiple. In terms of processing power, Apple was clearly ahead, since it mastered the 32-bit technology, whereas French computers were at best on 16 bits. However, other questions were raised: compatibility and interoperability with the existing hardware, which was one of the main criticisms of the Apple solution. Discussions also mentioned the availability of pedagogical software in different languages, potential telematic developments (linked with the launch of the French Minitel), etc. But the main argument defending the French solution was the original structure of the *nanoréseau.* The idea was to use powerful professional computers as network heads connected with a handful of domestic computers (workstations). Users of the workstation therefore had access to the software library, to a range of peripherals, and to the processing power of the network head. However, considering the potential of the Macintosh developed at the same time by Apple, it was not clear that the *nanoréseau* was such a good technological solution; the Thomson workstations would soon be outdated.

As early as June 1985, the Minister of Industry and the industrialists decided to seize this opportunity to sell the French integrated solution abroad; it would soon be too late. They prepared a leaflet (both in French and in English), as well as a series of promotional events linked to operation IPT.[52] Attempts were made to sell this integrated solution to various categories of countries, with different strategies depending on the centralization of their educational systems. In February 1986, contracts had already been settled with Catalonia, Belgium, Portugal, and Al-

49 Ministère de l'Économie, Directeur des relations économiques extérieures, "Plan IPT : respect de nos obligations internationals," March 27, 1985, AN 19860179/5.

50 27–29 Mayi 1985 Comité interministériel de coopération économique, AN 19890634/9.

51 Christian Mitjavile, 24 janvier 1985, "Ateliers informatiques : financement des matériels," AN 19860179/5.

52 The English leaflet of 1985 is entitled "Teaching and the computer. French educational project design. A world first", archives of the DIELI; Ministry of Industrial Redevelopment and Foreign Trade; Marc Mathieu (DIELI) to the cabinet director of the Minister "Objet : bilan et perspective de la promotion pour l'exportation du nanoréseau," February 6, 1986, AN 19860179/5.

geria, and discussions were pretty much advanced with Russia. It has not been possible to document what happened to these initiatives after the electoral defeat of March 1986.

Computers for All: The Pedagogical Failure?

Considering the genesis of the project, there was clearly a risk that the operation would be considered as "carried out from outside". This was emphasized by a representative of the Ministry of Education in an inter-ministerial meeting in January 1985: "the steering of the project must ensure the mobilization of the network of schools and teachers and not give the impression of an operation conducted from outside".[53] They may have had in mind the criticisms raised by the "10,000 micros" operation.[54] Some actors also remembered the piecemeal introduction of audiovisual equipment at the turn of the 1970s, which did not have the desired effect due to a lack of adequate teacher training.[55]

This shed light on the efforts made to secure the support of teachers and their representatives. Back in 1984, Gaston Defferre had enlisted a strong ally: the SNI-PEGC – the biggest union of elementary teachers and a traditional political ally of the socialists.[56] There are records of discussions between Defferre collaborators and union delegates that show the approval of the union, even if the SNI-PEGC considered Thomson hardware as completely outdated and clearly favored the Apple option. Secondly, the Minister of Finances accepted, for the first time, that teachers would be paid to attend training sessions during their holidays.[57] It would have been impossible to find enough substitute teachers to train them during school

53 A quotation from the Ministry of National Education, written in the minutes of the inter-ministerial meeting of January 17, 1985 (minutes of the January 21, 1985), AN 20180498/2.

54 "La mise en œuvre du plan informatique des établissements scolaires est interrompue," *Le Monde*, June 6, 1981.

55 Cour des Comptes, "Enquête sur l'enseignement audiovisuel dans les établissements du second degré du ministère de l'Éducation nationale," rapport 72–1046, December 5, 1972, AN 20160547/47.

56 "The National Union of Teachers said it was enthusiastic about this project. It is indeed an opportunity to improve the image of teachers in the country and to mobilize them around a project for the future, which is particularly necessary after the debate on private schools." Draft of a letter addressed by G. Defferre to L. Fabius, November 2, 1984, 19960290/6; Ismaïl Ferhat, *Socialistes et enseignants: le Parti socialiste et la Fédération de l'Education nationale de 1971 à 1992* (Pessac: Presses Universitaire de Bordeaux, 2018).

57 "Décret instituant une indemnité de sujétions particulières en faveur des personnels concernés par les stages de formation organisés en dehors de la période scolaire au titre du plan Informatique pour tous," Decree signed on March 22, 1985, and published on March 24, 1985.

time and impossible to find enough volunteers to attend the training sessions during the holidays without any compensation. Once again, this financial compensation gave clear evidence of the political stakes of this project. Teachers responded enthusiastically to this offer: there were four times as many volunteers as there were places in the training sessions. Clearly, from a political point of view, pedagogical success was important enough to justify unprecedented efforts.

However, the political will to act quickly, before the elections of March 1986, had several problematic consequences, as pointed out by a general inspectorate in a highly critical report written in July 1986: "Slow and disappointing start-up of pedagogical uses, clearly out of step with the rate at which equipment is installed in schools. This delay seems to be mainly due to the uncertain definition of training activities with low efficiency and the unequal technical and pedagogical value of the available software".[58] The inadequacy of the software – scarce and of mediocre quality – and the content of the training – turned towards programming in BASIC – had been widely criticized.

At that time, the socialists had already lost the elections of March 1986, and there was no political reason to rebuff criticism against this initiative promoted by the political adversary of the new government. While the repayment of the IPT Plan continued from 1986 to 1989, the right-wing government again reoriented its IT strategy. New credits for equipping schools with computers were mainly and discreetly earmarked for private schools, late beneficiaries of this initiative.[59]

Conclusion

Informatique pour tous followed a series of initiatives dating back to the early 1970s: "58 lycées" and "10 000 micros" paved the way for IPT. These previous experiments – along with the vivid memory of the hopes and disillusions linked to the introduction of audiovisual devices into schools – had highlighted the paramount importance of teacher training in any such endeavor.

Despite a certain continuity, IPT differs markedly from previous operations in the scale of the public resources deployed and the speed of the process. This difference is the result of a strong political commitment at the highest level of the State. In a sense, IPT was a political gamble with an eye on the general elections of 1986.

58 Yves Martin, doyen de l'inspection générale, July 20, 1986, "L'utilisation pédagogique de l'informatique. Situation actuelle et perspectives", AN 19890424.

59 Confidential note, September 3, 1986, "Note sur l'évolution des crédits de la filière électronique en cours d'exercice," archives of Gérard Longuet's cabinet (Gérard Longuet was at that time Secretary of State for Post and Telecommunications), AN 19890634/9.

Economic considerations relating to French industrial policy also influenced the decision and its implementation, especially with regards to the choice of equipment. However, as shown by the exceptional attention given to teacher training, political leaders were clearly aware that the political gamble could not be won at the cost of failure on the pedagogical front.

Politically, IPT may have helped to limit the extent of the defeat in 1986, which was much less severe than had been feared among the socialists, but it did not lead the government to victory,[60] nor did IPT save the French computer industry in the long run. An exploration of the companies' archives might possibly serve to clarify the short-term effects of this plan on both their financial balance sheets and their industrial strategy. As for its medium- and long-term educational effects, the analyses of computer advocates (EPI members) tend to value the symbolic impact of an operation that suffered above all from the lack of continuity.[61] In the short term, however, it seems clear that although computers entered thousands and thousands of schools, they did not necessarily make their way into the classrooms on this occasion. A selection of case studies could highlight local variations. Given the variety of stakeholders, different scales may be relevant: the local education authority, the department, the areas covered by the *inspecteurs départementaux de l'enseignement primaire* (departmental inspectors of primary education), the municipalities, or the schools themselves.

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60 Gérard Grunberg, "Les élections législatives de 1986," in *François Mitterrand, les années d'alternances : 1984–1986 et 1986–1988*, edited by Georges Saunier (Paris: Nouveau monde éditions, 2019), 39–53.

61 EPI, "Quelques jalons pour un historique de l'informatique dans le système éducatif français. Depuis 1970": "This operation, which is often criticized, especially by those who did not know about it, had the merit of raising awareness of the importance of IT for the education system and beyond for society as a whole. This long-term plan was unfortunately interrupted for the most part by a change of government", https://www.epi.asso.fr/revue/histosom.htm.

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Lajos Somogyvári, Máté Szabó, Gábor Képes

How Computers Entered the Classroom in Hungary: A Long Journey from the Late 1950s into the 1980s

Dedicated in memory of Edit Sántáné-Tóth (1938–2022), Hungarian pioneer of computing and eminent historian of computing and computer science education.

Abstract: Computers arrived in Hungary only by the end of the 1950s. During the 1960s, Hungary tried to implement several (mostly unsuccessful) reforms in the fields of education, economics, and even politics. However, the customary proliferation of bureaucracy was not fostering actual change. The strenuous efforts of the Hungarian "IT sector" in the field of education bore fruit only during the 1970s. Our paper focuses on the two decades of the 1960s and 1970s while providing a short summary of the 1950s as a background for these processes, and a short section about the spreading of personal computer culture and its use in education in the 1980s. We discuss computer education on multiple levels, from secondary schools to universities, including cybernetics and computer clubs, as well as vocational education. Discourse around the growing delay behind developed Western countries heightened as schools lagged behind in technological development more and more. Beyond the bureaucratic and ideological aspects, we also discuss the debates internal to the profession.

Keywords: computer education; vocational education; Hungary; socialism; Cold War

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Introduction: Context and Overview

Within the Cold War context, the educational race (besides the arms race and space race) intensified after the 1957 Sputnik Shock.[1] The two blocks tried to improve their educational and scientific capacity, gaining advantage in the "Era of coexistence." While the Soviet Union was leading the "space race" at the time, Soviet computerization was lagging behind the West, Hungary was farthest behind the East in terms of new technologies. Computers arrived in Hungary only by the end of the 1950s. During the 1960s, the country tried to implement several (mostly unsuccessful) reforms in the fields of education, economics, and even politics. However, the customary proliferation of bureaucracy was not fostering actual change. At the same time, several dedicated pioneers tried to spread knowledge about computers, and many cybernetics clubs were formed even in secondary schools. The Hungarian "IT sector" came into its power during the 1970s. During this period the focus on computer education was to train as many computer experts as quickly as possible. Thus, priority was given to postgraduate education in the form of trainings and courses. The strenuous efforts of members in the field bore fruit in secondary education only during the 1980s when a school computer program and the education of the growing numbers of home computer users were finally achieved.

Initiatives and funding from UNESCO and the progressive Western pedagogy were also important reference points in the Hungarian education sciences from the late 1950s in legitimizing reforms, updating school-plans, introducing educational technologies, and so on. Following isolation from the Western World (during the "Stalinist years" of the country, between 1949 and 1953), a slow reception of Western capitalist ideas began through a limited access to their sources, assuming they could be fitted with or translated into the ideological language of the country or get approved by politicians. These processes became stronger and more impactful from the 1970s.

As part of the educational transfer,[2] computers and computerization were tools to catch up to the West, together with other socialist countries – showcasing that technological superiority was very important for Khrushchev's propaganda. However, the economic-political context of the Soviet satellite countries didn't

1 Lajos Somogyvári, "Soviet Pedagogy and the American Educators," *Rivista di storia dell' educazione* 5 (2018): 133–155.

2 Gita Steiner-Khamsi, "The economics of policy borrowing and lending: a study of late adopters," *Oxford Review of Education* 32 (2006): 665–678, https://doi.org/10.1080/03054980600976353.

help in this case: according to Acemoglu and Robinson,[3] the non-democratic regimes hardly followed the technological changes in comparison to the democratic ones, which is similar to Kornai's argument about the inefficiency of bureaucratic coordination and overall state control in contrast to the flexibility of the free market.[4]

The First Courses on Programming in the Late 1950s

It is well known that the computerization of the Eastern Bloc lagged behind the US and Western Europe. However, the computerization of Hungary started out relatively slow even within the Eastern Bloc, not only in comparison to the Soviet Union but also to Poland and Czechoslovakia as well.

The first vacuum tube computer in Hungary started running reliably only from early 1959. It was built by the Cybernetics Research Group (Kibernetikai Kutatócsoport, KKCS, founded in early 1956) of the Hungarian Academy of Sciences in Budapest, comprised of small departments of mathematics, computers, economics, and automatization.[5] The establishment of this new research unit became possible just after the Soviets lifted the ban on cybernetics in 1955. The ideological justification of this change was provided by an article published in the Voprosy Filosofii (Problems of Philosophy). In the famous "The Main Features of Cybernetics" article,[6] written by three of the most acclaimed Soviet scientists, Sergei Sobolev, Anatoly Kitov and Alexey Lyapunov, the authors defended the research field from the accusation of being a pseudo-science and emphasized the potential military applications of the first Soviet computers as well.[7] In the years to come this article was

3 Daron Acemoglu and James A. Robinson, *Economic Origins of Dictatorship and Democracy.* Cambridge: Cambridge University Press, 2005, https://doi.org/10.1017/CBO9780511510809.

4 János Kornai, *Economics of shortage* (Amsterdam: North-Holland, 1980).

5 Ernő Csonka, "Új fogalom a tudományban. Beszélgetés a Tudományos Akadémia Kibernetikai Kutató Csoportjának igazgatójával [A new concept in science. Interview with the director of the Cybernetics Research Group of the Hungarian Academy of Sciences]," *Magyarország*, May 15, 1957, 6.

6 С. Л. Соболев, А. И. Китов, and А. А. Ляпунов, "Основные черты кибернетики," [S. Sobolev, A. Kitov, and A. Lyapunov, "The Main Features of Cybernetics"] *Вопросы философии* 4 (1955): 136–148, https://www.twirpx.com/file/1917939/.

7 Slava Gerovitch, *From Newspeak to Cyberspeak: A History of Soviet Cybernetics* (Cambridge, MA: The MIT Press, 2002). We can interpret the (re)opening toward using mathematical methods and cybernetics in the framework of de-Stalinization, as a beginning of a competition with the US in the aspect of computerization, see: Ekaterina Babintseva, "'Overtake and Surpass': Soviet Algorithmic Thinking as a Reinvention of Western Theories during the Cold War," in *Cold War Social Sci-*

widely cited around the Eastern Bloc to promote cybernetics as a legitimate and important research field.

It was in this international context that the Hungarian group received the blueprints and some of the parts of the Soviet M-3 computer in 1957 and began to build the first electronic vacuum tube computer in the country. The M-3 showed its first "signs of life" during 1958 and ran reliably by 1959.[8] By the end of that year there were three running computers in the country; however, since the other computers were at ministries, only the M-3 was available for educational purposes. Mihály Kovács, one of the most important pioneers of computerizing schools in Hungary, whose work we discuss in detail below, showed this computer to his students already in the spring of 1959. The lag in the computerization of the country is well illustrated by the fact that all of these machines were in the capital, Budapest. In fact, there was no working computer outside of Budapest until 1965!

The start of the earliest courses on programming was not entrenched in ideological debates, as it was clear that there were not enough experts to program the limited computers in the country. Also, these trainings and courses were offered to and attended by adults, and thus could not "corrupt" the youth.

Naturally, the first course on programming digital computers was taught by the members of the KKCS during 1958 and 1959. The course was devoted to the programming of the M-3 computer. It contained 37 lectures and trained 10–20 programmers. However, the course was so popular that it had to be repeated 3–4 times shortly thereafter. Many of the 50 or so participants of these courses later became renowned computer experts in Hungary.[9] In 1959, the lecture notes of the course were printed in a manuscript format and circulated in small number of copies.[10] The first publicly

ence: Transnational Entanglements, ed. Mark Solovey and Christian Dayé (Cham: Palgrave Macmillan, 2021), 63.

8 Bálint Dömölki, "The story of the first electronic computer in Hungary," *Studia UBB Digitalia* 62 (2017): 25–34, https://itf.njszt.hu/wp-content/uploads/db_ubb_cikk2.pdf; Győző Kovács, "50 Years Ago We Constructed the First Hungarian Tube Computer, the M-3: Short Stories from the History of the First Hungarian Computer (1957–1960)," in *History of Computing. Learning from the Past – IFIP WG 9.7 International Conference, HC 2010, Held as Part of WCC 2010, Brisbane, Australia, September 20–23, 2010. Proceedings*, ed. Arthur Tatnall (New York: Springer, IFIP Advances in Information and Communication Technology 325, 2010), 68–79; Máté Szabó, "The M-3 in Budapest and Szeged (Scanning Our Past)," *Proceedings of the IEEE* 104 (2016): 2062–2069. https://doi.org/10.1109/JPROC.2016.2601164.

9 Edit Sántáné-Tóth, *A számítástechnika felsőfokú oktatásának kezdetei Magyarországon* [Beginnings of the higher computer education in Hungary] (Budapest: Typotex, 2012): 38–39.

10 Tamás Frey et al., *Az M-3 elektronikus számológép programozása* [The Programming of the M-3 Electronic Calculator], Manuscript (Budapest: Magyar Tudományos Akadémia Kibernetikai Kutató Csoportja, 1959), http://misc.bibl.u-szeged.hu/49404/1/xc_70481.pdf.

available textbook on the programming of computers was written by János Szelezsán, another member of the KKCS, and published by 1963.[11]

Members of the KKCS, first and foremost Győző Kovács, offered to teach courses on programming at universities in Budapest. The largest universities, the Faculty of Natural Sciences at Eötvös Loránd University (ELTE) and the Technical University, both rejected these offers due to their lack of understanding of the future importance of computers and their conservative curriculum design practices[12] – Ferenc Sándor, a research fellow of the group, could only hold a few invited lectures in the first semester of 1958 at the Faculty of Science at Eötvös University.[13] Interestingly, the only place where these efforts were welcomed was the Karl Marx University of Economics. Unsurprisingly, one of the early uses of the M-3 computer was to provide calculations for the Planbureau as part of the economic planning. Rezső Tarján, the scientific deputy director of the Cybernetics Research Group was crucial in developing an effective economic expert group which prepared development plans, cost models, and solved different tasks of transportation. Béla Krekó, a young professor from the University of Economics, was hired part-time to help with such applications. By the academic year of 1961/62, Krekó was able to start a new, so-called "plan-mathematician" major at the University of Economics. This 5 year-long major trained about 15–20 students in modern, formal economics; the name of the major clearly appeals to the "economic planning" jargon of the time. The major included courses on linear and nonlinear programming in economics (taught by Krekó), as well as electrodynamics and mathematical machines, while the members of the KKCS regularly taught courses on programming and computer science.[14]

The first university-level programming and computer science training in Hungary began in 1957 at the University of Szeged due to the strenuous efforts of Professor László Kalmár. The interests of the eminent and internationally known mathematical logician turned towards the applications of logic to computer design and to engineering in general, automata theory, and cybernetics. When the training started there was no running computer in the country. Moreover, there was no computer at Szeged until 1965. Thus, it had to function without a computer in place

11 János Szelezsán, Elektronikus számológépek programozása [The Programming of Electronic Calculators] (Budapest: Magyar Tudományos Akadémia Számítástechnikai Központja, 1963).

12 Győző Kovács, *Válogatott kalandozásaim Informatikában* [My Selected Adventures in Informatics] (Budapest: GÁMA-GEO Kft., Masszi Kiadó, 2002).

13 Rezső Tarján, "A hazai kibernetikai kutatások [Researching cybernetics in our country]," *Magyar Tudomány* 67 (1960): 143.

14 Ferenc Forgó and Sándor Komlósi, "Krekó Béla szerepe a közgazdászképzés modernizálásában. Krekó Béla (1915–1994) emlékére [The role of Béla Krekó in the modernization of economic education: In memory of Béla Krekó (1915–1994)]," *Szigma* 46 (2015): 140.

for several years. Students in the first couple of years only had access to the M-3 computer through group visits about once per semester. This situation led, by necessity, to the so-called "chalk programming" method where programs were written on the blackboard with chalk, while their execution, by Kalmár and the students, were called "dry runs."[15]

Even though the Technical University of Budapest as a whole was not interested in engaging with the new "fad" of computers, at least one of their faculty members, the electrical engineer László Kozma saw its importance. He began working on the design of a small relay computer to be built solely for educational purposes in 1955. By the end of 1958 he had a working computer, the MESZ-1, made mostly out of telephone exchange parts. It was used in elective courses and special colloquia. However, this educational marvel remained somewhat hidden. Even though Kozma was internationally recognized for his work at the Bell Telephone Company in Belgium before the world war, as a former political prisoner who was rehabilitated and reinstated in 1954, he refrained from unnecessary engagement with the authorities.[16]

Beyond the trainings offered by the members of the Cybernetics Research Group and the University of Szeged, expository works in the field of cybernetics and a growing number of newly founded secondary school cybernetics clubs played an instrumental role to spread this knowledge more widely in the country. These clubs acted as intermediary contexts or tools, following the contemporary international trends.[17] In the next section, we survey the history of these secondary school cybernetic clubs.

15 For a detailed description of the program visit: Máté Szabó, "László Kalmár and the First University-Level Programming and Computer Science Training in Hungary," in *Histories of Computing in Eastern Europe. HC 2018. IFIP Advances in Information and Communication Technology*, vol. 549 (Cham: Springer, 2019): 40–68.

16 For Kozma's description of the computer see: László Kozma, "The New Digital Computer of the Polytechnical University Budapest", *Periodica Polytechnica Electrical Engineering* (Archives) 3, no. 4 (1959): 321–343, https://pp.bme.hu/ee/article/view/5399/4504. Kozma's short biography can be found in Kovács' (2012). A summary of contemporary reverse-engineering project of the MESZ-1 is available at https://mesz-i.org/?page_id=652/.

17 Ronald R. Kline, *The Cybernetics Moment: Or Why We Call Our Age the Information Age* (Baltimore: The Johns Hopkins University Press, 2015).

Cybernetics Clubs in Hungary

The prehistory of secondary school computer science education in Hungary (referred to as "informatics education"[18]) is tied to the Piarist order. The traditions of the religious teaching order made its members receptive to the new developments and issues in technology and natural sciences. For example, "Professor" Öveges, a nationally beloved early Hungarian "TV personality", who popularized physics on the screen through his famous experiments from 1957 until his passing in 1979, was a former teacher of the order as well. His prestige and fame contributed to the dissemination of the achievements of the Piarist community, even during the socialist era of the country.

The teacher Mihály Kovács also belonged to the Piarist order. He launched his cybernetics club for the students at the secondary school of the Piarist order from the 1958/59 academic year. The biweekly meetings of the club were held in the lab of the school. Kovács and his students built cybernetic games and models in the 1960s using electromechanical (relay) components.[19] The most important ones among them were:

18 In Hungary there are generally three terms used in computing related education. "Computer science" is reserved for purely theoretical courses and is used almost exclusively in higher education. The most prevalent term, used from the 1960s on, might be "computer technologies." It is a bit ungainly, as it encompasses both hardware and software studies. The Hungarian word "informatika," translated here as "informatics," became widespread in the country from the early 1980s. It is based on the French word "informatique" and most likely entered the Hungarian language through the frequent interactions between the French and Hungarian "IT sectors" from the late 1960s and throughout the 1970s. "Informatics" is used as an umbrella term, including not only computer science, computing technologies and information theory, but even cultural aspects of computing as well, including "computer literacy." On the meaning of "informatics," see the 2017 CECE report on *Informatics Education in Europe* at https://portalparts.acm.org/hippo/cecereport.pdf. On the interactions between the French and Hungarian IT sectors, see Máté Szabó, "From the East to the West and back Again: Hungary's Early Years in the Ryad," *2020 Fifth International Conference "History of Computing in the Russia, former Soviet Union and Council for Mutual Economic Assistance countries" (SORUCOM)* (2021), 27–33 and IEEE Xplore Digital Library, https://doi.org/10.1109/SORUCOM51654.2020.9465042.

19 Mihály Kovács, "Atomfizika, számítástechnika a Piarista Gimnáziumban [Atomic physics, computer science in the Piarist Grammar School]," *Fizikai Szemle* 44 (1994): 35, http://fizikaiszemle.hu/archivum/fsz9401/kov9401.html; László Görbe, *Kovács Mihály piarista tanár* [Mihály Kovács, piarist teacher] (Budapest: Országos Pedagógiai Könyvtár és Múzeum, 2007), 57–95; László Görbe, "A természettudományos oktatás a budapesti piarista gimnáziumban [Teaching sciences in the Budapest Piarist Grammar School]," in: *Hitre, tudásra – A piaristák és a magyar művelődés* [Faith and knowledge – Piarists and the Hungarian culture], ed. András Koltai (Budapest: Történeti Múzeum – Piarista Rend Magyar Tartománya, 2017), 193–202.

- Logi, a card playing machine, designed and built by Zoltán Perjés, 1960.
- Magic-mill, a 3x3 Tic-Tac-Toe playing machine, designed and built by Zoltán Perjés and György Vesztergombi, 1960/61. (Another Tic-Tac-Toe machine was created by Jenő and Zoltán Ágost in 1959/60).
- Heap (NIM-type game), designed and built by Örs Reé, 1962.
- Maze-solving mouse, designed by György Vesztergombi and built by Ferenc Vesztergombi and István Káli, 1962/63.
- Combining machine (8-as Kombinett, sorting numbers into series), designed and built by Zoltán Fodor and Tivadar Lohner, 1964.
- Planning and building bridges, designed and built by István Kende and Tivadar Lohner, 1965.

Thus, Kovács introduced his students to the world of cybernetics through games. Utilizing games was an excellent way to get the students interested in contemporary science – and the realized games can be seen as scientific models or illustrations as well. This practice was not Kovács' invention of course – it was already customary at the time to illustrate the capabilities of new technologies at industrial fairs with automata and computers playing games. An early Hungarian example was Zoltán Hennyey's Fantan logical machine playing a Chinese NIM-type game also popular in India.[20] Hennyey built his machine at the Technical University in Budapest and demonstrated it at the Hungarian Industrial Instrumentation Expo in 1958.[21]

Kovács designed his biweekly, two-hour long cybernetics club based on Lothar Wolf's *Elektronengehirn und Rechenautomat* from 1958.[22] The meetings of the club were similar to that of a university seminar, leaving time to build and test machines while establishing a community of creative pupils. Inventions of the cybernetics club were presented at several pedagogical exhibits and meetings of physics teachers. Some of the creations even made it to the press and reached a wider audience.

During the socialist era, religious schools were tolerated but definitely not promoted by the regime. Accordingly, the Budapest Piarist Grammar School was referred to via its location at the time as the "Mikszáth Square High School." Due to state discrimination and restrictions against religious institutions, students from these secondary schools faced more challenges when applying for higher education. This led to many of the pupils leaving the country, earning their university degree, and build-

20 Margit Csákváry, "Bemutatkozik a Fantan, az első magyar logikai játékgép [Introducing Fantan, the first Hungarian logic game]," *Magyar Nemzet*, November 23, 1958, 5.
21 Tihamér Nemes, *Kibernetikai gépek* [Cybernetic Machines] (Budapest: Akadémiai Kiadó, 1962), 165–256.
22 Wolf, Lothar: Elektronengehirn und Rechenautomat: Physikalische Schulversuche zur Automation (Frankenberg: Aulis Verlag, 1958).

Fig. 1: Mihály Kovács with his students. Archive: MTVA Sajtó- és Fotóarchívum. Record number: MTI-FOTO-830518. Photographer: László Mikó. People in the picture: Mihály Kovács (in the middle), András Nádasi, Ákos Hamza https://archivum.mtva.hu/photobank/item/MTI-FOTO-OEUwN0VnelYzQ1ZQdi90MU1iY0NiQT09

ing their careers abroad. This disadvantage faced by the students later benefited the Piarist School in turn: these students later sent teaching equipment catalogs and international literature, which helped Kovács to create and maintain an up-to-date physics lab. Kovács was able to obtain modern physics school equipment due to the customs regulations at the time, which allowed for receiving them as a gift through Caritas Internationalis. The lab steadily grew throughout the next decades, leading to the club's first experiences with real computers, a Lectron (an electronics building set from West Germany) and a Computer Lab from the US.[23]

While in some cases the students were inspired by international examples, such as Claude Shannon's Theseus when building the maze-solving mouse, most of their

23 Mihály Kovács, "Számítógép-ismeretek [Computer know-how]," *Köznevelés* 27 (1971): 3–5.

constructions were characterized by individual solutions. The most important and impactful outcome of the cybernetics club was the "cybernetic building set" called MIKROMAT, created by the student Ferenc Woynarovich. The MIKROMAT was in serial production from 1967, and in use in many schools during the 1970s. Even individuals could purchase it. It was inspired by and based on the American MINIVAC-601, another creation of Shannon's. Woynarovich was familiar with the MINIVAC-601 not only through short descriptions of scientific magazines but had access to an actual one as well. The MIKROMAT building set was a model computer built on a printed circuit board with four relays, simplifying and improving on its American precursor at the same time. Woynarovich called his prototype Tücsök (cricket), referring to the "chirping" made by the relays.[24] The prototype was then prepared for small-scale production by mechanic László Fazekas and his colleagues, and was then manufactured by a regional cooperative specializing in homecrafts (Budai Járási Háziipari Szövetkezet) and sold for 400 Hungarian Forints.[25] [26]

Kovács' cybernetics club deeply influenced the Hungarian pedagogical community during the 1960s and 1970s in two ways:

- Publications, among them Kovács' books about cybernetic machines playing games.[27] The illustrations and circuit diagrams served as useful sources for other teachers who planned to start their own cybernetics clubs as well as for hobbyists tinkering at home. One of Kovács' books was published in German translation as well.[28]
- Kovács wrote a methodological guide book, "Practical Road to Cybernetics" (1967),[29] which was a great introduction to the world of automata and computers, in addition to displaying wiring diagrams of the MIKROMAT, for example of the "farmer, wolf, goat and cabbage" logical game. As MIKROMAT reached private individuals as well, many consider it to be the first "home computer"

24 In 2022 the engineer Gábor Vid built multiple replicas of the MIKROMAT for NJSZT (see below) which will be regularly demonstrated at the "Past of the Future" permanent history of computing exhibition in the Agora in Szeged, https://ajovomultja.hu/news/mikromat-replika-volt-muzej-slagere.

25 The average monthly salary in 1967 in the country was around 1900 Hungarian Forints.

26 Gábor Képes, "Egy út a modern informatikához: Kovács Mihály és tanítványai [Road to modern informatics: Mihály Kovács and his students]," *HiperGalaktika* 3 (2009): 112–117.

27 Mihály Kovács, *Kibernetikai játékok és modellek* [Cybernetic Games and Models] (Budapest: Táncsics Könyvkiadó, 1968); Mihály Kovács, *Néhány Kibernetikai játékgép* [Some Cybernetic Games] (Budapest: Tankönyvkiadó, 1969).

28 Mihály Kovács, *Rechenautomaten und logische Spiele* (Frankfurt am Main: Verlag Harri Deutsch, 1971).

29 Mihály Kovács, *Gyakorlati út a kibernetikához* [Practical Road to Cybernetics] (Budapest, 1967).

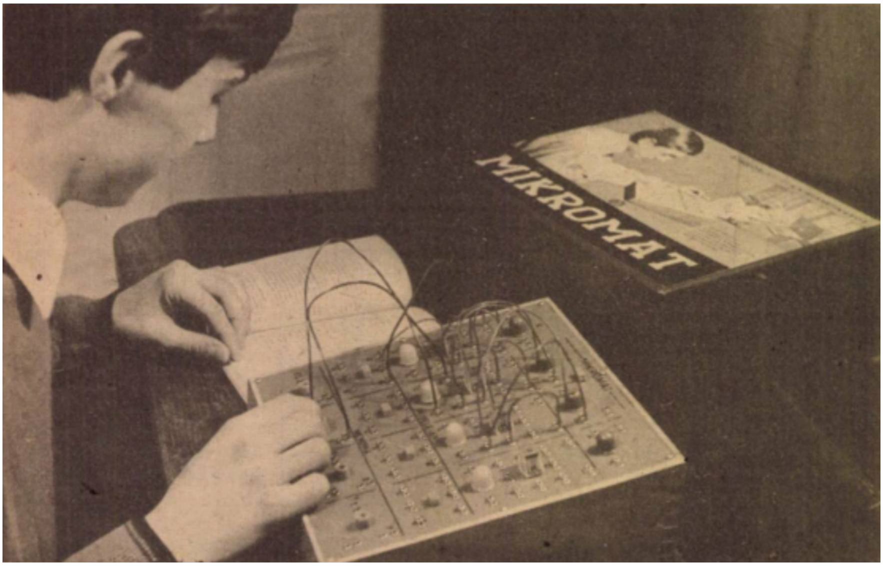

Fig. 2: Mikromat, the cybernetic building set. Photographer: unknown Mihály Kovács, "Számítógép-ismeretek [Computer know-how]," Köznevelés, 19 February 1971, 4.

> in Hungary. However, this should be taken with a grain of salt, since it was only a model to introduce the technology.[30]

Another important construction of the cybernetics club is the so-called DIDAKTOMAT multiple choice machine, which was able to evaluate student responses in the "classroom with feedback". It was created by Kovács and his Piarist teacher colleague Lajos Terényi with the cooperation of their student Zoltán Fodor. The teaching machine was originally built in 1964 and received a patent in 1969. Altogether 150–200 DIDAKTOMATs were in use in the country. The machine originates in Terényi's earlier work, which was deeply involved with "teaching machines" and "programmed education". At the time the field required some explanation in Hungary, hence, Terényi wrote the following in his paper (1964), capturing the Zeitgeist: "[Teaching machines] are not to displace or substitute the teacher. Not with respect to teaching. Not even in the peda-

30 Gábor Képes, "Mikromat kibernetikai építőkészlet [The Mikromat Cybernetic Bulding-kit]," in: *Hitre, tudásra – A piaristák és a magyar művelődés* [Faith and knowledge – Piarists and the Hungarian culture], ed. András Koltai (Budapest: Történeti Múzeum – Piarista Rend Magyar Tartománya, 2017), 193–202.

gogical aspect. Try to imagine what would have happened if instead of Makarenko, a machine would lead the commune!" (Translation by the authors)[31]

At the same time Terényi should not be seen as the "lone pioneer" of programmed education in Hungary. The use of cybernetic processes and new technologies (such as tape-recorders, televisions, movies, overhead projectors, teaching machines and computers) in the classroom was trending at the time in Hungary as well.[32] The researchers in this field even had their own Hungarian scientific journal, the Audio-Visual Bulletin (Audio-Vizuális Közlemények), which surveyed the similar developments and experiments in the USA, Soviet Union, United Kingdom, and France.

After being seen as an "idealist pseudoscience" in the early 1950s, cybernetics quickly became an accepted, even fashionable and trending scientific field in the Eastern Bloc. The public's interest in this field grew in tandem with its growing acceptance, which was catered to by several popularizing and expository publications. Consequently, similarly to the radio-amateur movement of the 1940s, during the 1960s cybernetics clubs were springing up all around the country. Clubs appeared outside Budapest in the larger cities as well. Sándor Vincze started his cybernetics club in 1959 in the Móricz Zsigmond High School and Dormitory[33] in Kisújszállás, a small town with a population of 10.000 in the countryside. Vincze even published a report on their activities in the methodological journal of the Ministry of Education and Culture.[34] It appears that Vincze's club was started and developed independently of Kovács' in Budapest and was based primarily on the logic books of Tamás Varga, a reformer of modern mathematics education in Hungary.[35]

In 1959/60 they built an adding machine, and in 1960/61, a machine that played a "nine men's morris" type game: a cybernetic game. The members of the club were mostly from the last two grades of secondary school (17–18 years of age). According to Vincze's observations, the students became acquainted with the binary

31 Lajos Terényi, "Tanítógép építése [Building a Teaching Machine]," *Magyar Pedagógia* 64 (1964): 32.
32 Bálint Dömölki and József Drasny, *Logikai gépek – tanuló gépek és tanító gépek* [Logic Machines – Learning Machines and Teaching Machines] (Budapest: Vas- és Fémipari Dolgozók Szakszervezete és a Tudományos Ismeretterjesztő Társulat Műszaki Szakosztályai Országos Választmánya, 1963); Lajos Somogyvári, "Tanítógépek Magyarországon a hatvanas években [Teaching Machines in Hungary in the 1960s]," *Létünk* 44 (2014): 93–104.
33 Where schools are named after individuals, we kept the Hungarian order of their names, as that is the proper name of the school. Thus, in this case Móricz is the last name and Zsigmond the first name of the novelist after whom the school is named. Otherwise throughout the text we wrote people's names in the English order.
34 Sándor Vincze, "Egy kibernetikai szakkör munkájáról [About the Work of a Cybernetics Club]," *A matematika tanítása* 8 (1961): 93–95.
35 Katalin Gosztonyi, "Tamás Varga's reform movement and the Hungarian Guided Discovery approach," *Teaching Mathematics and Computer Science* 18 (2020): 11–28.

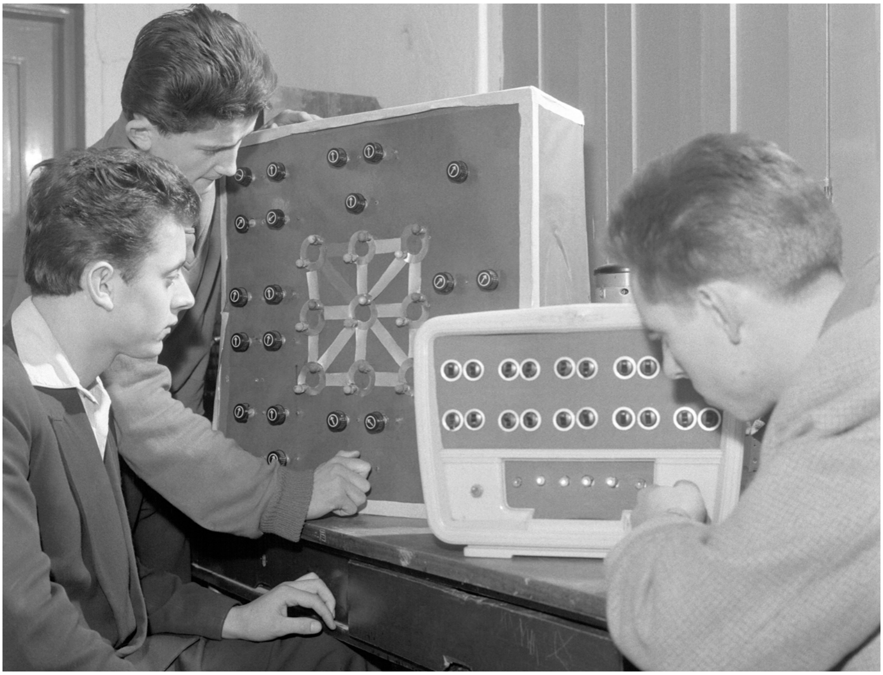

Fig. 3: Cybernetics Club in Kisújszállás. Archive: MTVA Sajtó- és Fotóarchívum. Record number: MTI-FOTO-830738. Photographer: József Bajkor. https://archivum.mtva.hu/photobank/item/MTI-FOTO-b0hRaTZLYzU2Q2FIWUF6OXpTQTA1UT09

number system, but their enthusiasm sky-rocketed when they began "tinkering". Cybernetics was able to provide insights into new scientific fields and cultivated "polytechnic" skills.

The Ministry of Education and Culture supported (besides the independent cybernetics clubs started by initiatives of individual teachers) the Central Cybernetics Club that was founded in 1961. The club ran for two years and took place in the József Attila High School in Budapest.[36] The club was led by the teacher Antal Müller with significant professional support from the members of the aforementioned Cybernetics Research Group (KKCS), namely József Drasny and Tibor Szentiványi. During the two years 30 students from 14 Budapest secondary schools participated in the activities of the Central Cybernetics Club.

36 Tibor Szentiványi, "A számítástechnika kezdetei Magyarországon [The Beginnings of Computer Technologies in Hungary]," *Természet Világa* 125 (1994): 250–255, 312–316, 362–366.

Fig. 4: The Central Cybernetics Club. Archive: MTVA Sajtó- és Fotóarchívum. Record number: MTI-FOTO-828693. Photographer: unknown. https://archivum.mtva.hu/photobank/item/MTI-FOTO-cUxxeTJwWHZTeXU0MTNtSHlIWHJPQT09

According to the recollections of Szentiványi, their aim was to introduce the students to the principles of the operations and circuitry solutions of computers in a playful way. This club also created several cybernetic and logical games, for example a "heads or tails" machine, as well as a model of traffic lights. Based on a contemporary account,[37] the Computer Science Group of the Hungarian Academy of Science (formerly the Cybernetics Research Group) and the Secondary School Division of the Ministry of Education and Culture established the club in order to accelerate the training of loyalists in the field. Further institutions and enterprises (e. g. Technical University of Budapest, Hungarian Postal Service) supported the club by providing tools and materials. Thus, the Central Cybernetics Club represented a new level of interest by the state in widespread computer science education. This club also acknowledged Kovács' "Practical Introduction to Cybernetics" book (1960) as a methodological predecessor.[38]

37 Rezső Kunfalvy, "Központi kibernetikai szakkör Budapesten [Central Cybernetics Club in Budapest]," *Köznevelés* 18 (1962): 336.

38 Kunfalvy, "Központi kibernetikai"; Mihály Kovács, *Gyakorlati bevezetés a kibernetikába. Útmutató középiskolai szakkörök számára* [Practical Introduction to Cybernetics: A Guide Book to the Secondary School Clubs] (Budapest: Felsőoktatási Jegyzetellátó, 1960).

As there were no readily available computers for these cybernetics clubs to use, most of them focused on building “hardware”. This meant that the machines and games built in these clubs may have had limited programmability through rewiring, but no use for programming languages. As mentioned above, this “tinkering” attitude fit well with the already established tradition of the radio amateur movement, now introducing the students to these new technologies and sciences.

Unfortunately, we know very little about the student body that attended these clubs, as there are barely any records to be found. In general, these clubs were open to the organizing secondary school’s own students with the exception of the Central Cybernetics Club, which had a selected membership from all of the secondary schools in Budapest. The clubs were open to both boys and girls. Based on the recollection of Drasny, one of the leaders of the Central Club, about a fourth or third of their students were girls.[39]

As the Hungarian computer industry came into its full power after the turn of the decade,[40] the education of computer experts in sufficient numbers became a pressing and central issue. Several further cybernetic clubs were formed during the 1960s and 1970s. The Berzsenyi Dániel High School in Budapest (the club led by János Garádi) and the Földes Ferenc High School in Miskolc (Árpád Dusza in the same position) were just some examples of this flourishing field. In the second case, the Miskolc University of Heavy Industry and Lenin Metallurgical Works might have aided this development. In 1970, Gyula Obádovics, the university’s lecturer and author of the most influential Hungarian course book in mathematics, provided computer training there for local teachers. Later the Földes school obtained a TPA computer, built by the Central Physics Research Institute (KFKI), a clone of the American PDP-8 computer.[41]

Due to growing interest, school clubs received access and computing time at computer centres, while ELTE in Budapest started a correspondent training course for mathematics teachers to become certified as “informatics” teachers as well. In addition, KFKI manufactured a “Computer-Labor”, a practicing computer model that schools could receive free of charge upon request, with the only requirement being that the teacher leading the club had to attend a brief training. Furthermore, the Institute for the Coordination of Computer Technology (see below) offered ac-

39 As the Piarist Grammar School is an all boys school, Mihály Kovács’ club was attended only by boys.

40 Győző Kovács, “Hungarian Scientists in Information Technology,” Reflections on the History of Computing 387 (2012*):* 289–319; Máté Szabó, “From the East to the West and back Again: Hungary’s Early Years in the Ryad.”

41 László Gulyás, “Interjú Dusza Árpáddal [Interview with Árpád Dusza],” https://mot.inf.elte.hu/dstore/document/27/interju_dusza_arpad.pdf.

cess for secondary schools (e.g. Apáczai High School, the high school teacher training centre of ELTE, Eötvös József Secondary School) to an EMG-830, a domestic transistor computer.[42]

Reforms (and Regresses) in the 1960s

Here, we turn to the national political and economic changes of the decade. It is during this period when the government finally began to understand the importance of computing technologies and became involved with it through its institutions, even if only precariously. In this section, we take a look at the institutional dimension of these developments and how they influenced the structural changes in the next decade.

The 1960s can be seen as a "decade of reforms" in Hungary (which came after the retaliation of the 1956 revolution and amnesty in its aftermath 1962–1963).[43] This decade saw several, not necessarily successful, reforms in the country. One of them was the long "school-reform" which affected mainly the secondary level (and whose design began in 1958), was implemented in 1961[44] and failed by 1965. Another reform, the New Economic Mechanism (in preparation from 1964 and implemented from 1968) introduced an artificial internal market and tried to create some kind of independence and competition at the level of the companies (still within the context of the planned economy). However, this experiment was not a success either (see below).

In the 1960s, the Soviets provided a role model of using computers in schools (Novosibirsk and Sobolev),[45] and began using cybernetics and interconnected devices (TVs and digital computers) to teach grammar, languages and mathematics; however, these affected only some universities and institutions.[46] Similar attempts

42 Frigyes Hack, "Számítástechnika az iskolában [Computer education in schools]," Manuscript (2010) https://mot.inf.elte.hu/dstore/document/30/Sz%C3%A1m%C3%ADt%C3%A1stechnika%20az%20iskol%C3%A1kban.pdf.

43 Béla Tomka, "A 'hatvanas évek' Magyarországon: összehasonlítások tanulságai [The 'Sixties' in Hungary: Lessons from comparisons]," in *Tanulmányok Kövér György hatvanadik születésnapjára* [Celebrating György Kövér on his 60th birthday: Studies], ed. Károly Halmos et al. (Budapest: Századvég Kiadó, 2009), 552–560.

44 Lajos Somogyvári, "Political decision-making in socialist education: a Hungarian case study (1958–1960)," *History of Education* 48 (2019): 664–681.

45 Zsuzsa Koroknai, "Milyen legyen a korszerű iskola? Szovjet viták anyagából. [What should the modern school look like? Review of the Soviet debate.]" *Köznevelés*, December 4, 1962, 731–732.

46 László Németh, "Elektronikus számítógépek a katedrán [Electronic Computers in the Classroom]." *Természettudományi Közlemény* 94 (1963): 70–72.

in Hungary appeared only as isolated islands in traditional offline schooling. The slogans of automatization, "permanent education" (the precursor of "lifelong learning") and scientific-technological revolution characterized these times. The behaviorist ideas of programmed learning and machines in education culminated in disseminating the results of electronics, the "modern magic science".[47]

Entering the 1970s: The New Economic Mechanism and the Computerization of the Country

Hungary, Czechoslovakia and Poland all introduced economic reforms in 1968. Many of these reforms were revoked in the following years in these countries. However, at least in Hungary, they still had a long-lasting impact on the economy and the way enterprises operated throughout the 1970s. It also contributed to the relatively fast computerization of the country. At the same time, it only meant that Hungary was catching up to its Eastern European counterparts by the end of the decade, but still lagging several years behind the West.

The New Economic Mechanism introduced a mixed system, where planning was retained only at the macro-economic level, and enterprises enjoyed freedom on the micro-economic level. That is, annual and five-year plans were still prepared for the national economy as a whole, but these were not broken down to targets on the level of individual enterprises anymore. This signified that enterprises had freedom in deciding what to produce in which quantities. The government influenced their decisions only in the form of incentives, such as taxation, credits, non-repayable grants, etc. There was also larger freedom in pricing: the government set only price-ranges for products, and within that range, enterprises could set their own, market-driven prices. However, state ownership remained unchanged. Not only did the enterprises remain state owned, but their leaders remained state officials, still being appointed or dismissed by the government.[48]

47 István Rubóczky, "Jeanne Bendick: Modern varázstudomány – az elektronika [Electronics: The modern magic science]," *Köznevelés* 24 (1965): 674. Barbara Hof and Jan Müggenburg, "Human – learning – machines: introduction to a special section on how cybernetics and constructivism inspired new forms of learning," *History of Education* 50 (2021): 89–92.

48 János Kornai, "The Dilemmas of a Socialist Economy: the Hungarian Experience," *Cambridge Journal of Economics* 4 (1980): 147–157. Béla Balassa, "The Economic Reform in Hungary," *Economica, New Series* 145 (1970): 1–22. Tamás Bauer, "The Hungarian Alternative to Soviet-Type Planning," *Journal of Comparative Economics* 7 (1983): 304–316. Tamás Bauer, "Reforming the Planned Econo-

These new economic policies fostered the computerization of the country. Since enterprises now had more freedom in their production and were not just mechanically fulfilling central plans handed to them, they became interested in optimization. Teréz Laky calls this phenomenon “interest in numbers” to emphasize that it did not coincide with capitalist profit maximization.[49] This new focus on optimization led to an increased interest in the use of computers for business data processing.

1968 was a turning point of Hungarian computer technology. In addition to the domestic New Economic Mechanism, the country became involved with a large-scale joint computer project of the Eastern Bloc. This undertaking began when in the beginning of 1968 Aleksei Kosygin, the Chairman of the Council of Ministers of the Soviet Union, wrote a letter to the leaders of the Comecon countries, including Jenő Fock, the Hungarian prime minister. Kosygin expressed concerns about the shortcomings of the computerization of the Comecon countries, and the need to develop a family of third generation computers, called the Unified System of Computers or Ryad (ряд is Russian for “series”). The project ended up reverse engineering the IBM’s 360 mainframe family that was dominating the market since 1964, and for many years to come. The tasks of the project were divided among the socialist countries (Bulgaria, GDR, Hungary, Poland, Czechoslovakia, and the Soviet Union).[50]

In the same year, the John von Neumann Computer Society (Neumann János Számítógéptudományi Társaság, NJSZT), the Hungarian flagship association in the IT field, was established, displaying both the growth and the gradual acceptance of the field in the country. The NJSZT immediately joined the IFIP (International Federation for Information Processing), opening the doors for international (including Western) connections. The NJSZT still exists today, encompassing all aspects of the field, including research, networking and education, and represents Hungary in several international organizations.[51]

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my: The Hungarian Experience.” *Annals of the American Academy of Political and Social Science* 507 (1990): 103–112; Ignác Romsics, *Hungary in the Twentieth Century* (Budapest: Corvina and Osiris, 1999).

49 Teréz Laky, *A számítástechnika elterjedésének társadalmi feltételei és várható hatása* [Social Conditions and Possible Conseqeuences of Spreading Informatics] (Budapest: INFELOR Közlemények 2, 1973), 30.

50 Szabó, “From the East to the West”.

51 The choice to name the society after John von Neumann was controversial at the time. Although von Neumann was born in Hungary and was world renowned, his involvement with US defense politics made him a bothersome choice for state officers. Those people who suggested him as the eponym of the society were considered ideologically suspicious, see: Bálint Dömölki, “Neu-

Out of these factors, it was Hungary's involvement with the Ryad effort that had the largest impact on the country's computing industry for the coming decade. The sector now received both political and financial support. While the project itself progressed slowly, the institutional sphere that was to accommodate it quickly proliferated, demonstrating the strongly bureaucratic character of Soviet-type systems. The main institute to oversee the country's participation in the project and coordinate the domestic actors was the aptly named Institute for the Coordination of Computer Technology (Számítástechnikai Koordinációs Intézet, SZKI). Several further institutions were formed both domestically, as well as on the intra-governmental level to accommodate international cooperation. As the computing sector was becoming more important, the government now paid more attention to the field and devised a program for the general computerization of the country. More precisely it ordered the National Committee of Technological Development (Országos Műszaki Fejlesztési Bizottság, OMFB) to develop the so-called Central Development Program for Computing (Számítástechnikai Központi Fejlesztési Program, SZKFP).[52] The most important outcome of this program for education was the founding of the Computer Education Centre (Számítástechnikai Oktató Központ, SZÁMOK[53]), which originally belonged to the Central Statistical Office (Központi Statisztikai Hivatal, KSH).[54] SZÁMOK played a decisive role in the education of computer experts throughout the 1970s; its impact is discussed in the next section.

Hungary was also able to utilize international sources for its computerization. The country received special UN funding and support from the International Labor Organization (ILO): the newly established National Leadership Centre (Országos Vezetőképző Intézet) of Hungary was equipped with computers between 1968 and 1970. More than 1.4 million USD was available to purchase computers, invite

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mann János Számítógéptudományi Társaság [The John von Neumann Computer Society]" *Természet Világa* 131 (2000): 53–54.

52 János Sebestyén, "Az ESzR és SzKFP indulása [Beginning of the Unified System of Computers and the Central Developing Program of Computerization]," Manuscript, John von Neumann Computer Society (NJSZT), https://itf.njszt.hu/wp-content/uploads/Sebestyen0_PDF.pdf; Géza Álló, "Az Egységes Számítógéprendszer [The Unified System of Computers]," in *A "hiteles helyektől" az elektronikus közigazgatásig* [From the credible local sources of authentication to the e-government], ed. Géza Álló and Szilárd Molnár (Szeged: Primaware, 2014), 81.

53 The acronym "SZÁMOK" is a pun in Hungarian, as it means "numbers".

54 The KSH had an important role in the history of computing in Hungary, as this institute was one of the largest users of punchcard machines already in the first half of the 20th century. In the second half of the century many important institutions and enterprises began as member organizations or subsidiaries of KSH. For more information, see: https://itf.njszt.hu/ksh-birodalom.

experts, and bring training to Hungary.[55] As intended, the interactions with the UN also led to technology and knowledge transfer across the Iron Curtain. In the summer of 1968, Zoltán Báthory (another important educationalist, who was associated with reforms and innovations) participated in UNESCO's 2nd Seminar on Learning and the Educational Process, in Skepparholmen, Sweden. The event was sponsored by Western companies and institutions. Among the 35 attendees (including 11 scholars from the US) Báthory was not the only one from the Eastern Bloc; a colleague from Czechoslovakia and another from Poland were also in attendance. The participants went through a selection process, and during the seminar they became familiar with modern methodologies and technologies, such as a "typewriter-sized desktop computer".[56] Surprisingly, in the next year, Hungary joined the International Association for the Evaluation of Educational Achievement (IEA) international survey, and the NJSZT organized another international seminar in Balatonszéplak (Eastern European Symposium on Computer Education, 1969).[57]

In the coming years, the state began to support computer developments (not independently from the Soviet initiative) while more and more bridges were built between the opposing sides of the Iron Curtain by scholars through conferences and meetings. A growing number of books and articles promoted computers and computer education, and cybernetics became a household name.

Computer Education on Different Educational Levels During the 1970s

With the relatively rapid computerization of the country throughout the 1970s, the dissemination of programming and computer skills became a necessity. This section gives a short summary of the progress made throughout the decade in every educational level.

55 Magyar Nemzeti Levéltár (MNL OL) Hungarian National Archives, 1967. Az Országos Vezetőképző Központ létesítésével kapcsolatos egyes kérdésekről [About some issues of establishing the National Leadership Centre], Minisztertanács [Cabinet], XIX-A-83-b 3311–3370/19673331/1967.

56 Zoltán Báthory, "Tanulás és nevelés. Nemzetközi szeminárium Svédországban [Learning and Education. An International Seminar in Sweden]," *Köznevelés* 25 (1969): 30.

57 Béla Balázs, "Az elektronikus számítógépek pedagógiai célú alkalmazása [Pedagogical Applications of Electronic Computers]," *Magyar Pedagógia* 69 (1969): 456.

Programmed Educators

While in the previous decade dedicated teachers ran the cybernetics clubs, the 1970s brought, for the first time, a central, unified vision for secondary school teachers to implement new technologies in their classrooms. In the keynote lecture of the 5th National Educational Congress, Tibor Erdey-Grúz, president of the Hungarian Academy, declared the following task for pedagogues: every technological tool and automated learning process had to be taken into consideration for educational purposes, such as TV, radio, film, other audio-visual equipment, their possible combinations, including the electronic computer as well (1970).[58] This plan might have been rather ambitious, since at the time there were only around 100 computers in the country, and according to the upcoming 5-year plan (backed by the government), this number was supposed to be increased to 400. Despite a significant increase, this would still have left the country "undercomputerized", at least in comparison with the West.

On August 1, 1972, the Hungarian Government and the UN signed yet another agreement in the Development Programme (UNDP) framework. UNESCO, the project's manager, provided a 1.150.000 USD budget to improve educational technology. Therefore, a new institute was founded in 1973: the National Educational Technology Centre (Országos Oktatástechnikai Központ, OOK). This new institute was responsible for training, production, R+D, documentation, coordination, and leading in the field of educational technology.[59] In addition, to involve open-minded teachers, the SZKI called for applications to make learning programs for R-10 computers (these machines were manufactured in Hungary, in the framework of the Unified System of Computers). Hundreds of proposals were submitted before the deadline in various topics, such as mathematics, physics, chemistry, history, political economy, and foreign languages – from these, 31 courses were programmed for computers and were presented in the Budapest International Fair (1974).[60]

Computers in Secondary Education

As mentioned above, many initiatives started in the late 1960s and early 1970s (associated with the New Economic Mechanism), but the results appeared only spor-

58 Tibor Erdey-Grúz, "A gazdasági-társadalmi és tudományos-technikai fejlődésnek az iskolai nevelésre és oktatásra kiható fő tényezői [The main socio-economical and scientific-technological factors influencing school education]," *Köznevelés* 26 (1970): 8.
59 MNL OL, "Az Országos Vezetőképző Központ [The National Leadership Centre]", 1st Appendix.
60 Tibor Fónay, "Egy pályázat tanulságai [Lessons from a Tender]," *Köznevelés* 30 (1974): 10.

adically in school classrooms. The Fazekas Mihály High School in Budapest, an elite school, was famously the first school that introduced "specialized mathematics classes", where students learned the subject in significantly increased numbers of courses. In 1968 they introduced computer education as part of their curricula for these specialized classes. The tutor Péter Ada-Winter built his own relay-machine, and he also visited the Karl Marx Economic University's URAL-2 vacuum tube computer multiple times with his students.[61] The first functioning (and not just representative) computer installed in a secondary school was an R-20 type (produced in the Soviet Union, put into operation for more than 10 million forints). It was given to the Hámán Kató Economy School in Budapest, to equip their computer lab where 5 classes were trained to use electronic systems. The installation was the result of a typical cooperation and mixing: GDR-machines for data preparation, Czechoslovakian typewriters, an Austrian cooling system, Soviet computers, and Hungarian expertise.[62] Two further secondary schools started computer education at that time in the countryside: the Alpári Gyula Secondary Vocational School in Eger and the Csányi László Economic Secondary Vocational School in Zalaegerszeg.[63] As an optional subject, computer training was implemented in a typewriting school in Budapest (XX. district, 1973),[64] and as an after-school activity (Kvassay Technical School, Budapest; cybernetic study group in Mezőtúr, 1974).[65] A similar trend unfolded in the Czechoslovak vocational education and in the Soviet postgraduate education.

University Level

In the beginning of the 1970s there was a nationwide, unified computer science education initiative in Hungary. As part of this initiative, ELTE, the University of Szeged and the University of Debrecen cooperated in developing a common curric-

61 Péter Ada Winter, "A számítástechnika középiskolai oktatásának kezdetei Magyarországon [The Beginnings of Computer Education on the Secondary Level in Hungary]," https://mot.inf.elte.hu/dstore/document/29/A%20sz%C3%A1m%C3%ADt%C3%A1stechnika%20k%C3%B6z%C3%A9piskolai%20t%C3%B6rt%C3%A9nete.pdf.

62 György Győri, "Látogatóban az R-20-asnál [Visiting the R-20]," *Köznevelés* 32 (1976): 7.

63 Zoltán Nagy, "Csány emlékkönyv [Csány memory book]," https://mot.inf.elte.hu/dstore/document/32/Cs%C3%A1ny%20sz%C3%A1m%C3%ADt%C3%A1stechnika%201973-2010.pdf.

64 Győző Rácz-Székely, "A gép- és gyorsíróiskola jövője [The Future of Typewriting School]," *Köznevelés* 29 (1973): 7.

65 János Karlovitz, "Számítástechnikai szakkör [Computer Club]," *Köznevelés* 30 (1974): 9; Gizella Tál, "450 éves Mezőtúr iskolája [The school in Mezőtúr celebrates its 450th anniversary]," *Köznevelés* 36 (1980): 14.

Fig. 5: R-20 in the school – Köznevelés, 28 May 1976, 7. Photographer: Kornélia Naszályi (MTI-photo)

ulum based on other contemporary international curricula. This resulted in the design of a 3 year long 'programming mathematician' major, providing a "college" or "bachelor" equivalent degree. This new major was offered at all three universities from the 1972/73 academic year onwards. The most talented students in this new major could then proceed to a 2 year extension, earning a "university" or "master's" equivalent degree at the end. This master's degree was offered by ELTE from 1975/76, at Szeged from 1979/80 and at Debrecen from 1988/89.[66]

From 1971/72 ELTE started a specific correspondent training course (mostly) for mathematics teachers, entitled *Basic Computer Education in Secondary Schools.* The lectures were given by Frigyes Hack, whose lecture notes on how to teach the basics of computer science in secondary schools and to develop algorithmic thinking were published already in 1974 to support this training.[67] While the various postgraduate trainings became more and more popular throughout the decade, ELTE offered a regular "computer science secondary school teacher'" degree only from 1983. Even then it was offered as an optional third subject (in Hungary secondary school teachers are typically trained in two subjects). It was not until 1991 that future secondary school teachers could choose "informatics" as one of

66 Edit Sántáné-Tóth, *A számítástechnika*; Edit Sántáné-Tóth, "Computer Oriented Higher Education in Hungary," *Studia Universitatis Babes-Bolyai Digitalia*, 62 (2017): 35–62.
67 Frigyes Hack, *Számítástechnikai alapismeretek oktatása a középiskolákban* [Basic computer education in secondary schools] (Budapest: ELTE, 1974).

their main subjects. The instructors of these programs, first and foremost Frigyes Hack and László Zsakó, supported these efforts with several publications as well.[68]

Education of Computer Professionals

As the rapid growth of the number of computer installations was planned for the 1970s, the country needed scores of programmers and operators in a short period of time. This meant that there was no time to wait until the students graduated from these newly initiated programs. This problem had a high priority within the Central Development Program for Computer Technology (SZKFP). To quickly remedy the increased demand for computer experts, the Computer Education Centre (SZÁMOK) put a strong emphasis on adult education, mostly in the form of postgraduate courses.[69]

In 1970 SZÁMOK got a 480.000 USD budget from OMFB to purchase an educational license from the Control Data Corporation (CDC). This meant that around 40 of its instructors were trained in the technical vocational school of CDI (Control Data Institute, a school created by CDC) in Frankfurt for 6–9 months in 1971, and it was allowed to use the CDC's educational materials for 7 years and received its updates. Soon SZÁMOK expanded its activities to international students as well. In 1972 SZÁMOK applied for and won a contract with the UNESCO's UNDP for computer technology education in developing countries and Hungary. Subsequently, in 1973–1978 SZÁMOK received 2.2 million USD from UNDP. From this time on it offered training in Russian, German, and English in addition to Hungarian.

Throughout the 1970s and early 1980s, SZÁMOK (and its legal successor) was the most important place to educate computer professionals. Between 1970 and 1982 SZÁMOK trained more than 80.000 students, around 7000 people annually. As part of the UNDP project, it also had more than 800 international students from 45 countries. It also published, sold, and distributed its own textbooks, about 12–14 titles and 45.000 copies annually. In addition, SZÁMOK also educated Hungarian computer specialists about Soviet import computers, and domestic computers (exported within the Eastern Bloc) both in Hungary and abroad. To match these enormous tasks, SZÁMOK had outstanding facilities. Its headquarters, de-

68 Frigyes Hack, *Az ABC-80 számítógép programozása* [Programming ABC-80 computer] (Budapest: ELTE, 1982); László Zsakó, Anna Veszprémi and Katalin Némethy, *Az ABC80 BASIC elemei* [Elements of the ABC80 Basic] (Budapest: FPIK, 1981). These papers supported the implementation of ABC 80 computers in the Hungarian schools.

69 Szabó, *László Kalmár and the First University-Level Programming and Computer Science Training in Hungary*; Sántáné-Tóth, *Computer Oriented Higher Education in Hungary.*

signed especially for its needs, was fully operational by 1976. The building included 2 lecture halls and 15 seminar rooms, which could seat 735 students simultaneously. By the next year it also added a hotel wing including 90 double rooms to host students from outside Budapest. Besides computers manufactured in the Eastern Bloc, it also had an IBM 370/145 and a PDP 11/70 with 16 student terminals. The importance of SZÁMOK for the Hungarian computer sector can hardly be overstated. During the 1970s it trained about three quarters of computer experts at the time.[70]

Early 1980s: The Breakthrough of the PC?

The 1980s saw the arrival of the computer to people's homes. Personal computers revolutionized access and attitudes towards computers in both the West and Eastern Bloc. An early effort to spread the so-called home or micro-computer in Hungary came from the initiative of Endre Simonyi, an engineer who began to build a computer "on a kitchen desk" on his own already in the 1970s.[71] He had a connection with the Californian Homebrew Computer Club,[72] and founded the Hungarian Homebrew Computer Club organization, taking the American one as a role model. In the early 1980s the initiative was incorporated by the NJSZT as one of its departments. Simonyi wrote a letter on 2 December 1980 to György Pomezanski, program editor of the Hungarian State Television, proposing his plan (accepted by the Ministry of Education and Culture) to provide components for schools and companies to build their own cheaper and simpler computers, as "not everyone needs a big car, sometimes a Trabant is more than enough". Unfortunately, Simonyi did not find a manufacturer to produce the parts. From 1983 the NJSZT published a popular micro computer magazine (Mikroszámítógép Magazin) showing the growing popularity of home computers

70 Sándor Faragó "A SZÁMOK" in *A SZÁMALK és elődei* [SZÁMALK and its predecessors], ed. Miklós Havass (Budapest, 2011), 157–163; Lajos Pesti, "Visszaemlékezés a gépi-adatfeldolgozás, a számítástechnika haza fejlődésére (1950–1990) [Reminiscences about the development of data processing and comuter sciences in Hungary, 1950–1990]," in *A SZÁMALK és elődei*, ed. Miklós Havass (Budapest, 2011), 69–88. Sántáné-Tóth, *A számítástechnika.*

71 About the importance of home computing and amateurs see: Jaroslav Švelch, *Gaming the Iron Curtain: How Teenagers and Amateurs in Communist Czechoslovakia Claimed the Medium of Computer Games* (Cambridge, MA: MIT Press, 2018).

72 Endre Simonyi, "A Special Function Approximation Method and Its Application," *Interface Age: Computing for Home and Business Applications* 3 (1978): 74–77.

in the country. Simonyi's series of articles, entitled "Let's Build Our Own Computer," was also published in this journal.[73]

Although the Eastern Bloc still lagged behind the West during the 1980s, the members of the Hungarian computer industry were also well integrated internationally by this time. They were already acquainted with microprocessors in 1979 in Budapest at the international conference (IFIP and UNESCO); a Canadian scholar introduced it successfully, and at the end of the symposium the international audience made a proposal to UNESCO to elaborate how to use computers in education – the next example shows the beginning of this success story. Tamás Varga, the previously mentioned, internationally acclaimed representative of "complex mathematics education," attended a conference in Berkeley in August 1980 and returned to Hungary with a computer, supplied with the Basic programming language.[74] This led to the first school computer placed on the Hungarian market: the ABC 80 (Advanced Basic Computer – developed by Dataindustrier), resulting from the cooperation between the Swedish Luxor AB Company and the Budapest Factory of Radio Technology (Budapesti Rádiótechnikai Gyár, BRG), who bought the license. One computer cost 80.000 HUF (the average monthly salary was around 4.000 HUF in 1981) and had a 16 KB RAM memory. The acquisition was supported by the School Computer Program and based on the plan of the Ministry of Education and Culture; 112 computers were ordered in 1982.[75]

However, the real breakthrough for school computers came the following year. In a press meeting on 24 February 1983, György Páris, the director of the Institute of Science Organization and Informatics (Tudományszervezési és Informatikai Intézet), made news headlines with a sensational announcement: by the next academic year, every secondary school and vocational institution (altogether 762 locations) would receive a school computer. The HT-1080Z computer, which was selected in an open competition, was manufactured domestically by the Telecommunications Cooperative (Híradástechnikai Szövetkezet).[76] 820 computers were delivered as part of this initiative. Taken together with the previously allocated ABC-80 computers in 112 colleges and secondary schools, it meant that altogether 932 microcomputers

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73 Gábor Képes, "Építsünk számítógépet! Simonyi Endre és kora [Let's build our own computer! Endre Simonyi and his age]," *Óbudai Anziksz* 5 (2018–19): 82–87, https://obudaianziksz.hu/kepes-gabor-epitsunk-szamitogepet/.

74 György Győri, "Bízhatunk-e az új matematikában? Beszélgetés Varga Tamással [Can we trust the New Mathematics? Interview with Tamás Varga]," *Köznevelés* 37 (1981): 3.

75 György Appel, "Matematika és számítástechnika [Mathematics and computer education]," *Köznevelés* 37 (1981): 12, György Páris, "Számítógépek az iskolában [Computers in school]," *Köznevelés* 40 (1984): 13.

76 György Győri, "Verset 'elemeztem' – számítógépen [I analyzed a poem – with computer]," *Köznevelés* 39 (1983): 7.

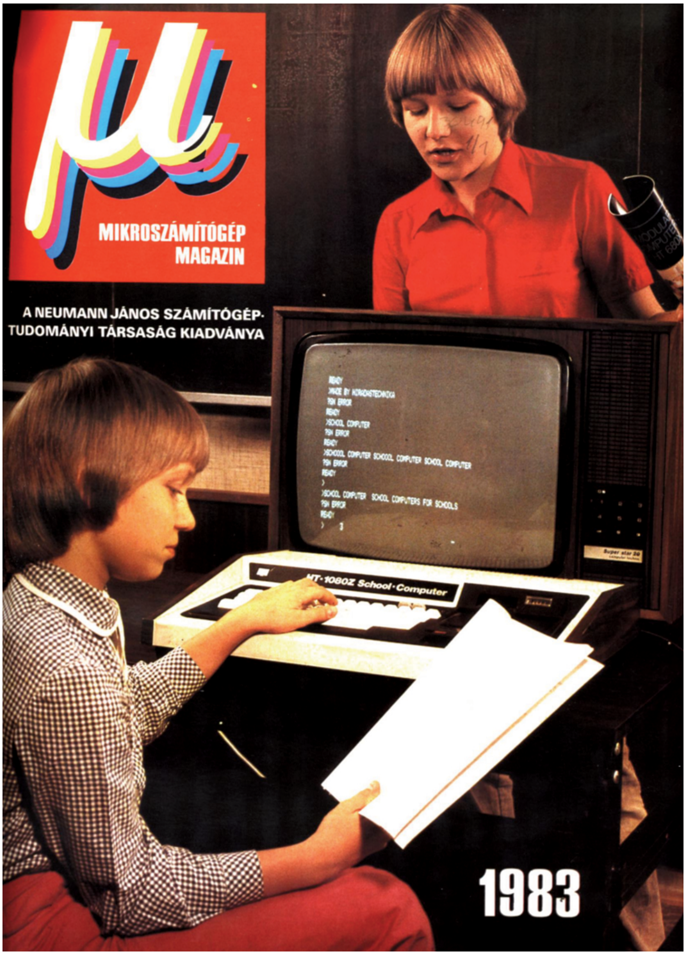

Fig. 6: The cover of the first issue of Mikroszámítógép Magazin with the HT-1080Z, 1983. Archive: NJSZT and Pál Faklen

were distributed among schools.[77] The HT-1080Z computer was based on a Video Genie license (originally produced in Hong Kong), compatible with the TRS-80 (Tandy/Radio Shack, US) as well. From the start of the school year of 1983, once the ABC-80 and HT-1080Z computers arrived, every secondary school had a "com-

77 Rózsa Budai, "Mikroszámítógép az iskolában [Micromputers in schools]," *Vas Népe*, January 25, (1984): 5.

puter technology club". The Program provided training for the teachers where they were taught the BASIC programming language as well as study-aid materials for the clubs. It also made various funds available to develop software packages for these computers. This initiative can be considered as the first tangible step on the long road towards computer-based education in schools in Hungary.[78]

The School Computer Program was also supported by the aforementioned micro computer magazine, Mikroszámítógép Magazin, edited by Győző Kovács and Pál Könyves-Tóth. The magazine, published between 1983 and 1990, was among the most popular publications on computing technologies, and the first one to include students as its target audience as well. It even had a School Computer Program column from the very beginning. In the first issue, György Páris, one of the key figures of the Program, provided a summary of previous activities in computer education on the secondary school level and described the intents and future plans of the School Computer Program.[79]

In the first issue the editorial board of the magazine, the NJSZT and Garay János High School in Szekszárd, jointly announced a competition for secondary school students to design and present their own computer games. This turned into the annual Garay Competition, now called Neumann Competition. Students now present their own software in six categories (Animation, Application Software, CAD programs, Games, Graphics and Robotics) and can enter the competition even from Romania and Serbia. In 1985, the NJSZT organized a national programming competition as well. This competition, named after the computing pioneer Tihamér Nemes, continues to this day too.[80]

Although personal computers were expensive, there was a growing base of users, owners, and tinkerers. To reach these users the NJSZT cooperated with SZÁMALK (the legal successor of SZÁMOK) and the Hungarian State Television to educate the public about computer programming. In 1985 they aired a TV series, aptly titled "TV Basic" (around 15 episodes, 30 minutes each) that taught the viewers how to program in Basic. This undertaking was clearly influenced by the British BBC's "The Computer Programme" from 1982. One interesting aspect of this public training through television comes from the fact that most Hungarian households had only one television at the time. In most cases the television was utilized as the

78 Balázs Czékmán and Péter Fehér, "A számítógéppel támogatott tanítás és tanulás története a közoktatásban Magyarországon, 1983–2016 [The history of computer based education in Hungary, 1983–2016]," *Képzés és Gyakorlat* 15 (2017): 45–66.

79 György Páris. "A középszintű számítástechnikai képzés feladatai [The tasks of secondary school computer technology education]," *Mikroszámítógép Magazin* 1 (1983): 4.

80 For Nemes' short biography visit Kovács, "Hungarian Scientists"; the website of the competition can be found at http://nemes.inf.elte.hu/.

screen of the home computers. Thus, most of the audience could not listen to the instructions on TV and code at the same time, but had to take notes (or video record the episode) and try to implement them later. The series was accompanied by a book (printed in 60.000 copies), as well as a nationwide "Basic proficiency" test that everyone was allowed to take. More than 6.000 people (in between the ages of 8 and 76) took this test and more than 3.000 passed. While the certificate was not official, some places did consider it as a proof of rudimentary coding skills during their hiring process.

Conclusion

Attempting to summarize the complex and diverse history of the computer's arrival into the classroom in Hungary, we can attest that the decades of the 1950s and 1960s were marked by the pioneers, a small network of rather active and influential individuals characterized by their excitement about the new computing technologies and their passion for sharing this knowledge with others. During the 1970s the state became involved to a greater extent in these issues to satisfy the needs of the economic sphere. This put an emphasis on adult education and postgraduate trainings and courses as the country needed computer experts quickly. Much of the state support was provided through academic institutions (even though many of these institutions were lacking in serious research output). Hungary finally placed at least one computer in its secondary schools and began to teach its students to program in an organized fashion in the 1980s. In addition, the users of home computers were also supported with textbooks and the TV Basic series. The education at the time focused on programming and not on "computer literacy," which seems a natural choice with the computing technologies the users had access to.

The transnational dimension of the development of computer and technology related education is more obvious than in other cases of educational innovations in Hungary.[81] This may be due to the growing importance of Eastern-Western technological exchange, knowledge transfer in this period in general, as well as to a network of personal connections. In future research we aim to examine the concrete contributions of these projects from national and international initiatives.

81 This direction fits very well with the recent trends in historiography, see: Eckhardt Fuchs and Eugenia Roldán Vera, *The Transnational in the History of Education: Concepts and Perspectives* (Cham: Palgrave Macmillan, 2019).

There are many possibilities to take future research in new directions: the support system of talented students (which has a long-standing and proud tradition in STEM subjects in Hungary), the role of competitions, and the International Mathematical Olympiad movement as an Eastern-European innovation[82] are just a few examples that are worth a deeper study on their own. Analyzing the connections between theoretical-methodological questions and technological challenges through mutual transfers across the Iron Curtain is another possible fruitful direction of scholarship.[83] While this current Hungarian case study is closer to a "people's history of computing",[84] in the future we hope to further clarify the individual-institutional interactions and involve more archival sources.

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MNL OL Archives, 1967. Az Országos Vezetőképző Központ létesítésével kapcsolatos egyes kérdésekről (About some issues of establishing the National Leadership Centre). Minisztertanács (Cabinet), XIX-A-83-b 3311–3370/19673331/1967.

MNL OL Archives, 1980. SZTAKI igazgatójának megválasztása a Nemzetközi Automatizálási Szövetség elnöki tisztére (Electing the director of SZTAKI to the presidency of the International Federation of Automatic Control). Külügyminisztérium (Foreign Affairs), 1980, VII, 148. d.

The NJSZT Archives of the History of Computing Forum (https://itf.njszt.hu/)

The von Neumann Computer Society runs a forum on the history of computing, focusing on Hungary. The group involves many of the pioneers who participated in these developments. The website of the forum contains a database, a collection of papers and manuscripts, short descriptions of the main actors (both people and institutions) and artifacts of computing technologies in Hungary, as well as several biographical oral history interviews. Many of the online accessible scans of earlier books that we cited in the paper were made available by this forum. We also used the following oral history videos when preparing this article:

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82 Dušan Djukić et al., *The IMO Compendium: A Collection of Problems Suggested for the International Mathematical Olympiads: 1959–2009* (New York: Springer, 2011).

83 Barbara Hof, "The turtle and the mouse: how constructivist learning theory shaped artificial intelligence and educational technology in the 1960s," *History of Education*, 50 (2020): 93–111.

84 Borrowed from Lisi Joy Rankin, *A People's History of Computing in the United States* (Cambridge, MA: Harvard University Press, 2018).

A biographical interview with Mihály Kovács conducted by Henrik Hargitai and Gábor Képes in 2001. https://www.youtube.com/watch?v=EIuuy8fTdug

A video-portrait about Béla Frajka, the former student and colleague of László Kozma. https://www.youtube.com/watch?v=QWYHjwhUQ44

Simonyi Endre és az amerikai és hazai HCC klub [Endre Simonyi and the American and Hungarian HCC Club – a biographical interview conducted by Gábor Képes in 2018]. https://www.youtube.com/watch?v=8jcLpBy2_1s

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Computers in the Classrooms of an Authoritarian Country: The Case of Soviet Latvia (1980s–1991)

Abstract: Our study focuses on the time when the subject 'Informatics and basics of computing techniques' was introduced in Soviet secondary schools' curriculum during Gorbachev's *perestroika* in 1985. The sources of our research were reflections on computing and informatics studies in the Soviet press, as well as interviews with early informatics teachers and students. The story of the entering of the computer into the classroom of one Soviet republic – Latvia – reveals the introduction of major innovation in everyday school life: how the need for innovation is explained and justified in the authoritarian country, and how it is accepted by educational consumers and innovation subjects – students, teachers and society in general; what changes in the socialization process of schooling accompany innovation: how innovation processes accumulate unintentionally transmitted values, belief systems and relational norms, and how innovation can generate social agreements "not to see" what is in hidden in plain sight – a hidden curriculum, the inevitable companion to schooling.

Keywords: informatics; hidden curriculum; Soviet school; Soviet Latvia

Introduction

When the subject 'Informatics and basics of computing techniques' was introduced in Soviet secondary schools' curriculum during Gorbachev's *perestroika* in 1985, the number of people who could successfully predict that the computer would gain ground in everyday education was modest. However, in the Soviet Union, an authoritarian state, orders from above were not discussed. According to "internal hypernormalization of authoritative discourse"[1] – if informatics was provided in the school curriculum, then it had to be taught in schools.

The record of the first years of informatics is a story about how major innovations are introduced in everyday school life, how the need for these innovations is explained and justified, and how it is accepted by educational consumers and

1 Aleksei Yurchak, *Everything Was Forever, Until It Was No More: The Last Soviet Generation* (Princeton, NJ: Princeton University Press, 2005), 163.

https://doi.org/10.1515/9783110780147-004

innovation subjects – students, teachers, and society in general. The story of the entering of the computer into the classroom also leads to a broader look at the introduction of innovation, namely what changes in the socialization process of schooling accompany innovation: how innovation processes accumulate unintentionally transmitted values, belief systems, and relational norms, and how innovation can generate social agreements "not to see"[2] what is hidden in plain sight – a hidden curriculum, the inevitable companion to schooling. Our research questions are as follows: how did the new technologies enter the classrooms of Soviet Latvia? What hidden curriculum accompanied digital change in Soviet schools?

In recent years, interest in the history of computing has grown in proportion to the popularity of computers in education, further accelerated by the COVID-19 pandemic. One can agree with Tedre, Simon and Malmi that history of a discipline is a revealing sign of a mature field.[3] Our study mainly utilized works that analyze the history of computing in the Soviet Union and the United States, the most powerful computer producing countries.[4] However, the experience of the Soviet Union in these works is considered by associating this super-power with only one republic, namely, Soviet Russia. The fact that the Soviet state consisted of 15 different republics, including the present-day Baltic states, is neglected. The aim of our research on the computerization of Latvian schools will enhance the understanding of the transition of the center's (Moscow) orders to the periphery of the country. The doctoral dissertation on the introduction of informatics in Latvian schools, defended by Viesturs Vēzis,[5] helped us immensely in the case study of Latvia. The dissertation is written in Latvian and therefore, unfortunately, is not available to a broader international community.

Researchers have followed the world of computing as it has evolved. Two papers from the existing scholarship are relevant to our study. The first is an article by Aleksandr Uvarov, first published in 1989 at the Institute of Sociology of the

2 Eric Margolis et al., "Peekaboo. Hiding and Outing the Curriculum," in *The Hidden Curriculum in Higher Education*, ed. Eric Margolis (New York and London: Routledge, 2001), 1, 6; Fulya Damla Kenti, "Comparison of Hidden Curriculum Theories," *European Journal of Educational Studies* 1, no. 2 (2009): 83–88.

3 Matti Tedre, Simon and Lauri Malmi, "Changing Aims of Computing Education: A Historical Survey," *Computer Science Education* 28, no. 2 (2018): 159, https://doi.org/10.1080/08993408.2018.1486624.

4 Alexander Nitusov, "Computer Development in the Socialist Countries: Members of the Council for Mutual Economic Assistance (CMEA)," in *Perspectives of Russian and Soviet Computing*, ed. John Impagliozzo and Eduard Proydakov (Heidelberg, Dordrecht, London and New York: Springer, 2006): 209.

5 Viesturs Vēzis, "Informātika skolā [Informatics at school]" (PhD diss., University of Latvia, 2005).

USSR Academy of Sciences.[6] Uvarov provides a comprehensive analysis of the computer literacy campaign in the Soviet Union. The author explains in detail the social aspects of computing education in the context of *perestroika*, the implementation strategy, and does not shy away from revealing the problems that should be addressed at a national level. Uvarov's article, knowing the still authoritarian USSR of that time with the presence of censorship, is not the opinion of a single author, but rather represents the official computing literacy programme of the whole Soviet educational elite. We used the digitized version of this work.

Alongside Uvarov's article, in the same year of 1989, the study by the American David A. Wellman on the situation in the field of computer technology in the USSR was published.[7] Both Uvarov's and Wellman's studies, although on different sides of the Iron Curtain, are strikingly similar. Wellman, focusing on highlighting the USSR's technological backwardness, identifies similar problems as Uvarov. Thus, the synthesis of Uvarov's and Wellman's articles revealed the entry of computers into Soviet classrooms from the perspective of the country's highest levels of power.

To reveal how the guidelines of the "center" were adapted in the local context, we compiled and analyzed 179 articles in Latvian periodicals. As the press of the respective period has been digitized, the selection of articles was made by relevant keywords search.

The introduction of computers into school practice was explored by using five video interviews and one telephone interview with informatics teachers who started teaching informatics in secondary schools at the very beginning, in the mid-1980s. Teachers' views are complemented by six video interviews with the first informatics students. The respondents represent all regions of Latvia. Five of the teacher respondents are male and one is female, which corresponds to the gender ratio among the first IT teachers. Open-ended questions were used in the interviews. Each interview lasted approximately 40 to 60 minutes, was conducted by one of the authors of the study, and all interview recordings were listened to by both authors. Content of the interviews was processed to determine the frequency of words most often used to describe new technologies. References to the interviews were encrypted in order to respect the ethical standards of the study and to maintain the anonymity of the respondents.

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6 Aleksandr Uvarov, "Perestroika obrazovanija i informatizacija obscestva [Restructuring education and the informatisation of society]," in *Prognoznoje socialnoje projektirovanije: Metodologiceskije i metodiceskije problemi* [Predictive social design: Problems of methodology] (Moskva: Nauka, 1989).

7 David A. Wellman, *A Chip in the Curtain. Computer technology in the Soviet Union* (Washington: National Defense University Press, 1989).

Historical Context: Computer as an Indicator of State Power and Social Progress

The real goals of the introduction of the subject of informatics, the hidden curriculum designed by the state, can only be understood by knowing the future, that is, from today's perspective, where the policies and ideology of the Soviet Union are evaluated.

In the Soviet Union, all new technologies were developed primarily with the country's military potential in mind.[8] Soviet computing grew as part of military power, alongside nuclear bomb, radar, antiballistic defense systems, and space programs.[9] However, the topic of militarisation was top-secret and excluded from the public discourse. The development of military potential did not match the Soviet Union's image as a peaceful state. Therefore, other arguments had to be found to legitimize the teaching of computers and influence society's need for it.

In the context of Gorbachev's *perestroika*, a demand was made to present the Soviet Union as a modern and innovative country, which should not be information dependent on "developed countries" and lag behind in the latest technologies. Concerns about the backwardness of the Soviet Union in the 1980s were justified because of the slow commutation of the "civilian" sector.[10]

Central to the push for computing was, of course, education, whose task was to produce young, educated minds that would further develop the country's technological potential in the never-ending competition with the "Western capitalists".[11] Informatics in school was the agenda for the making of exemplary citizens for the socialist "information society" in the 1980s.[12] Hence, the entry of computers into Soviet classrooms was associated not only with educational, but also with ideological goals.

In the public domain, the computer was presented as a working tool for creating, processing and using information, on par with food products, industrial goods, and energy.[13] The Communist elite was well aware that centralized and well-supervised state computing was a struggle for media and information con-

8 Georg Trogeman, Alexander Nitussov and Wolfgang Ernt, *Computing in Russia. The History of Computer Devices and Information Technology revealed* (Wiesbaden: Vieweg+Teubner, 2001), 6.

9 Wellman, *A Chip in the Curtain*, 6; Ksenia Tatarchenko, "The Computer Does Not Believe in Tears," *Kritka: Explorations in Russian and Eurasian History* 18, no. 4 (2017): 736.

10 Uvarov, "Perestroika obrazovanija," 14; Wellman, *A Chip in the Curtain*, 6.

11 See Wellman, *A Chip in the Curtain.*

12 Tatarchenko, "The Computer."

13 Uvarov, "Perestroika obrazovanija," 3–4.

trol.[14] The outcome of this struggle in an authoritarian state from today's perspective can only be the subject of conjecture and speculation.

To mobilise the public, the state-controlled mass media produced the vision that new technologies would straight away enter every home and workplace, and it would be difficult to work in the future without computer skills.[15] Therefore, the new generation must start preparing for working with computers at school.[16] The newspapers predicted that "It will not be long before ECM[17] enters our apartments, becomes our mentor, helps us navigate through difficult situations in life, and does some of the homework for pupils. It will become the most rigorous and knowledgeable teacher".[18] Hence, the challenge was the one ever cherished by decision-makers in education, i.e. to prepare for the future. In hindsight, they did succeed this time – the computer really became "an ordinary element of the environment for most members of society",[19] only it was no longer a Soviet society.

In speeches by Communist Party leaders, in documents of the Party and Communist youth organisations, and thus also in the press publications serving Soviet ideology, the course towards the general elimination of so-called computer illiteracy was proclaimed.[20] The acquisition of computing was compared to the elimination of illiteracy after the Russian Revolution of 1917[21] and Lenin's Russia's electrification programme in 1922.[22] Consequently, the "nations computer literacy campaign"[23] began.

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14 Wellman, *A Chip in the Curtain*, 13.

15 Arnis Blodons, "Arodu apgūst ar kompjūteru [The craft is learned with a computer]," *Padomju Jaunatne* [Soviet Youth], November 10, 1987.

16 Baldurs Apinis, "Bez noslēpumainības plīvura [Without the veil of mystery]," *Padomju Jaunatne* [Soviet Youth], September 27, 1985.

17 Electronic Counting Machine (ECM).

18 U. Koškins, "Iepazīsimies! Mani sauc ESM [Let's get acquainted! My name is ECM]," *Pionieris* [Red Pioneer], March 21, 1986.

19 Uvarov, "Perestroika obrazovanija," 6.

20 Apinis, "Bez noslēpumainības plīvura [Without the veil of mystery]."

21 Wellman, *A Chip in the Curtain*, 125; Tatarchenko, "The Computer," 736; Apinis, "Bez noslēpumainības plīvura [Without the veil of mystery]."

22 Uvarov, "Perestroika obrazovanija," 3.

23 Wellman, *A Chip in the Curtain*, 131.

Computers as a Material Challenge

In Soviet Latvia, the use of digital technologies entered teaching-learning process already in the 1960s, when the subject ‘Computational Mathematics and Programming’ appeared in specialized mathematics school’s curriculum. The terms ‘audiovisual’ (*audiovizualnyi*) and ‘screen-sound’ (*ekranno-zvukovoi*) frequently appears in schooling and research of Soviet Union field.[24] However, computer technologies were not present at the school but more often students would go on excursions to the local computing centre to see how the ECM works.[25]

When informatics became a compulsory subject in the curriculum of comprehensive secondary schools, an avalanche of problems hit educators at all levels, affecting teachers especially. In 1985, the situation in the schools of the Soviet Union, and thus in Latvia, was as follows: informatics was introduced in the school curricula, but there were no computers in schools, teachers were poorly trained to teach informatics, and there was a lack of teaching aids.[26] Everything had to be started from scratch, “there was nothing”, the only resource was the teacher’s mind.[27]

The subject of informatics in schools started as theory classes, as work on paper and blackboard, as a “machineless” version.[28] This paradoxical situation, i.e., computer training without computers, was portrayed by the Soviet mass media as perfectly normal, they claimed that the informatics curriculum contained a great many basic ideas which everyone should know, and that everyone should learn to program.[29]

As there were no computers in the schools, the teachers taught the theory about the structure and functions of computers, algorithms, computing techniques, and drew schemes on blackboards. Teachers gave tasks to their students, the students solved it independently or in pairs and then compared the results with the whole class.[30] “It was interesting to do it, but we did not see the meaning in it”.

24 Stephen Kerr, “Innovation on Command: Instructional Development and Educational Technology in the Soviet Union,” *Educational Communication and Technology* 30, no. 2 (1982): 97–116.

25 Vēzis, “Informātika skolā”’; Interview with teacher, February 9, 2021.

26 Wellman, *A Chip in the Curtain*, 131.

27 Interview with teacher, February 24, 2021; Interview with teacher, February 9, 2021.

28 Apinis, “Bez noslēpumainības plīvura [Without the veil of mystery]”; Interview with teacher, February 12, 2021.

29 Wellman, *A Chip in the Curtain*, 130; Apinis, “Bez noslēpumainības plīvura [Without the veil of mystery].”

30 Interview with teacher, February 24, 2021; Interview with teacher, February 8, 2021; Interview with student, February 9, 2021; Interview with student, February 24, 2021.

Informatics was not perceived seriously more like the subject of entertainment where everyone received excellent grades. Accordingly, the result was: "I did not learn anything".[31]

Practical reality began to settle in when the first calculators appeared in schools, which at the time were perceived as "key devices"[32] and "top-flight".[33] As Gorbachev's *perestroika* with partial freedom of expression had begun, teachers could lament the lack of programmers' calculators in public, namely in the press: "[…] incomprehensibly little attention is paid to the very real boxes, which, although much smaller and more modest than the non-existent personal computers, perform in principle analogous functions. I mean programmable pocket micro-calculators. […] Why do we forget [most readers do not even get to know] that these really accessible devices allow a practical introduction to programming […]".[34]

The calculators could be used for real operations in informatics lessons,[35] but these calculators had to be provided to students, and this was a problem for teachers. One of our respondents said that she had seen calculators at the University of Latvia: "I did my homework. I went to the Ministry of Education, and they gave us programmable calculators for the school", which could be used for programming games or teaching algorithms.[36] "We had six or eight Japanese-made calculators in the school, at least two of which were regularly broken".[37]

Industrial companies helped schools with calculators by "making arrangements". One of the IT teachers had seen a picture of a large, working calculator on the wall, on which operations could be demonstrated. He approached the school patrons, a rich industrial company, with a request to get a wall-mounted calculator for their informatics classroom, which the company made specifically for the school (see *Fig. 1*).[38]

The calculators were the first complex technological device that the students could use themselves. Teachers had to accept pupils' independence, learn to entrust them with complex technological tools.[39] Calculators have pushed the boun-

31 Interview with student, January 22, 2021; Interview with student, February 10, 2021; Interview with student, February 26, 2021.

32 Tatarchenko, "The Computer," 737.

33 Interview with student, January 26, 2021.

34 Baldurs Apinis, "Par dažādām idejām [About different ideas]," *Padomju Jaunatne* [Soviet Youth], December 18, 1985.

35 Interview with teacher, February 12, 2021; Interview with teacher, February 10, 2021.

36 Interview with teacher, February 9, 2021.

37 Interview with teacher, February 12, 2021.

38 Interview with teacher, February 9, 2021.

39 Uvarov, "Perestroika obrazovanija," 13; Interview with student, January 22, 2021; Interview with student, February 9, 2021.

Fig. 1: Calculator on the wall. Teacher Valdis Lūsis at a secondary school in Riga, 1980s. Personal archives.

daries in the treatment of pupils and technology that had hitherto been rigidly marked out. For example, our respondent recalled her experience with "old" technologies: "God forbid you touch the player!"[40] Calculators as part of "hands-on curriculum"[41] initiated the use of individual technical tools in the daily classroom routine.

Teachers reiterated the experience they had gained during their university studies. At least once during the school year students were taken on a field trip to institutions where, to quote a phrase, "on the basis of friendship",[42] they could learn the workings of the ECM. "On the basis of friendship" means that such excursions were not part of the curriculum but were arranged through teacher acquaintances who worked at the Computing Centers. The organization of such excursions also had to take into account factors of security because, as is mentioned earlier, all technology in the Soviet Union was related to national defense and security, and thus the Computing Centers were also heavily guarded and could only be entered after passing through a security check. In the Computing Centers, the students were introduced to ECMs and punch cards. From these excursions, the respondents have remembered especially the huge computing cabinets and the loud noise.[43]

The "era" of informatics in schools as a purely theoretical subject and based on calculators did not last long. On 1 January 1986, the first computer class was established in Lielvārde, a village about 50 kilometers from the capital city Riga.[44] This was an incentive for other enthusiastic teachers to try, because it was "psychologically difficult – I know it is there, but I don't go near [the computer]".[45]

Since the allocation of resources in the Soviet Union was carried out under a centralized control/planning system, funding was provided through special state programmes.[46] Computer classrooms in Latvian schools could only be set up through centralized distribution under the supervision of the Ministry of Education of the Republic. Thus, the distribution of material resources among schools was bureaucratic and the centralized system unwieldy. The backwardness in the

40 Interview with student, February 10, 2021.
41 See Heshium Lawrence and Mark Miller, "A Historical Perspective of the Evolution of Technology Education," *International Journal on Integrating Technology in Education* 3, no. 2 (2014): 1–7, https://doi.org/10.5121/ijite.2014.3201.
42 Interview with teacher, February 9, 2021.
43 Interview with student, January 22, 2021; Interview with student, February 9, 2021; Interview with student, February 10, 2021.
44 Interview with teacher, February 8, 2021.
45 Interview with teacher, February 12, 2021.
46 Uvarov, "Perestroika obrazovanija," 8, 11.

material provision of informatics was acknowledged even by official Soviet sources and it did not remain hidden abroad either.[47] It was impossible to buy computers as an individual for personal use, as the price was too high in the modest conditions of Soviet life.[48] It should also be noted that computer production in the USSR was associated with "exaggerated secrecy" as part of the military industry.[49] By 1989, 200 computer classes had been established in 58 % of secondary schools in Latvia.[50] By comparison, as early as 1984 in the USA 85.1 % of all elementary and secondary public schools had microcomputers for student instruction.[51] Therefore, the computerization of Soviet schools lagged far behind the largest competitor of the Soviet Union, the United States.

The first computer classrooms were given to schools specialising in science subjects and staffed by "enthusiastic teachers".[52] Although the material equipment of schools was under the supervision and control of the state, the human factor, which was very important in Soviet society, played a role here, namely the ability to "find," "arrange" and "knock out" what was needed for the school. "In order to implement your ideas, you had to understand where to get [the funds]."[53] Initiative on the part of the school and the teachers was important.[54] One of our respondents recalled that several computers had been received by a school in a nearby city and that he "hankered after one for a long time until I was given one "beka" [BK computer[55]]". It was the only computer in the whole school, but at least it could serve to demonstrate the topics teachers discussed in informatics lessons in practice.[56] Another respondent praised the school principal who did not take the outdated computers ("bekas") offered to the school, but waited two whole years for a newer model to arrive, thus making his school's computer room the best in Latvia.[57] Of course, this also brought fame to the school management and this was not secondary in the "battle" for innovation. Whichever pathways led to computers; the winners were not judged.

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47 Uvarov, "Perestroika obrazovanija," 9; Wellman, *A Chip in the Curtain*, 15; Uvarov, "Perestroika obrazovanija."

48 Wellman, *A Chip in the Curtain*, 10.

49 Nitusov, "Computer Development," 209.

50 Vēzis, "Informātika skolā."

51 Wellman, *A Chip in the Curtain*, 122.

52 Interview with teacher, February 8, 2021.

53 Interview with teacher, February 8, 2021.

54 Interview with teacher, February 12, 2021.

55 Elektronika BK-0010 – the first Soviet personal computer, mass-produced since 1984.

56 Interview with teacher, February 12, 2021.

57 Interview with teacher, February 24, 2021.

When the first lucky ones were given computers through the Ministry of Education, they had to be delivered to school. A typical case was told to us by one of the respondents: an informatics teacher came to the First Deputy Minister of Latvia's Ministry of Education to explain the need for computers in school and to receive her signature for a business trip to a computer factory. The teacher personally drove several hundred kilometres to a factory near Moscow to pick up the computers for his school in Latvia.[58]

When computers arrived in schools, it was also up to the teachers to install them because in the Soviet Union it was customary that the practical work was done by whoever was interested – so if a teacher needed a computer room, he would run the wires and clad the walls, sometimes with the help of pupils.[59] In the first computer rooms, the wires were hung on clotheslines and stretched overhead in the classroom. Only later were the wires built into the floor.[60] Under the poor Soviet conditions, it was taken for granted that all males knew how to "build and assemble and make something",[61] as this skill was a basic need in every household. During this time, the Soviet Union lacked the most basic materials needed to set up a computer room. Materials could not be bought in a shop but had to be procured privately through an influential contact.

Teachers' work in setting up computer rooms, for which they received no extra remuneration, was taken for granted.[62] It is true that teachers were rewarded in Soviet style: they received moral support, were recognised as successful in their profession and were praised in the press. In 1987, a typical teacher's story was published: "We worked all summer (it's good that a teacher has such a long vacation). First, we had to prepare the classroom – interior design, rewiring, furniture, then we had to arrange all 12 workstations rationally and finally we had to connect the computers to one control system. Each workstation needs six cables, a local cable for the tape recorder, a cable for the central computer [allowing for the possibility that the whole machine will run on DC power], some of these cables had to be hidden under the plaster, etc. The only support and advisor was V. Remicāns, a foreman from the production association *Impulss*, who had come to install the equipment. I can quietly say that I got the materials – cables, etc. – with the

58 Interview with teacher, February 8, 2021.

59 Interview with teacher, February 24, 2021; Interview with teacher, February 9, 2021.

60 Interview with teacher, February 12, 2021.

61 Interview with teacher, February 9, 2021.

62 Wellman, *A Chip in the Curtain*, 132.

help of my old schoolmates, otherwise I would not have made it".[63] Our respondents had similar stories.

Computer classrooms were usually set up in the summer, during the pupils' and teachers' holidays, and Soviet propaganda material was also displayed on the walls, such as Gorbachev's quote about the importance of learning new technologies.[64] On the teacher's desk was the "main computer", a huge box. The number of computers provided for the pupils was not large – about 12 to 16. The pupils then worked on them either in two groups or in pairs on one computer.[65] All were satisfied – 12 to 16 computers in the school were considered a sufficient number, other schools were not as fortunate.[66] Wellman describes visiting a Moscow school, "a showpiece for visiting reporters", where there were 16 computers for 900 pupils in grades 1 to 10 "to support the computer literacy instruction".[67]

Understandably, computers were an expensive asset, hence security was necessary. The school had bars on the windows of the computer room, the classroom had iron doors and "it felt like a bunker".[68] The computer was a treasure, with material as well as symbolic value,[69] so it had taken the place of a powerful actor in the field of education.

Computer as an Intellectual and Psychological Challenge

"From the earliest days, computing was linked in the public mind to the brain and intelligence".[70] To introduce informatics, it was necessary to find "intelligent" teachers who could quickly acquire the necessary technical and specific pedagog-

63 L. Liepa, "Jau dara. Domā. Sapņo [Already doing. Thinking. Dreaming]," *Padomju Jaunatne* [Soviet Youth], January 16, 1987.
64 Interview with teacher, February 10, 2021.
65 Interview with student, January 26, 2021; Interview with teacher, February 10, 2021; Interview with teacher, February 12, 2021; Interview with student, February 10, 2021.
66 Interview with teacher, February 12, 2021.
67 Wellman, *A Chip in the Curtain*, 128.
68 Interview with student, January 26, 2021.
69 Matti Tedre and Peter J. Denning, "Shifting Identities in Computing: From a Useful Tool to a New Method and Theory of Science," in *Informatics in the Future*, ed. Hannes Werthner and Frank van Harmelen (Cham: Springer, 2017), 14, https://doi.org/10.1007/978-3-319-55735-9_1.
70 Tedre and Denning, "Shifting Identities," 14.

ical skills at the same time. "All technical teaching tools will be only as effective as the teachers who are trained to use them," wrote Uvarov.[71]

The choice for teaching informatics fell on mathematics teachers, whose professional thinking was considered suitable for understanding programming and algorithms.[72] In addition, physics and mathematics students at Latvian universities had to pass an exam in pedagogy to qualify as teachers. However, for math teachers, the workload in schools was already maxed out. Therefore, human resources were found among pedagogues around the age of retirement, which in the Soviet Union was 55 for women and 60 for men. As the pension was calculated according to the salary of last years of work, seniors were happy to earn, thus increasing their pension. The reliance on the intellectual potential of pensioners to master computing seems paradoxical, given the official set-up of the computer as an accelerator of generational change in the labour market.[73]

The recruited informatics teachers quickly split into two categories: the first was technology experts who had taken up the role of teacher by accident, as teachers were also recruited from universities and Computing Centers. They were not pedagogues and thus did not fully understand how to organize teaching and learning.[74] However, the other category comprised of teachers-enthusiasts who started the job because "they were interested in this subject",[75] they "just liked racking their brains".[76]

For many of the teachers, informatics became a lifelong passion, and they are still working in this field. One of our respondents described the first informatics teachers as follows: "The most enthusiastic were those who no longer had a problem with their subject, with their pupils, and so the school had become boring. And now they had discovered something new".[77] Something extraordinary had entered the Soviet school routine, something that made teachers approach teaching with renewed interest, accepting new challenges. Burbules notes that "New is exciting. New is cool. New is unprecedented".[78] Informatics teachers became charismatic role models, as Wellman claims, they could be described as inspirational, above

71 Uvarov, "Perestroika obrazovanija," 12.
72 See Tedre, Simon and Malmi, "Changing Aims"; Tedre and Denning, "Shifting Identities."
73 See Uvarov, "Perestroika obrazovanija," 4.
74 Interview with student, February 10, 2021.
75 Interview with teacher, February 9, 2021.
76 Interview with teacher, February 24, 2021.
77 Interview with teacher, February 10, 2021.
78 Nicholas C. Burbules, "Technology, Education, and the Fetishization of the 'New'," in *Educational Research: Discourses of Change and Changes of Discourse*, ed. Paul Smeyers and Marc Depaepe (Cham: Springer International Publishing, 2016): 9.

average intelligence, adaptive to rapid change, and unique.[79] The most enthusiastic of informatics teachers were ready to accept all challenges and to learn together with their students,[80] which was also acknowledged by our respondents: "change forces learning".[81] Moreover, in the field of new technologies, every experience quickly becomes obsolete,[82] which is why advancing education became a daily routine for informatics teachers.

While studying mathematics at university, the future informatics teachers had at least heard of new technologies, even learned programming without computers and worked with programmable calculators.[83] During their studies, they were familiar with programming machines at the Institute of Physics or computing machines at the Computing Centre of the Riga Polytechnic Institute.[84] Some had even seen real computers and touched them![85] This experience gained during the years of study was then reproduced at school when they began teaching informatics.

Before the introduction of special training for informatics teachers at universities (which was slow, as the curricula had to be changed), the responsibility for training in the new subject was given to the Teacher Training Institute, whose work was supervised by the Ministry of Education. Short-term courses were organised, but their effectiveness was low.[86] The same teachers who had taught informatics for only a few years became course instructors. For example, one of our respondents started working as a teacher of informatics in 1985, but by the autumn of 1989 he was teaching informatics to his colleagues at the Teacher Training Institute.[87] Three years of work in a new field was already considered a respectable experience to share with others.

An important part of teachers' training was the exchange of experience, networking, or "human contacts".[88] When some schools had computer labs, teachers from other schools went there to learn best practices. Teachers could even be so enthusiastic that they took public transport to another school after working

79 Wellman, *A Chip in the Curtain*, 120.
80 Wellman, *A Chip in the Curtain*, 131.
81 Interview with teacher, February 9, 2021.
82 Tedre, Simon and Malmi, "Changing Aims," 161.
83 Interview with teacher, February 8, 2021; Interview with teacher, February 9, 2021; Interview with teacher, February 10, 2021.
84 Interview with teacher, February 8, 2021; Interview with teacher, February 9, 2021.
85 Interview with teacher, February 10, 2021; Interview with teacher, February 12, 2021.
86 Interview with teacher, February 24, 2021.
87 Interview with teacher, February 10, 2021.
88 Uvarov, "Perestroika obrazovanija," 7.

hours so that they could work on the computer and then, to quote, "I was running breathlessly so as not to miss the last bus home".[89]

Teacher training offered necessary networking opportunities in a situation where one of the personal problems faced by IT teachers was professional loneliness. Colleagues in the school did not understand what new technology enthusiasts really did. Although the official position was that the computer should become part of the whole pedagogical process,[90] in practice nobody thought that computers could be useful in subjects other than informatics. And even if the idea arose that perhaps computers could be used, for example, in Biology lessons, colleagues had no interest in them at that time.[91]

Therefore, it was very important for the "newborn" informatics teachers to meet other enthusiasts and like-minded people and to understand that, to quote, "you are not the only idiot in the world".[92] Groups of thought-mates were formed, informally exchanging professional news with each other,[93] because during the Soviet period bottom-up professional organizations were not allowed under the strict supervision of the state security police.

While the national propaganda campaign was in full sail, standing face to face with their pupils in the classroom, informatics teachers were put in an awkward position. Our respondents, remembering the feelings of that time, admit that "no one knew why the subject informatics was introduced".[94] They admit that computers and algorithmic thinking "just came in, it could not be avoided".[95] Yet, the practical relevance of informatics was not understood by the teachers themselves: "At that moment I thought for a very long time myself, even for several years, why it was necessary." One of the hopes was that there would be no more paper, everything would be done electronically.[96]

However, doubting the need of teaching informatics in schools did not matter: the Soviet Union was an authoritarian country. Informatics had to be learned and that was the end of discussion.[97] Today, the teachers' view of this inevitability and coercion at the time is quite positive: it was good and necessary because it made

89 Interview with teacher, February 12, 2021.
90 Uvarov, "Perestroika obrazovanija."
91 Interview with teacher, February 12, 2021.
92 Interview with teacher, February 12, 2021.
93 Interview with teacher, February 8, 2021; Interview with teacher, February 10, 2021.
94 Interview with teacher, February 24, 2021.
95 Interview with teacher, February 10, 2021; Interview with teacher, February 12, 2021.
96 Interview with teacher, February 24, 2021.
97 Interview with teacher, February 10, 2021.

the field of computing develop rapidly. "Maybe the commanding form was not good, but nothing would have come without it".[98]

However, pupils in the classroom needed motivation to learn the subject, the applicability of which in practice was quite unclear to the teachers themselves. At the beginning of the new subject, the teachers had to explain, at least for appearances' sake, why one should study informatics. One of most common reasons brought forward was "brain training" through algorithmic thinking, which was recognised as a central skill in computing.[99] "If you liked mathematics, you could bend your brain"[100] and moreover, "algorithms help to organize thinking and learn a new way of thinking".[101] The emphasis was on theoretical programming skills. Among educators, civil servants and many specialists, there was a belief that computing would develop as programming, which every Soviet citizen would learn in school.[102] This was a prediction that did not come true.

In the "machine-free" period, all the arguments did not sound convincing to pupils, as evidenced by the answers in the interviews: "Everything was abstract [...] it could not be applied in life".[103] "It all seemed like some kind of cosmos – what, why...".[104] The situation changed, and the impetus to learn came when real technology – calculators and computers – entered the classroom and became a new, interesting toy, and technical marvel: "What mattered was that one could play".[105] For example, you could make pictures out of letters, which was very popular: "We made the Mona Lisa".[106] You could also play "war".[107] The pupils invented competitions for themselves, for example, a keyboard race to see who could type the fastest.[108] Games became a motivation to learn, and the opportunity to play became a reward because no one was interested in calculations.[109] The computer classes were also a chance to try out technical innovations. For example, attaching a tape recorder to the teacher's computer and sending messages. To ensure

98 Interview with teacher, February 9, 2021; Interview with teacher, February 12, 2021.
99 Tedre, Simon and Malmi, "Changing Aims," 165.
100 Interview with teacher, February 24, 2021.
101 Interview with teacher, February 10, 2021.
102 Tatarchenko, "The Computer."
103 Interview with student, January 22, 2021.
104 Interview with student, February 10, 2021.
105 Interview with teacher, February 24, 2021.
106 Interview with teacher, February 9, 2021.
107 Interview with student, February 9, 2021.
108 Interview with teacher, February 24, 2021.
109 Interview with teacher, February 9, 2021; Interview with teacher, February 12, 2021.

that the messages went both ways, the teacher, together with a male student and her father, a computer specialist, fitted special switches to the tape recorder.[110]

In the interviews, teachers mostly mentioned students who were particularly interested in informatics. It was exactly with this advanced group that the teachers enjoyed working. They searched for literature and worked with computers after the lessons, as well as assisted the teacher during classes.[111] Teachers still recall their first pupils, enthusiastic learners of informatics, vividly, emphasising their fascination: "Those who were interested in it were terribly interested in it. They were ready to queue up outside the classroom and wait for the lessons to finish to get to the computers".[112] The opportunity to work on the computer became a reward for pupils.

However, students who were fascinated by the new technologies were as lonely as their enthusiastic teachers. Neither their peers nor their parents really understood what they were doing. They raised quite a few eyebrows: "We were like dinosaurs".[113] However, there were those who appreciated them. The introduction of informatics into the school marked a frontier: Some of the pupils proved to be able and willing to learn a whole new area of knowledge and skills, thus becoming intellectual leaders in the eyes of the teachers. As one teacher admitted: "Algorithms are a way of thinking. There are those who can master it and those who cannot. It's like music. If you don't get it, you don't get it. It cannot be drilled".[114] Needless to say, in the eyes of teachers, of course, a pupil with algorithmic thinking skills is more capable than one who does not have it. It is true that learning new technologies required not only talent but also patience and perseverance, it was "difficult" and, to quote an interviewee, one always tends to find an excuse why one does not need it.[115]

Those who were successful with computers became the elite of the school – they were recognised as intelligent, hard-working, and persistent, the true "dream pupils".

110 Interview with teacher, February 9, 2021.

111 Interview with student, January 26, 2021.

112 Interview with teacher, February 9, 2021.

113 Interview with student, February 9, 2021; Interview with student, February 10, 2021.

114 Interview with teacher, February 12, 2021.

115 Interview with teacher, February 9, 2021.

Computer and Social Order

The Computer Literacy campaign brought with it changes in the hitherto fundamental and entrenched Soviet order of life, as well as highlight social challenges.

The first novelty was the breath of freedom and the hope for a better everyday reality. In the official ideological setting, the computer was presented as part of the revolutionary processes of the *perestroika* era, as an instrument for democracy and the reorganisation of the pedagogical process.[116] Modernising education was seen as an opportunity to solve social problems, as social problems have always been educationalized.[117] Soviet press stated: "Educational backwardness is ultimately reflected in low productivity, slow pace of scientific and technical progress and also in social problems such as alcoholism, lack of humanity in society and crime".[118]

In Soviet Latvian school practice, the officially proclaimed revolutionary processes of *perestroika* were understood more radically than the Communist elite thought – the longing for independence of their country had not been eradicated in Latvian collective memory during the 50 years of Soviet occupation. Computers became a tangible sign of change, harbingers of freedom: "Independence was already in the air".[119]

New technologies were also the cause of the opening of the Iron Curtain, "the sacred Soviet border" suddenly became crossable.[120] There were calls from the Communist elite, aware of the Soviet Union's backwardness in the field of new technologies, to provide informatics teachers with Western journals in the field and even to involve foreign pedagogues in training.[121] One of our respondents, an informatics teacher in a Latvian village school, participated in a unique event, namely a visit to London initiated by the Soviet leader Mikhail Gorbachev and UK Prime Minister Margaret Thatcher in the autumn of 1987. "We received a lot of material, and I gave it to the Ministry of Education. These were then used as

116 Uvarov, "Perestroika obrazovanija," 5.

117 See David F. Labaree, "School Syndrome: Understanding the USA's Magical Belief That Schooling Can Somehow Improve Society, Promote Access, and Preserve Advantage," *Journal of Curriculum Studies* 44, no. 2 (2012): 143–163.

118 "Kopīgi domāt, kopīgi rīkoties [Thinking together, acting together]," *Padomju Jaunatne* [Soviet Youth], June 10, 1988.

119 Interview with teacher, February 8, 2021.

120 Yurchak, *Everything Was Forever,* 205.

121 Uvarov, "Perestroika obrazovanija," 10, 13.

the basis for teaching standards. In the UK, it [computing technology] was already a reality".[122]

Informatics teachers also perceived freedom in their workplaces. Of course, freedom within the limits of the Soviet education system. In the uncertain and chaotic beginnings of informatics teaching, teachers today also see the positive: they were the first and therefore enjoyed their uniqueness. "The teacher could teach more of what they wanted, what they believed and what they needed [...]".[123] Teachers' freedom of action was officially accepted: educational institutions themselves were allowed to choose the forms and pace of teaching computer literacy, but at the same time, the educational institutions themselves "assume full responsibility for the validity of the decisions taken".[124] This message of Uvarov reveals the convenient position of the state to shirk the responsibility for the tactics of computer literacy implementation, while reserving the right to punish innovators for their mistakes.

Alongside the celebration of new technologies, their side effects were also revealed, namely that the computer contributed to the traditional companions of education to which Margolis refers – differentiation, selection, and stratification.[125]

Officially, all comprehensive secondary schools in the Soviet Union were supposed to be equal. In practice, however, the distribution of material resources and thus the introduction of new technologies was uneven, depending on "local context".[126] The beginning of computing, like any Soviet innovation, is to be found in the metropolis republic of the Soviet Union, in Russia. However, the Baltic States were also in a leading position and Latvia, in turn, was the leader among them. This is evidenced by the first computer classrooms set up as early as 1986 and the invitation of Latvian teachers to share their experience at All-Union conferences.[127] Within Latvia, the situation regarding school initiatives varied between regions. This was highlighted by the first computer competitions.

Once informatics became a bit more established in schools, subject Olympiads were organized. In 1989, it was held for the second time: "On the first day, participants wrote algorithms and did calculations; on the second day, they worked with calculators. For two days, pupils put into practice their knowledge of a subject that has only recently appeared in the timetable in some schools. Perhaps that is why the high level of training of the Riga schools was felt. [...] Not all the participants

122 Interview with teacher, February 8, 2021.
123 Interview with teacher, February 24, 2021.
124 Uvarov, "Perestroika obrazovanija," 9.
125 Margolis et al., "Peekaboo," 18.
126 Uvarov, "Perestroika obrazovanija," 11.
127 Interview with teacher, February 8, 2021.

were provided with Yamaha computers, so their users were in a more privileged position than the others. Thus, not all participants were treated equally".[128] The Olympiads highlighted the unequal provision of technology in schools. Computers manufactured in Japan, with which the Soviet Union had regular trade agreements, were a luxury item[129] available only to a small number of schools. Yet, in the second half of the 1980s, the competition for material resources was confined to schools only. The much more painful individual inequalities created by the introduction of personal computers into households in the 1990s were still in the future.

While computers were located only in schools, the IT teacher was lord and king of the computing field. The teacher had the material and intellectual resources, they managed them and only they decided how to use them: it was a "one-way movement".[130] The now grown-up boys remember standing in front of the computer room and praying in their minds that the teacher's children would not get sick, that she would be at school and that they would have access to the computers.[131] "Waiting for the teacher" is a disguised power mechanism, as Margolis et al. acknowledge,[132] but it teaches pupils who the authority is.

Competition, another indispensable companion to education, logically led to assessment. Pupils who had mastered computer skills were sent to the school Olympiads, and their hard work and talent were rewarded. As Margolis et al. write, rewards are part of the selecting procedure, which in turn makes the non-rewarded feel like "the losers in competition".[133] New technologies created a new elite, as the computer contributed to the classification of children. The same was true for teachers. The first generation of informatics teachers or "the first tribe", to use Tatarchenko's expression,[134] whether they realised it or not, was special: informatics pioneers received full, comprehensive state support,[135] were heard by large audiences, were reported on by the mass media, and doors opened for them to new intellectual and social worlds.[136]

128 K. Puriņa, "Beigusies otrā republikas informātikas olimpiāde [The second Republican Informatics Olympiad is over]," *Padomju Jaunatne* [Soviet Youth], August 4, 1989.

129 Wellman, *A Chip in the Curtain.*

130 Interview with student, February 9, 2021.

131 Interview with student, February 9, 2021.

132 Margolis et al., "Peekaboo," 5.

133 Margolis et al., "Peekaboo," 6.

134 Tatarchenko, "The Computer," 721.

135 Interview with teacher, January 21, 2021.

136 Tatarchenko, "The Computer," 717.

Next to the intellectual differentiation highlighted by computer literacy, issues of gender also emerged. First, the involvement of mathematicians in pedagogy meant that Computer Science became a predominantly male field of work since science and engineering in the Soviet Union, and thus in Latvia, were predominantly male. Consequently, the selection of informatics teachers masculinised the field, a similar trend in the West.[137]

Second, "algorithmic thinking", highly valued by both teachers and authorities, was associated with a disciplined mind, which, in turn, was traditionally considered a male trait.[138] As our respondents explained, "women found that thing scary [...], it was a difficult thing".[139]

Third, boys were more interested in computers than girls.[140] Although teachers did not acknowledge deliberate gender segregation, boys' greater interest in computers was acknowledged as a fact and inevitable reality: "Boys have always been more interested in computers than girls".[141] Girls were blamed for this viewpoint as apparently they considered technology a "men's affair," although programming "requires accuracy"[142] – a quality that is associated with women. As one respondent claimed, girls are more impatient with technology – if something doesn't work right the first time, they say "oh, well, let it be," while boys will try again and again.[143]

New technologies taught new social relations centered around the material object, the computer, as a "reservoir of cultural and social resources".[144]

Conclusion

Computing technologies entered the classrooms of Soviet Latvian schools "from above" through the compulsory subject of informatics. From the state perspective, the elimination of computer illiteracy rooted in hidden military (development of country military potential) and ideological (symbolic demonstration of dominance

137 Tedre, Simon and Malmi, "Changing Aims," 173; Tatarchenko, "The Computer."
138 Tatarchenko, "The Computer," 723, 736; David Knights, "Binaries Need to Shatter for Bodies to Matter: Do Disembodied Masculinities Undermine Organizational Ethics?" *Organization* 22, no. 2 (2014): 12, https://oi.org/10.1177/1350508414558724.
139 Interview with teacher, February 9, 2021.
140 Interview with teacher, February 12, 2021.
141 Interview with teacher, February 9, 2021.
142 Interview with teacher, February 8, 2021.
143 Interview with teacher, February 12, 2021.
144 Margolis et al., "Peekaboo," 8.

over the West) goals, as well as an openly propagated social agenda (computer literacy as an inevitable necessity, for a future in the labour market). However, the exciting practice shifted the hidden and open goals of Communist elite to the background. The introduction of informatics was a successful attempt to "predict the future", which poses an endless challenge in the field of education. New technologies started as a marginalised sector but became hegemonic. The pioneers of computing technologies in recent years are winners both intellectually and financially.

The celebration of new technologies in Latvian classrooms also highlighted the side effects that accompany innovation: "In the secret garden of the curriculum, power and knowledge lie coiled like serpents".[145]

The first and least hidden side effect of computing was differential access to material goods, which became an instrument of power: who will get the resources needed for innovation? These inevitable, innovation-compliant challenges formed the differences between the republics of the Soviet Union, and the differences between the capital and the periphery within the republics. The distribution of material benefits in the needy Soviet education system was in the hands of a circle of people who had the power to choose who would receive them. Official power structures such as the Ministry of Education were joined by "hidden hands",[146] i. e. those with whom one had to "negotiate". "The place from which power is exercised is often a hidden place".[147] In Soviet society, there was an informal structure on which those who needed goods for their daily duties, namely teachers, depended.

Teachers' unpaid work in providing all the necessities and setting up computer rooms was taken for granted, it belonged to the social agreement "not to see" – "we use hides to cover our nakedness".[148] In our case, it means pretending that everything is right with the management of Soviet teacher's working in classrooms. Equally tacitly accepted was the fact that the teacher became the owner of access to the treasure – the computer. Pupils had to learn to wait.

The second sign of a hidden curriculum revealed by the computer was the segregation of winners and losers or "digital divide".[149] The new makes you feel special, which forms a sense of community. Others were judged from the perspective of this community: who is the first? Who owns the pioneer mandate? Who is the most capable to learn the new? The acquisition of innovations divided teachers

145 Margolis et al., "Peekaboo," 3.

146 Margolis et al., "Peekaboo," 4.

147 Margolis et al., "Peekaboo," 3.

148 Margolis et al., "Peekaboo," 2.

149 Ulli Samuelsson and Tobias Olsson, "Digital Inequality in Primary and Secondary Education: Findings from a Systematic Literature Review," in *Media and Education in the Digital Age Concepts, Assessments, Subversions*, ed. Matteo Stocchetti (Berlin: Peter Lang, 2014), 41.

and students as the rapid acquisition of new knowledge and skills became an important indicator of intellectual capacity; it created an elite. This elite was "fed" with open, hidden, and even unnamed rewards. Rewards included access to a computer outside school hours, a special relationship with a teacher, the opportunity to compare skills in computer science Olympiads, publicity, state-funded trips, and school honours.

Working with new technologies also brought about stereotypical beliefs regarding the most appropriate gender of savvy computer users, namely boys. They were assigned the traditional place of men – to be a brave pioneer, while girls were placed on the periphery of the path of innovation as "funky".

One can only agree with Tatarchenko that the arrival of the computer in Soviet classrooms was framed by issues of access and control, power, and inequality.[150]

The third, not publicly discussed, side effect of computing that we want to highlight is freedom. Because the new is unique, it allows for a greater degree of freedom. In the early phase of innovation, there is no group of established "preachers" who inevitably standardise their own experience and, with the best of intentions, offer it to others, arriving at rules or even laws that everyone must eventually follow. In the early days of informatics, the teachers were free to make their own choices (within the framework of the Soviet educational system). This bite into the pie of individual freedom made the computer a sign of the "advent" of the collapse of authoritarian rule.

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Teachers Translating and Circumventing the Computer in Lower and Upper Secondary Swedish Schools in the 1970s and 1980s

Abstract: Computers made their appearance in some Swedish schools in the late 1970s when teachers and administrators, interested in the possibilities these machines represented for education, brought the first devices, and used them in the classroom. More systematically and at the initiative of the State, national projects and initiatives brought computers to a larger number of schools. However, it was not until the 1990s that computers had a more obvious place in the classroom. The computerization of the classroom depended on a large extent on teachers who acted as both catalysts and detractors of the process. With the help of Bruno Latour's model of translation, I argue that teachers as a group did not react homogeneously but showed a variety of attitudes and positioning according to their experiences and place within the educational system and the political structure, which had tangible consequences for the development of the process of computerization of schools.

Keywords: computers in education; teachers; Sweden

"Joyful and hopeful I went to my meeting with 'the computer'. My experience with computers was reading about them in books. I had never even touched one. But I really longed to do so".[1] During spring 1988, Solveig Eriksson, a secondary school teacher from Huddinge reported her delight at her first opportunity to work with computers and to include them in her teaching. After a crash course with the technician who delivered the Macintosh SE to her school, she was able to get started and keep learning, with the aid of the user's manual. By then, plenty

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1 Solveig Eriksson, "Datorn på mellanstadiet," *Datorn i utbildningen* 1 (1989): 54.

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had happened at a national and regional level regarding pilot projects and national initiatives. However, computers were still far from ubiquitous in Swedish schools, and while teachers showed a varied range of attitudes towards computers, from enthusiasm to scepticism, most were certain that computers were on their way into classrooms.

In the early 1970s, few people had had any contact with computers, mostly researchers and workers in some industries, but by the early 1980s, many felt that computers were going to transform society. A researcher on employment questions claimed, in 1981, that "[computer technology] will affect us in all of our roles, as consumers, as producers and as workers […] during our free time, at home, […] [and] it will change our way to think and create new meanings".[2] The main difference between computer technology and other technological changes that had affected Swedish industry was that this had the potential to transform all sectors of the economy, including the service sector. A healthy way to deal with the risks of computerization was, in his view, to steer computer development through state policy which included educational measures.[3] Thus, in the early 1970s, most of the population, not least teachers, had never touched a computer, by the 1980s, it seemed clear that schools needed to train computer users and teach pupils how to live in a computerized society.

Teachers had a key role in discussions about and the implementation of computer technology in schools. Although use of computers in schools was very limited during the 1970s, interested teachers started conducting trials in their schools using their scarce resources. Others found ways to circumvent or postpone use of computers in their teaching, even when they were urged to incorporate them. The general process of introduction of computers into schools depended largely on the actions (or lack of action) of teachers, and their interactions with other actors and the computer devices themselves.

In this chapter, I explore the role of teachers in the introduction of computers into classrooms in Swedish lower secondary and upper secondary schools in the early stages. The period covered in this study is from ca. 1970 to the end of the 1980s, the years in which the first pilot projects and state-sponsored initiatives were developed and implemented. I am interested in capturing the actions of the first proponents of computer education, the first demands teachers faced and their responses. To this end, I will outline school projects and local trials as well as governmental initiatives and pilot programmes for the integration of com-

2 Nils Unga, "Tar datorn bort jobben?" in *Tar datorn bort jobben?*, ed. Lasse Svanberg (Östervåla: Forskningsrådsnämnden and Styrelse för teknisk Utveckling, 1981), 4.
3 Unga, "Tar datorn bort," 13.

puters into the classroom, exploring the role of teachers and the intended aims under discussion regarding the use of computers.

The sources used in this study include the following: official reports on computer education initiatives; evaluations and reports emanating from or ordered by government agencies; official memos; archival material from some of the initiatives; material from teachers' journals and newspaper articles; and literature on the introduction of computers into lower secondary and upper secondary education, providing a historical and an educational perspective.

While there was a variety of actors involved in this process, such as politicians, the business sector, school managers and pupils themselves, I have chosen to focus on the views and actions of teachers as they constituted the group on which implementation of computer education was expected to rely. This chapter is inspired by sociologist Bruno Latour's model of translation,[4] which sees actors not as groups who either exert, follow, or resist power, but as people who may act in different ways in a particular situation, depending on the context and their relationship with other actors and objects. Teachers, in this line of reasoning, could react in different ways to the use of computers in schools: they could resist, modify, deflect, or appropriate the process. This view also allows teachers to be visible as the heterogeneous group that I claim they were, and observe the variety of practices they engaged in.

Computers in Education in the Public Debate

Public debate on the effects of new technologies on democratic society was sparked by early adoption of computerized systems by the Swedish state. In 1955, the government decided to rationalize state administration with the use of new technologies,[5] leading to the computerization of population statistics in the 1960s. This gave rise to a general debate on questions of integrity.[6] Many believed that computers would impoverish work tasks and become government tools to control the population. Critics of the use of computer technology by central government to gather information demanded strict and clear legislation to avoid abuse

4 Bruno Latour, "The powers of association," in *Power, Action and Belief: a new Sociology of Knowledge?*, ed. John Law (London and Boston: Routledge & Kegan Paul, 1986), 266–269.
5 Magnus Johansson, "Smart, Fast and Beautiful. On Rhetoric of Technology and Computing Discourse in Sweden 1955–1995" (PhD diss., Linköping University, 1997), 31.
6 Sten Henriksson, "When Computers Became of Interest in Politics," in *History of Nordic Computing*, ed. Janis Bubenko, John Impagliazzo, and Arne Sølvber (New York: Springer, 2005), 418.

of power and integrity violation.[7] However, the education of citizens was also brought up as a solution.

During the 1960s and 1970s, the state promoted ICT development through the support of industry and education.[8] The Swedish government saw computer instruction as a necessity in order to cope with the effects of new technologies in the labour market, which was then embodied in a variety of initiatives and measures proposed in education in the coming years.

Critics argued that despite the dangers of computer technology, Swedish industry needed it in order to avoid being outcompeted by other countries. Hence, simply disregarding the need to learn about computers was not an option.[9] Education could help citizens make the right demands in relation to technology, and therefore, the role of schools was vital.[10] In this case, the argument centred on learning about computers in school and the importance of information.

Another angle in the debate was the role of computers in the teaching of different subjects. A positive argument was that these devices could take over the more concrete and boring parts of teaching from teachers and free them up for the important ones: placing the subject in context, making generalizations, and drawing conclusions.[11] However, on the question of transforming education with computers, distrust was patent. A liberal member of the Swedish parliament wrote in 1975 that the experiences of places like the United States, where computers had been introduced in some schools, showed that computer technology could be of benefit for vulnerable communities and low achievers, as well as the most privileged and high achievers, but it was not clear whether it would benefit all pupils and be worth the high level of investment required. By accentuating differences in achievement, the strategy could go against the highly democratic principles on which Swedish schooling was based.[12] Moreover, teachers were worried about a loss of autonomy in the classroom. The idea of using computers in teaching often brought about the fear of being replaced.

7 See analysis of the integrity debate in the 1970s in Åsa Söderlind, "Personlig integritet som informationspolitik" (PhD diss., Borås College and Gothenburg University, 2009), 158–212.

8 Lars Ilshammar, "Offentlighetens nya rum: teknik och politik i Sverige 1969–1999" (PhD Diss., Örebro University, 2002), 70–71.

9 Jacob Palme, "Before the Internet: Early Experiences of Computer Mediated Communication," in *History of Nordic Computing 3*, ed. John Impagliazzo, Per Lundin, and Benkt Wangler (Berlin/Heidelberg: Springer, 2011), 271–272.

10 Jacob Palme, "Datorer i dagens och morgondagens samhälle," *Nämnaren*, Special issue on Computers 1 (1976): 1–5.

11 Börje Langefors, ed., *Datorn och du* (Uppsala: Scientia Brombergs, 1979), 96.

12 Kerstin Anér, *Datamakt* (Stockholm: Gummesson, 1975), 60–65.

However, the idea that came to form the basis of the state strategy to introduce computers into schools in Sweden was that all citizens needed to become familiar with computer technology as a prerequisite for democracy and working life.

First Investigations and School Trials

The earliest investigations of the use of computer technology in Swedish education took place in the 1960s. A Swedish delegation, the CAI group (*Computer Assisted Instruction*) travelled to the United States to study, first-hand, projects such as the Plato system at the University of Illinois. The group released a report in 1966, in which it proposed initiatives to adapt CAI for Swedish schools. The report stated that the implementation of CAI could lead to higher quality and lower costs in education through, for instance, the substitution of teachers.[13] This report formed the basis of a governmental proposal suggesting use of radio, television, and CAI as possible measures to deal with the lack of trained teachers that schools were then experiencing.[14]

The idea of rationalizing schools came from the central government and could be regarded both as part of the development taking place in industry and administration and as a response to the scarcity of trained teachers. In his book *Rationalise School!* (*Rationalisera skolan!*), Commissioner of the *National Board of Education* (NBE) (*Skolöverstyrelsen*) Mats Hultin argued that the problems brought about by growth of the school system could be solved using computers and television in school administration and teaching.[15] Hence, one of the first arguments on the use of computers in schools was related to changing pedagogical practices and rationalizing education. There are no signs of this approach having been backed up by teachers or schools, and, as I will show later, the first formal state projects did not follow this line.

Before the 1980s, computer instruction was limited to upper secondary schools. Few schools had access to equipment then, and in some cases, schools with connections to local industry relied on these to access computers. For example, an upper secondary school in Västerås, which had ties with the electrical en-

13 *Government proposition regarding measures within the area of adult education 1967/85*, 47, 54. https://data.riksdagen.se/dokument/ES3085.

14 *Proposition 1967/85*, 9, 36, 47.

15 Lennart Sturesson, *TV som undervisningsteknologi – Exemplet Linköpings tekniska högskola* (Malmö: Stiftelsen Etermedierna i Sverige, 2005), 58.

gineering company ASEA, was the first in the country to set up a computer laboratory to support its teaching.[16]

At this point, computer instruction was primarily technical, dealing with questions of programming and the functioning of computers. Systematic training in computing had not yet been established, and very few teachers were qualified to teach it. Some schools started trials, responding to the interest of teachers or school managers, using their own resources.[17]

In a school in Karlshamn, mathematics teacher Kenneth Borg, who had taken an evening course in the early 1970s, drove the initiative to firstly hire and then buy a minicomputer financed by the municipality. He, and other subject teachers, visited *Sunnerboskolan* to learn from this school's experiences and afterwards organized training for 10 teachers in BASIC programming.[18] Some schools offered training for their staff, including social science teachers, with the help of training consultants. These consultants faced different attitudes from the participants. One of them noted that teachers would normally start the course expressing thatcomputers did not concern them. But after his introductory lecture, *The computer and the people*, he recalled attendees would become enthusiastic and accept that computers were relevant for them, not only as teachers but also as citizens.[19] Teachers also shared knowledge in forums like the meetings held by mathematics and natural sciences teacher associations, where modules on programming were organized.[20]

At this point in time, it was mathematics and natural science teachers who had the monopoly on computer instruction and shared their experiences among them. At these courses and conferences, technical knowledge as well as views on what computers meant for education were disseminated among teaching colleagues by the few initiated ones, albeit on a small scale.

In the 1970s, the question of computers in schools was also discussed in forums that involved a broader group of teachers. At the *Education Days* event, organized by the *Swedish Confederation of Professional Employees* (TCO), the question of tech-

16 "Dator i undervisningen vid Västeråsgymnasium," *Dagens Nyheter*, January 21, 1970, 16.

17 Lennart Rolandsson, "Teacher Pioneers in the Introduction of Computing Technology in the Swedish Upper Secondary School," in *History of Nordic Computing 3*, ed. John Impagliazzo, Per Lundin, and Benkt Wangler (Berlin/Heidelberg: Springer, 2011), 162.

18 Kenneth Borg, "Några terminer med en minidator," *Nämnaren*, Special issue on Computers 1 (1976): 122–124.

19 Lennart Eliasson, "Kullor, masar och datorer. Hur det gick!," *Nämnaren*, Special issue on Computers 1 (1976): 48–49.

20 Harry Lindholm, *Föreningarna för Matematisk-naturvetenskaplig undervisning: Fortbildning och skolpolitik 1933–1971* (Uppsala: Förening för svensk undervisningshistoria, 1991), 182–183.

nical tools in schools dominated the programme. Several speakers at this event stressed that technological tools would not replace teachers. A social democrat minister proposed research investment to prepare people for the drastic changes to come. Politicians and TCO representatives agreed that research in humanities and social sciences should be promoted to catch up with technical development.[21]

The message from the upper echelons of educational politics seemed unified on the need for investment in computer technology for schools. However, in a teaching magazine, one concerned teacher advised against seeing investment in educational technology as more profitable than investment in human resources. He stated that school should not be a super technological intelligence industry; rather, human aspects needed to take primacy.[22]

In the 1960s and 1970s, there was a clear divide between enthusiastic teachers who sought training on their own, pushed for equipment purchases and implemented computing courses in their schools, and sceptics who warned about the risks of introducing computers into schools without the necessary knowledge; the latter being the majority and the former subsequently becoming active participants in the design and implementation of state initiatives.

Translating Practical Knowledge into Pilot Projects and First Government-Funded Initiatives

Some schools have become iconic in the history of computer education in Sweden due to their early attempts to offer computer instruction, such as upper secondary schools *Sunnerboskolan* in the municipality of Ljungby, and *Berzeliusskolan*, located in Linköping. Rolf Nilsson and Bo Loftrup worked in the former as mathematics and technology teachers. Both had studied engineering and mathematics at university, and Nilsson had also worked in industry and used computers there. Lars-Eric Björk, another *Sunnerboskolan* teacher, had a background in social sciences and was interested in the consequences of computerization for social development.[23]

21 "Tekniska hjälpmedel ersätter inte lärare," *Lärartidning/Svensk Skoltidning* 46 (1970): 24–25; "Forskning måste också handla om människor," *Lärartidning/Svensk Skoltidning* 46 (1970): 24–26.
22 Stefan Svedberg, "Skolan får inte bli en superteknologisk intelligensindustri," *Lärartidningen/Skoltidning* 44 (1973): 24–25.
23 Bo Loftrup and Rolf Nilsson, "Intervju 104. Från matematikmaskin till IT," interview by Martin Emanuel, July 18, 2008, transcript, 17, https://wwwtekniskamusee.cdn.triggerfish.cloud/uploads/2017/08/104-rolf-nilsson-och-bo-loftrup.pdf.

They all proposed computing teaching in their school and, with the aid of the school budget, grants from the NBE and donations, obtained some equipment.

Berzeliusskolan started to offer computer instruction from the late 1960s, pushed by the head of the school, Peter Fagerström. Some of the school staff had connections with industries such as DataSaab.[24] Saab's management in Linköping promoted computer education early on in schools. According to the vice-CEO of Saab-Univac, society needed to take responsibility for educating pupils in computing as this would be the basis of future development. He also recognized the work of industry and computing associations in Sweden to put a greater focus on computer education in schools.[25]

When in 1971 the *Ministry of Education* assigned the NBE the task of surveying the possibilities for using computers in schools, the first national project took place.[26] This project was not centrally run but was located in Linköping, where expertise in this matter already existed.

In 1973, the project *Computers in the School Municipality* (DISK) (*Datorn i Skolkommunen*) began in Linköping, led by Peter Fagerström. Its aim was to investigate the possibilities for computerizing school administration and teaching.[27] The DISK report served as a basis for the NBE's strategy, which was to implement computing in different subjects, as quickly as possible, at the same time as experimental work would help establish best practices.[28] Lars-Eric Björk, Bo Loftrup and Rolf Nilsson collaborated on the DISK report, thanks to the contacts that the former had with the NBE, particularly through the teacher training activities in which he had been involved. The DISK report stated that computing should not be taught as a subject on its own. Rather, computers should be used to enhance and facilitate learning in other subjects. Natural sciences and mathematics were subjects in which use of computers could be successfully adapted and could even transform teaching and learning.[29] These subjects were those in which they all had first-hand experience.

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24 Lennart Rolandsson, "Changing Computer Programming Education. The Dinosaur that Survived in School," (Licentiate thesis, KTH Stockholm, 2012), 32.

25 "Datorer är ett krav för Saabs produkter," *Svenska Dagbladet*, September 24, 1979.

26 Anita Kollerbaur, "Intervju 133. Från matematikmaskin till IT," interview by Martin Emanuel, September 17, 2008, transcript, 8, https://wwwtekniskamusee.cdn.triggerfish.cloud/uploads/2017/08/133-anita-kollerbaur-2.pdf.

27 Martin Emanuel, "Datorn i skolan: Skolöverstyrelsens och andra aktörers insatser, 1970 and 80-tal: Transcript of a witness seminar," Stockholm, October 30, 2008, 8, http://urn.kb.se/resolve?urn=urn:nbn:se:kth:diva-10287.

28 Rolandsson, "Teacher Pioneers," 163.

29 Rolandsson, "Changing Computing," 31; Lennart Rolandsson and Inga-Britta Skogh, "Programming in School: Look Back to Move Forward," *ACM Transactions on Computing Education* 14, 2 (2014): 12, https://doi.org/10.1145/2602487.

The conference *Computers as a Tool in Education* took place in 1973 aimed at creating a forum to promote contact between pedagogues and technology professionals, and to spread activities and experience in this area. The Minister of Education, Ingvar Carlsson, presented the government approach: the aim of bringing computers into education was not to use them as tools to transmit knowledge, but to bring pupils closer to new technologies and help them lose their fear of them. Anita Kollerbaur, representing the national initiatives, assured teachers that the Swedish strategy was about using computers as a complement to their work and not to serve as a substitute.[30] Professor Donald Blitzer, from the University of Illinois, talked about the PLATO system at the conference. Although his contribution was received with great interest, a researcher from the Karolinska Institute argued that such a system might not immediately be accepted in Sweden because there was a plentiful supply of teachers.[31] Teachers also participated in this conference, such as Rolf Nilsson, who presented practical examples of the use of calculators in mathematics teaching. While this event functioned as a stage for initiated teachers to promote their practices and form contacts with like-minded colleagues and professionals, it also addressed the fears and anxieties of the hesitant ones.

In 1972, as a result of the task assigned to the NBE to survey the introduction of computers into schools, an internal investigation was launched, followed by the pilot project *Computers in Schools* (DIS) (*Datorn i skolan*), which operated from 1973 to 1980. According to Anita Kollerbaur, the work of Lars-Erik Björk at *Sunnerboskolan* influenced the work of DIS.[32] Several subgroups were created within DIS. One of these investigated how computers could be used in subjects such as mathematics, physics, and economics, as well as in construction and electrical technologies. The group leaders were the teachers who had been active in their schools in places like Ljungby and Gothenburg.[33] Another group was established in 1975 to examine equipment-related questions and formulate specifications for equipment purchases for schools. In 1974, the informatics teachers subgroup was created to outline modules for a computing subject (*datalära*) in the 8th and 9th grades in lower secondary schools and the informatics subject in upper secondary schools (*datakunskap*) for both mathematics and social sciences. Lars Bolander, a former lower secondary, upper secondary, and higher education teacher, who had started

30 Bo Estmer, “Utbildningsministern: Datatekniken bör läras ut i skolan,” *Dagens Nyheter*, October 3, 1973.
31 Rolf Bergin, “Datorundervisning mot total kontroll?,” *Svenska Dagbladet*, November 14, 1973.
32 Anita Kollerbaur, “IT for learning: A need for a New Approach?,” in *History of Nordic Computing*, ed. Janis Bubenko, John Impagliazzo, and Arne Sølvber (New York: Springer, 2005), 225.
33 *Datorn i Skolan: SÖ:s handlingsprogram och slutrapport*, SÖ-projekt 628 (Stockholm: Skolöverstyrelsen, 1980), 23–24.

working with computers in education since 1968, was involved in outlining these courses.[34] The working group proposed a syllabus in 1975 which included basic knowledge of how computers work, the basics of information processing, the uses of computers in society, and the ability of individuals and institutions to influence development of a computerized society.[35]

In the first stages of the DIS project, the course content was not clearly detailed because the idea was that teachers participating in the pilot projects would contribute to defining the contents. A mathematics teacher, for instance, promoted among his colleagues the inclusion of programming in the mathematics curriculum. He argued that teaching programming as a tool to solve problems could help develop a healthy attitude towards computers.[36] Computer science professor Börje Langefors added that basic programming could be simple to learn through dialogue-oriented systems, which would find a natural place in mathematics courses in the modern school.[37] But although some teachers were convinced that programming was necessary, variations in the content of teaching occurred, reflecting schools' situations and needs.

The DIS project's final report was adopted as the first action plan of the NBE in the area of computers in schools. The action plan formulated a threefold target for computer education in lower secondary schools: computer education should "give pupils knowledge so that they want to, dare to, and are able to take a position regarding computers and the use of computers in society".[38] The final report also mentioned that access to computer equipment was not a requirement in lower secondary schools. In order to support municipalities and schools in purchasing computer equipment, the DIS group suggested centrally formulated specifications, recommendations, and state grants.[39]

The DIS group recommended continuous renewal of computer use according to changes in the use of computers in society and school. To support this aim, the action plan proposed the following: teacher training; changes in teacher education; access in upper secondary schools to computer equipment and software

34 Emanuel, "Datorn i skolan," 11.

35 Anita Kollerbaur, "Datorn i skolan – DIS projektet," *Nämnaren*, Special issue on Computers 1 (1976): 19–20.

36 Håkan Söderström, "Dumma data! … eller Hur människan åter kan bli herre över maskinen," *Nämnaren*, Special issue on Computers 1 (1976): 8–9.

37 Börje Langefors, "Datorer och skolan," *Nämnaren*, Special issue on Computers 1 (1976): 15.

38 *Datorn i skolan: SÖ:s handingsprogram*, 2.

39 *Datorn i skolan: SÖ:s handingsprogram*, 6.

through state grants; special resources for schools to help them organize their activities; and continuation of the work on creating course syllabuses and material.[40]

Although DIS concluded that the computing subject should include only basic notions of programming and the functioning of computers and emphasize the effects of computerization in society and work, there was an ongoing debate on the importance of programming, steered by mathematics and natural science teachers, which was often mirrored in the teaching that took place in many schools and in broader teacher training.

Early Teacher Training

During the school year 1975/76, the contents of the computing courses for lower and upper secondary schools were the same. The DIS group organized teacher training for both levels starting in the summer of 1975. Publishers of teaching materials created resources, some of which were used and evaluated during the project.[41]

Teacher training in computing was scarce at this time, and to tackle this problem, Lars-Erik Björk recommended that readers of the mathematics teaching journal *Nämnaren* exhaustively read the journal's articles on computing and start working on a computer with an initiated guide.[42] In addition to the NBE's summer courses, adult education and higher education institutions offered teacher training in computing.

Bengt Nilsson, who was in the Gothenburg County teacher training department in the mid-1970s, remembers that several teachers, especially those of natural sciences, were very interested in computers. For his training, Nilsson borrowed minicomputers from companies to demonstrate simple programming and invited dedicated guests and researchers as speakers to talk about the importance and future of computers. According to Nilsson, after the introductory courses, teachers expressed the desire to gain even more programming knowledge. Natural science and physics teachers showed such a high interest in programming that it almost became the main goal of the computing lessons. These teachers complained

40 *Datorn i skolan: SÖ:s handingsprogram*, III–IV.

41 Kollerbaur, "Datorn i skolan," 21–22.

42 Allan Henriksson, "Några frågor om datorer och fortbildning," *Nämnaren*, Special issue on Computers 1 (1976): 38–39.

about modules that dealt with the social aspects of the computer society and wanted this knowledge to be directed towards social science teachers instead.[43]

The DIS report recommended that training be arranged in such a way that the teachers concerned would be able to influence the form and implementation of courses and take a leave of absence to attend training.[44] However, in practice, teachers had restricted influence on their training. In 1982, the demand was greater than the offer. In the Stockholm region alone, 965 teachers were on a waiting list for spring courses; there were only funds available for 20 to 30 teachers. A training consultant noted that technology was developing extremely rapidly, and the teacher training they were about to carry out already required an update.[45]

In a teachers' union magazine article, Anita Kollerbaur (who was involved in development of the DIS summer courses and led training for lower secondary teachers at Stockholm university) addressed the concerns of many teachers she had met and stated that no programming knowledge was necessary to teach computing. Computing in lower secondary education, she affirmed, was mainly about the use of computers in society.[46] The scope of DIS remained limited throughout the duration of the project, reaching merely 450 teachers and 8000 pupils.[47]

Feedback on training showed that mathematics and natural science teachers often acted as translators of computer knowledge, and transmitted the experience they had acquired through formal training and through their own practice. They had been involved with computers previously in their own schools and in their work outside schools, and they were considered by educational authorities and teaching colleagues as specialists in translating computer technology into classroom practice.

43 Bengt Nilsson, "Intervju 135. Från matematikmaskin till IT," interview by Martin Emanuel, December 5, 2008, transcript, 9, https://wwwtekniskamusee.cdn.triggerfish.cloud/uploads/2017/08/135-bengt-nilsson.pdf.

44 *Datorn i skolan: SÖ:s handingsprogram*, 5.

45 Anita Rooth, "På väg in i dataåldern? Skolfolk och dataexperter diskuterar datorns roll i skolan," *Lärartidningen/Svensk Skoltidning* 11 (1982): 2–4.

46 Anita Rooth, "Hur många fick en dator av tomten i julas?," *Lärartidningen/Svensk Skoltidning* 3 (1983): 17–18.

47 *Digitaliseringen i skolan – dess påverkan på kvalitet, likvärdighet och resultat i utbildningen*, Parliament report (Stockholm: Riksdagstryckeriet, 2016), 2015/16: RFR18, 67.

PRINCESS and PRODIS Focus on Pedagogy and Computer Equipment

The PRINCESS (*Project for Research on Interactive Computer-Based Education SystemS*) (1973–1983) and PRODIS (*Software and Computer Equipment for Computers in Schools*) (1979–1981) initiatives were carried out in parallel with the DIS project. PRINCESS was a research and development project on use of computers as teaching aids in education, based at the *Department of Automatic Data Processing* (ADP) at Stockholm University.[48] The aim of the PRINCESS project was to improve education using computer aids, developed in an interdisciplinary fashion, involving pedagogues in system development.[49]

Bengt Nilsson, who was partly responsible for the administration of teacher training in computing, recalls that his attitude and that of other mathematics teachers towards PRINCESS was critical because they considered its objectives to be too ambitious for the times. Mathematics teachers wanted to learn and teach basic programming, while the research project was using more advanced methods to integrate computers in schools. The lack of acceptance might, at least partly, have been a matter of gender, considering that a predominantly male teaching staff would be receiving input from a female research director. Nilsson affirmed: "She [Kollerbaur] was a woman and quite combative. This [meant] that she [encountered] antagonists in the natural sciences ranks, those who wanted to bring out these more math-oriented elements [in computing teaching]".[50] While it is not possible with the sources available to analyse the effects of gender structures in the teaching body, teacher training, and the development of computing as a subject in schools, there appears to have been a masculine culture which would be worth investigating further.

The PRINCESS group concluded that computers could improve learning by allowing students to gain knowledge from performing meaningful activities in a way that satisfied their individual needs. Moreover, the project's final report stressed the role of the user in hard- and software development. These results convinced the NBE to fund courseware development, and the Board for Technical Development (STU) to initiate a procurement project to build a school computer.[51]

48 Kollerbaur, "IT for learning," 224; Martin Emanuel, "Folkbildning kring datorn 1978–85, Transcript of a witness seminar," Stockholm, October 9, 2008, 22, http://kth.diva-portal.org/smash/record.jsf?pid=diva2%3A214187&dswid=8485.

49 Kollerbaur, "IT for learning," 225.

50 Nilsson, interview, 14.

51 Kollerbaur, "IT for learning," 233–234.

The PRODIS group was formed by members of the DIS subgroup on computer equipment questions, some of whom also held (between 1975 and 1985) teacher training courses every summer. Part of the work of PRODIS was to find and create software that could be useful for different subjects. Teachers were encouraged to send their self-made programs to the PRODIS group for distribution, but nobody did. Instead, the PRODIS members created software and published a booklet[52] with lists of programs for different subjects.[53]

Except for PRINCESS, most pilot projects and national initiatives were primarily led and supported by teachers who had had early experience of computers in schools. They translated schools' needs and helped set the NBE's agenda. They were able to merge the government guidelines that stressed computer literacy for pupils with their interests in programming and use of computers, to transform teaching in certain subjects through their practical work in teacher training, creation of teaching materials and their work outlining specifications for hardware and software purchases. However, throughout the course of these projects, the participation of teachers was limited. Many felt excluded or apathetic regarding the use of computers in their teaching practice. Two important changes came about in the 1980s that broadened the scope of teacher participation: the curriculum reform for lower secondary schools and, to a larger extent, the three-year campaigns that funded the purchase of computer equipment on a broader scale.

Computing in Lower Secondary and Upper Secondary Schools

The curriculum reform for compulsory education (Lgr80) introduced computing as a central module in mathematics and as a topic in social sciences in the senior years of compulsory education, from 1982 onwards. This module consisted of basic programming and computer technology knowledge.[54] The idea was for all pupils to have an opportunity to become familiarized with the workings of computers.[55]

52 Rolf Nilsson, ed., *Programvara i datalära* (Stockholm: LiberLäromedel/Utbildningsförl., 1980).
53 Emanuel, "Datorn i skolan," 30–31.
54 Ulla Riis, *IT i skolan mellan vision och praktik – En forskningsöversikt* (Stockholm: Skolverket, 2000).
55 Jörgen Nissen and Ulla Riis, *Datalära på grundskolans högstadium: en ögonblicksbild från tre kommuner och sex skolor vintern 1984/85.* Report Ds C 1985:15 (Stockholm: Liber/Almänna förlag, 1985).

However, this change did not lead to immediate and pervasive computing teaching practice in all Swedish schools, which can be explained partly by the process of decentralization of Swedish schools, which started in the 1970s.[56] Nevertheless, the reform laid the basis for subsequent initiatives and programmes to expand and implement computer education.

Teachers' engagement in computer instruction was considered crucial at the upper levels. The NBE's general director, Birgitta Ulvhammar, argued that teachers should be a bridge between the suspicious and ignorant older generation and the new computer-savvy generation.[57]However, computers were a source of anxiety for many. Computers changed established teaching situations and challenged the status of teachers as pupils in many schools knew more about the workings of computers than their teachers.[58]

Municipalities had different strategies and levels of prioritization. While some municipalities aimed to offer computer instruction from the lower levels of mandatory education, others focused on higher level programming, and others were interested in stressing democratic values in their teaching. Teacher training strategies also varied, from sending teachers on advanced courses at the university to touring computer-equipped buses.[59] Despite the reform, however, scepticism was still latent, and most schools lacked equipment, which made the endeavour impracticable.

An orientation towards computing as well as programming had been offered in upper secondary education since the 1960s. However, to give computer instruction more time and depth in all tracks, upper secondary schools received a state grant for the purchase of computer equipment in 1981.[60] In 1983, the NBE developed a syllabus for computer science within the natural sciences programme, in the computing track. The curriculum was highly detailed, in order to give teachers clear guidelines to plan their teaching. It also led to an urgent need for training for

56 Carl-Henrik Adolfsson and Daniel Alvunger, "Power dynamics and policy actions in the changing landscape of local school governance," *Nordic Journal of Studies in Educational Policy* 6/2 (2020).
57 "Nya lär oplanen ger möjlighet för en skola som vill lyckas," *Lärartidning/Svensk Skoltidning* 11 (1980): 38.
58 Gunilla Jedeskog, "Lärare och IT," *Human IT Tidskrift för studier ur ett humanvetenskapligt perspektiv* 4 (1998): 5.
59 Anita Rooth, "Här har lärarna datautbildningen in på knuten," *Lärartidningen/Svensk Skoltidning* 29 (1985): 31; Anita Rooth, "Gymnasieelever gör program åt barnen på lågstadiet," *Lärartidningen/ Svensk Skoltidning* 8 (1985): 20–21; Anita Rooth, "Datorn i Skolan- Temanummer om datorer, lärare och elever," *Nämnaren* 4 (1982–1983): 66.
60 Regeringens skrivelse Skr. 1984/85:218, *Med redovisning av vissa planerade åtgärder för att effektivisera statens insatser inom informationsteknologiområdet*, 30.

mathematics teachers.[61] Upper secondary schools and municipalities tried a variety of training strategies, although many required more advanced training in information processing, programming techniques, numerical methods, and systemization[62] which was offered at universities and colleges. Social science teachers were generally less involved, even though some schools stressed questions of integrity and the social effects of computerization.[63]

Teachers' Unions

In 1983, the *Swedish Teachers Association* (SL) decided to monitor the development of computer technology in education. While it recognized that the question of computers in schools had been the responsibility of a few enthusiasts, with the new curriculum change and the computerization of society, it was necessary for them to act centrally and involve a larger number of teachers.

The SL was concerned with the development of teaching forms that promoted pupil involvement in computer learning, increased gender equality in technical subjects, and help for pupils with learning difficulties.[64]

In the early 1980s, a third of schools (primary, upper secondary, and municipal adult education) were not providing computer instruction. By the summer of 1983 there were 3000 computer workstations in primary schools and 5000 in upper secondary schools. On average, there were five workstations per primary school and 20 per upper secondary school, among the schools that offered computer instruction.[65]

Against the backdrop of this situation, the SL presented its computer policy programme in 1984. The SL demanded that computers be used only when better pedagogical results could be ensured; that all teachers and school administrators were offered training; and that computer equipment be made available in all schools.[66] Inclusion of all teachers in computer education turned out to be unfea-

61 Rolandsson, "Teacher Pioneers," 164.
62 Bertil Lind, "Datateknik – variant på N-linjen," *Nämnaren* 2 (81–82): 57–58.
63 "Vi vill krossa myten att det är svårt att hantera en dator," *Lärartidningen/Svensk Skoltidning*, 3 (1983): 34–38.
64 Lars Emanuelsson, "SL: Datafrågor ger förbundet ett nytt bevakningsområde," *Lärartidningen/Svensk Skoltidning* 3 (1983): 24; Hans Hamber, "SÖ: – År 2000 finns säkert en dator i varje klassrum," *Lärartidningen/Svensk Skoltidning* 3 (1983): 26.
65 SOU 1985:50, Datadelegationen, *Bred datautbildning*, 36.
66 Anita Rooth, "Nu presenterar SL ett datapolitiskt program för skolområdet," *Lärartidningen/Svensk Skoltidning* 8 (1984): 10–13.

sible due to a lack of material resources (equipment, teaching materials, and teacher training funds) and the disinterest of many teachers.

A couple of years after the introduction of the computing subject in lower and upper secondary schools, teachers were concerned about the development. Up until then, the role of mathematics and natural science teachers had been dominant, even though the syllabus included the social consequences of computerization and awareness of the uses, risks, and benefits of computers in society. As an attempt to broaden teacher participation and increase schools' access to equipment, stimulus grants were distributed with the three-year campaigns of the 1980s.

Access to Computers – The Three-year Campaigns

In 1984, the second action plan for computers in school, *Education Facing the Computer Society*,[67] was released. This plan acknowledged the need for computer equipment and established a goal of 80 hours of computer instruction during the three years of lower secondary education.[68] In order to achieve this, the *Three-Year Campaign in Computing* (*Treårssatsningen på datalära*) (1984–1987) was launched. This campaign provided lower secondary schools with a stimulus grant of 20 million kronor per year to equip one computer room with eight computers in a local network.[69] Schools were required to present a teaching plan; to have at least one staff member trained in automatic data processing; to purchase NBE-approved equipment; and the municipality should contribute the same amount.[70] One year after the start, participating schools still had a long way to go in terms of achieving the set goals. The schools that were farthest ahead had one or two interested teachers (usually from the natural sciences) who had driven the development. In most cases, computing instruction was limited, and teachers were dissatisfied with the possibilities for undergoing training and the equipment available.[71] Computer instruction and use of computers in schools were very far from meeting the expectations of policymakers.

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67 *Utbildningen inför datasamhället: utgångspunkter och inriktning* (Stockholm: Skolöverstyrelsen, 1984).

68 Anders Söderlund, "Det långa mötet IT och skolan: om spridning och anammande av IT i den svenska skolan" (PhD Diss., Umeå University, 2000), 76.

69 Ulla Riis, "Skolans datorisering under 1980- och 90-talen," in *IT i skolan mellan vision och praktik*, ed. Ulla Riis (Stockholm: Skolverket, 2000), 10–11.

70 Nissen and Riis, *Datalära.*

71 Nissen and Riis, *Datalära.*

In 1985, in parallel with the *Three-Year Campaign in Computing*, two groups were established within the *Ministry of Education:* the *Informatics Education Group* (DUG) (*Datautbildningsgruppen*) and the *Educational Software Group* (DPG) (*Dataprogramgruppen*). The DUG was in charge of developing an action plan for the future of computer education at all levels, which was completed in 1986.[72] The DUG's report proposed to revise the content of the computing subject, with the aim of deepening pupils' knowledge gained in lower secondary school and assessing the appropriate soft- and hardware needs to meet their curriculum ambitions.[73] While this group was part of a higher level political structure, there were also members who had closer contact with schools, such as Lars Bolander.[74] Bolander argued, in retrospect, that the ambition of the government to bring computers to schools was limited by the available funds, the state of software at that moment and the lack of interest of most teachers.[75] The report that resulted from this group's work was the basis of subsequent measures and programmes, such as the *Computer as a Pedagogical Tool* project (DOS).

The DPG, active from 1985 to 1988, was led by a director of the *Ministry of Education*; former teachers Lars Bolander and Göran Nydahl were also members of the group. The aim of the DPG was to establish criteria for appropriate educational software and to create software suited to different subjects in lower secondary and upper secondary education. This group was relocated in 1988 to the NBE to work within the framework of the DOS project.[76]

The Swedish parliament established another three-year campaign, called the *Computer as a Pedagogical Tool – The Computer and the School* (DOS) (*Datorn som pedagogiskt hjälpmedel- Datorn och skolan*) in the period 1988–1991. This initiative, led by former teacher Leif Davidsson, included curricular development, educational software production, and evaluation of computer hard- and software.[77] The project aimed to promote use of computers as pedagogical aids in vocational tracks for occupations in which computers were present, as aids for pupils with a disability or learning difficulty and to facilitate individual learning.[78] This project

72 Ds U 1986:10, Datautbildningsgruppen, *Handlingsprogram för datautbildning i skola, vuxenutbildning och lärarutbildning.*

73 Rolandsson and Skogh, *Programming,* 17.

74 Emanuel, "Datorn i Skolan," 11.

75 Emanuel, "Folkbildning," 22.

76 Söderlund, "Det långa mötet," 82–83.

77 Leif Davisson, *Verksamhetsplan för projektet Datorn och Skolan- DOS-projektet*, 75–88:210 P. 1989–03–22. Skolöverstyrelsen V-avd/ KOMVUX och GRUNDVUX Datorn och skolan/DOS-verksamheten F2: 1. National Archives of Sweden.

78 Ulla Riis, *Skolan och datorn: satsningen Datorn som pedagogiskt hjälpmedel 1988–1991* (Linköping: Linköping University, 1991), 10–11.

was once again of a pilot character and did not encompass all Swedish schools. Schools of all levels could apply for funds, which were distributed to a total of 160 local projects. In practice, language teachers were the most frequent users and they simply applied commercial word processing programs. Little was accomplished regarding software for other school subjects, and when such software was created, it could seldom be diffused beyond its local creator.[79]

Some of the work on software development took place locally. The NBE's DPG gave the *Centre for Computer Pedagogy* in Gävle (GDPC), led by mathematics and physics teacher Örjan Broman, the task of developing pedagogical software according to the NBE's specifications. The DOS project ended rather abruptly when the NBE was replaced by the *Swedish National Agency for Education* (*Skolverket*) in 1991.

The DOS project was an attempt to broaden computer use to a wider variety of subjects and to engage a larger number of teachers and schools. The interest in software development responded to the need for more user-friendly programs, as many teachers had requested, but also to the further development of computer technology at the time. Unlike earlier projects in which programming knowledge was, in practice, a required skill for teachers, the DOS project focused more on the pedagogical needs of teachers and schools. While, according to school leaders, more teachers were interested in the projects, there were still many who were against the use of computers, arguing that pupils' social competencies could be at risk. At this time, many teachers who had fulfilled the role of computer expert and a driving force of school computerization were no longer active, and many had left for the IT industry.[80] However, in those schools who participated in the campaign, there were one or two enthusiastic teachers who led local projects. In most schools, the projects did not lead to the instituting of comprehensive and steady computer use, mainly because the great majority of teachers did not participate in such projects, even in schools where trials took place.

Concluding Discussion

In this chapter, I have presented a historical overview of the introduction of computers into lower secondary and upper secondary schools in Sweden. The projects discussed here were all trials focused on discovering and determining good practice.

79 Riis, *IT I skolan.*
80 Riis, *Skolan och datorn*, 57–58.

Although state initiatives and plans mandated computer education in Swedish schools (and budgets and personnel were allocated to support this aim), the role of teachers as agents of change was crucial. But teachers also acted as opponents, hindering the diffusion of computer use in schools.

With the help of Bruno Latour's model of translation, I have sought to uncover the framework around the introduction of computers in the classroom within which teachers have been a central actor. I have shown how the first attempts to use computers in education were initiated by teachers who brought computer devices to their workspaces and promoted teaching practices among their colleagues. The interest of these pioneering teachers matched centrally formulated political decisions. These teachers then became translators, their teacher peers and the educational authorities, when they were finally actively included in national projects.

I have shown the connections between so-called teacher enthusiasts and the authorities. Some names persisted as notable actors throughout the very early trials up to the 1980s campaigns, even though the aims and perspectives of computer education changed throughout the period.

But there is another side to the story often left untold. While sceptical teachers are often excluded from the narrative of computerization of Swedish schools, their views also help to explain the timing and development of the phenomenon. On the one hand, lack of action from their side prevented curriculum changes from being effectively implemented. On the other hand, critical stances gave rise to the engagement of, for example, teachers' unions and teacher training providers. Thus, when teachers encountered a computer (with guidelines on hand for teaching about computers, or the possibility of training in this area), their decisions and actions formed the path for what would become the Swedish experience of early computer education in Swedish schools.

Plenty changed in the 1990s, after the first pilot projects outlined here. One major change was the engagement of a significantly larger number of teachers in the endeavour. How and why this happened and which networks then became crucial are worthy questions for future research. I have, however, sought to provide a basis for understanding future developments in education in a country that, by the 1990s, was at the forefront of computer use.

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Carmen Flury

Joining Forces: The Promotion of Public-Private Partnerships to Bring Computers into West German Schools in the 1980s

Abstract: This chapter focuses on the dynamics and conflicts of interest that have emerged in the process of involving new actors in education policymaking to prepare West German schools for the digital age. In the 1980s, the federal government of West Germany saw the involvement of the private sector as a way to reduce the financial burden on the state in equipping schools with computers. Moreover, it considered the establishment of a public-private partnership under its auspices as a means to strengthen centralized state power within Germany's federal system in order to reduce regional disparities and differences in the efforts to integrate computers into schools. An intermediary actor in the form of the support association "Computers and Education" was brought into play to mediate between the interests of the private and the public sector. However, the association's efforts to reconcile the different vested interests of the involved parties in its mission to kickstart and boost the introduction of computers into public education eventually failed.

Keywords: West Germany; public-private partnership; computer industry; computer education; intermediary actors

The history of how computers entered the classroom is not just about innovative ideas, curricular reforms, and the use of new technologies in teaching and learning. First, it is a history of how tangible objects entered the classroom, that were to be used by teachers and pupils, the hardware that had to be advertised, selected, bought, paid for, installed, and put into use in schools. Such a history allows us, for example, to focus on how the process of equipping schools with computers enabled private actors to become involved in setting the stage for the introduction of com-

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puter education into schools. New constellations of actors from education policy, science, and the private sector emerged, each with different interests, demands and ideas. In particular, "intermediary" actors such as support associations, private foundations, and lobby groups increasingly gained influence on education policy programs,[1] for example by providing "expert knowledge" in education policy discourse or by financing and coordinating activities.[2]

In the mid-1980s, a joint effort by the private sector and the public school system was advocated as the allegedly only viable solution to address the financial challenge of equipping German schools with computers and train teachers for their use in the classroom within a short time. On the one hand, this meant that the state openly acknowledged that it could no longer fulfil its task of financing the equipment of schools on its own and had to rely on the private sector to provide the needed material, personnel, and technical support to introduce computers into public schools. On the other hand, it gave manufacturers of hard- and software, as well as commercial providers of computer training privileged access to the promising market of public education to establish potentially long-term sales relationships. In the early 1980s, most federal states and a large majority of schools in West Germany had no consolidated concepts for computer instruction in

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1 Stephen J. Ball, *Education plc: Understanding private sector participation in public sector education* (Oxford: Routledge, 2007); Ben Williamson et al., "Education recoded: policy mobilities in the international 'learning to code' agenda," *Journal of Education Policy* 34, no. 5 (2019): 705–725, https://doi.org/10.1080/02680939.2018.1476735; Ben Williamson, "Mediating Education Policy: Making Up the 'Anti-Politics' of Third-Sector Participation in Public Education," *British Journal of Educational Studies* 62, no. 1 (2014): 37–55, https://doi.org/10.1080/00071005.2013.857386; Ben Williamson, "New power networks in educational technology," *Learning, Media and Technology* 44, no. 4 (2019): 395–398, https://doi.org/10.1080/17439884.2019.1672724; Ben Williamson, "Meta-edtech," *Learning, Media and Technology* 46, no. 1 (2021): 1–5, https://doi.org/10.1080/17439884.2021.1876089. On the case of Germany, see Martina Schmerr, "Sponsoring an allgemeinbildenden Schulen – Erfahrungen, Probleme, Handlungsmöglichkeiten," in *Die verkaufte Bildung*, ed. Ingrid Lohmann and Rainer Rilling (Opladen: Leske + Budrich, 2002), 189–206; Annina Förschler, "Das ‚Who is who?' der deutschen Bildungs-Digitalisierungsagenda. Eine kritische Politiknetzwerk-Analyse," *Pädagogische Korrespondenz* 58, no. 2 (2018): 31–52, https://doi.org/10.25656/01:21106; Sigrid Hartong and Annina Förschler, "The rising power of business interests through intermediary policy networking: insights into the 'digital agenda' in German schooling," *Working Paper* (2020), https://doi.org/10.13140/RG.2.2.27433.62568.

2 Marcelo Parreira do Amaral, "Neue Akteure der Governance des Bildungssystems – Typen, Einflussmöglichkeiten und Instrumente," in *Handbuch Neue Steuerung im Schulsystem*, ed. Herbert Altrichter and Katharina Maag Merki (Wiesbaden: Springer, 2016), 469.

schools.[3] Thus, as this chapter will demonstrate, this early phase of experimentation opened up a possibility for the computer industry to gain influence over pedagogical practice and the organization of teaching and learning with and about computers, by advertising and selling their products to schools, and by working in cooperation with the Ministers of Education and Cultural Affairs of the federal states. As a result, conflicts flared up in the 1980s over the role of private-sector actors while introducing computer instruction into German schools. An intermediary actor in the form of the support association "Computers and Education" was thus brought into play to mediate between the interests of public education policymakers and school administrators on the one hand, and the computer industry on the other.

This chapter is based on an analysis of historical documents from the German federal archive about the government initiative "Computers and Education" launched in March 1984 and the association of the same name founded shortly thereafter by private actors. From the perspective of the federal ministry of education, the chapter explores to what extent the establishment of public-private partnerships for equipping German schools with computers in the mid-1980s resulted in a shift of competencies and power struggles in public schooling with regard to how computer education was organized and implemented. In what follows, it will be shown that the federal government not only saw the involvement of the private sector as a means of reducing the financial burden on the state in equipping schools with computers, but also considered the establishment of a public-private partnership under its auspices as a possible means of strengthening centralized state power within Germany's federal system in order to reduce regional disparities and differences in the various strategies for integrating computer technology into schools. The case study on West Germany contributes to a better understanding of the dynamics and conflicts of interest that have emerged in the process of involving new actors in education policymaking to prepare schools for the digital age.

3 Among the first was the federal state of Baden-Württemberg. On 14 March 1984, a concept for "New media and modern technologies in school" was presented, which included the introduction of basic informatics and computer education into upper secondary schools (Ministerium für Kultus und Sport Baden-Württemberg, "Computer- und Informatikunterricht in den Fächern Mathematik und Technik ab Klasse 9," *Kultus und Unterricht Baden-Württemberg* 33, no. 9 [1984]: N 101–N 103).

"Don't Sleep through the Computer Revolution": The Debate on Computers in the Classroom

The development and use of microelectronics in the second half of the 20th century were seen as a means of rationalization, and thus to improve the productivity and competitiveness of businesses and the economy at large.[4] In West Germany, the dominant discourse reflected the fear that if the German economy failed to catch up with this global spread of technology, its already threatened position as a global player and an export nation would deteriorate even further. This seemed especially apparent in comparison with the leading industries of the USA and Japan which had benefitted from massive state support in the research and development of new information technology.[5] Computers had been introduced on a small scale into West German companies already in the 1950s to rationalize and partially automate economic production. The following two decades saw rapid development of data processing technologies and the establishment of a national computer industry, with substantial financial support from the federal government to modernize the German economy by introducing computer systems.[6] At the same time, technological advances enabled the production of smaller and cheaper computers, which in turn led to the emergence of a growing market for affordable personal and home computers in the late 1970s and early 1980s.[7]

The increasing prevalence of computers in society and the economy triggered a broad, general debate on education in the age of computers, which was underpinned by a sense of urgency and pressure to act. Euphoric advocates of computer education elevated the use of computers to the rank of an indispensable cultural technique that children and young people needed to acquire just like reading, writ-

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4 Bundesrat, *Informationstechnik. Konzeption der Bundesregierung zur Förderung der Entwicklung der Mikroelektronik, der Informations- und Kommunikationstechniken* (Drucksache 291/84) (Bonn, 1984), 4–6.

5 Bundesregierung, *Bericht der Bundesregierung zur Förderung von Forschung und Entwicklung auf den Gebieten Datenverarbeitung, Informationstechniken* (Drucksache 9/1556) (Bonn, 1982); U. Thomas, "Technologie, Politik und Innovation," in *Mikroelektronik Information Gesellschaft. Informationstechnik und Datenverarbeitung*, ed. Heinrich Niemann, Dieter Seitzer, and Hans Wilhelm Schüßler (Berlin and Heidelberg: Springer, 1983), 188–189; Bundesrat, *Informationstechnik*, 3.

6 Annette Schuhmann, "Der Traum vom perfekten Unternehmen. Die Computerisierung der Arbeitswelt in der Bundesrepublik Deutschland (1950er- bis 1980er-Jahre)," *Zeithistorische Forschungen/Studies in Contemporary History* 9, no. 2 (2012): 231–256, https://doi.org/10.14765/zzf.dok-1596.

7 Thomas Haigh and Paul E. Ceruzzi, *A New History of Modern Computing* (Cambridge, MA: MIT Press, 2021), 191–192.

ing and arithmetic.[8] Thus, the need to familiarize the younger generation with new technologies in schools was emphasized: "Only a generation who cannot just make use of this new technology, but truly 'understands' it, will be able to use the positive opportunities of microelectronics without prejudice for the benefit of all of us".[9] Pupils ought not to only learn how to use computers for their later professional life, but also to understand its implications in a wider social context. Following the premise of "learning by doing", pupils were also meant to learn how to use computers to solve problems by practically learning with and working on computers. However, attempts to realize this idea were doomed to failure in most schools during the early 1980s due to the lack of computer hardware. While many public schools in Germany did not offer any computer education at all, others had to resort to "frontal teaching about computers, with the help of blackboard and chalk, at best loosened up by the use of school television films and then perhaps followed by a 'gala performance' by the computer specialist on the one and only computer owned by the school".[10]

One argument of why computer education needed to be taught in schools often recurred: competition. According to the proponents of computer education in schools, computer skills promised to be a great advantage in the competition of individuals for career opportunities. And on a macro level, the German economy would require a large pool of computer literate, skilled workers to remain competitive in the global market. This rationale reminded Jochen Schweitzer, board member of the German Education Union (GEW), of the Sputnik-shock in 1957, and the fear of falling behind other countries in terms of the skills and qualifications of the workforce. He criticized the German obsession with competition – the "ideology of always having to be a little bit better than the others", while failing to reflect upon the social and pedagogical implications of computerizing education.[11] While some opposed the idea of computers in schools altogether, others were displeased by the way this endeavour was approached. Opponents and sceptics like Schweitzer criticized that computers were being rushed into schools under the discursive pressures of economic competitiveness and with reference to the alleged needs of an emerging "information society" – at the expense of a thought-through pedagogical approach to bringing computers into schools. At the heart of their criticism was the concern over the growing influence of the computer industry over German

8 Jürgen Danyel, "Zeitgeschichte der Informationsgesellschaft," *Zeithistorische Forschungen/Studies in Contemporary History* 9, no. 2 (2012): 198, https://doi.org/10.14765/zzf.dok-1598.

9 Udo Ulbricht, "Verschlafen die Schulen die Mikrochip-Revolution?," *Die höhere Schule*, no. 2 (1984): 63.

10 Ulbricht, "Verschlafen die Schulen die Mikrochip-Revolution?," 64.

11 Peter Körfgen, "Hart am Rande der Sprachlosigkeit," *Erziehung & Wissenschaft*, no. 6 (1984): 25.

schools. Once schools were equipped with a certain brand of computer systems, they would be unlikely to change the provider again any time soon.[12] Moreover, they feared a lack of possibilities for democratic participation and control once the computer industry had taken control over the educational market. As a result, students would be put at the mercy of corporate profit and sales interests. If the task of equipping schools with computers was left to private businesses and companies, they would possibly privilege certain regions or types of schools, while others were left out.[13]

Despite such debates and concerns about the specific ways in which computers should be introduced into schools, a broad consensus was forming in the early 1980s that schools needed to respond to the new reality of an increasingly computerized society by providing all children with a basic computer education. However, both the necessary computer equipment and the qualification of teachers for the implementation of computer education in schools required substantial costs. Moreover, this task came at an unfavourable time. Following a long period of economic growth, West Germany had entered a phase of stagnation in the 1970s and 1980s, accompanied by inflation and rising unemployment. In response to chronic deficits in the federal budget and mounting public debt, a fiscal regime of austerity was established.[14] In face of the tight financial situation of the West German state sector in the 1980s, the task of equipping all public schools with computers seemed almost impossible to accomplish within a reasonable time. In line with the promotion of neo-liberal policies under chancellor Helmut Kohl, great faith was put in the forces of the free market and partnerships between the public and the private sector to address the pending challenges.[15] As representatives of businesses and industry in particular had publicly called for the rapid introduction of school-based computer education, there was an increasing expectation on the part of educators and educational authorities that the private sector would also contribute to meeting this challenge: "If [our industry] wants to be taken seriously with its lamentations about the computer illiteracy of most German citizens and the increasing hostility towards technology, even among parts of the young generation, it must make a financial and/or material contribution to ensure that our

12 Jochen Schweitzer, "Absatzmarkt Schule. Bildungsbürokratie und Wirtschaft Hand in Hand," *Erziehung & Wissenschaft*, no. 5 (1984): 22.
13 Schweitzer, "Absatzmarkt Schule," 22.
14 Wolfgang Streeck and Daniel Mertens, "Politik im Defizit: Austerität als fiskalpolitisches Regime," *dms – der moderne staat – Zeitschrift für Public Policy, Recht und Management*, no. 1 (2010): 7–29, https://doi.org/10.3224/dms.v3i1.01.
15 Detlef Sack, *Vom Staat zum Markt. Privatisierung aus politikwissenschaftlicher Perspektive* (Wiesbaden: Springer VS, 2019), 151.

schools are adequately equipped with hardware and software. This will show whether the fundamental willingness expressed in the public media by some computer manufacturers for immediate support measures was more than mere lip service".[16] Eventually, it was the federal ministers themselves that formulated a public appeal to the private sector to take an active part in tackling the challenge ahead.

Equipping Schools with Computers – Fast and with very Limited Funds

On 19 March 1984, the Federal Minister of Education and Science, and the Federal Minister of Research and Technology organized an action day for a joint action on "Computers and Education" through a partnership between industry, science, and education. The main goal was to quickly equip all secondary schools with computers to prepare and implement a new field of instruction for basic computer education and to qualify teachers accordingly. Both ministers maintained that the equipment of schools and the training of teachers in computer technology could not be achieved without the support of the private sector. Without their involvement, schools and educational administration would not be able to successfully manage these tasks in the foreseeable future as they lacked the necessary technical competence and financial resources. However, if it was left to the private sector alone, schools would risk being bypassed by suppliers of computer hard- and software that pursued a technocratic implementation strategy that would not meet the pedagogical requirements of schools and teachers.[17]

Therefore, only a joint effort was seen as a viable solution to solve these tasks. The central argument put emphasis on the extraordinary speed with which the computerization of the economy and society progressed. As a result, long-term development processes of adapting schools to this new reality would not be sufficient. An additional effort by everyone "beyond their actual mandate"[18] was

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16 Gregor Krämer and Udo Ulbrich, "10 Thesen zur Realisierung eines zeit- und sachgemässen Einsatzes von Mikrocomputern im Unterricht," *Die höhere Schule*, no. 5 (1984): 150.

17 Georg-Berndt Oschatz, "Einführung durch den Präsidenten der Ständigen Konferenz der Kultusminister der Länder und Niedersächsischer Kultusminister, Georg-Berndt Oschatz," in *Computer + Bildung, Eine Gemeinschaftsinitiative von Politik, Wirtschaft und Wissenschaft. Bericht einer Tagung vom 19. März 1984 im Wissenschaftszentrum in Bonn*, ed. BMBW/BMFT (Bonn: Arbeitsgemeinschaft für politische und wirtschaftliche Kommunikation, 1984), 27.

18 Dorothee Wilms, "Einführung durch den Bundesminister für Bildung und Wissenschaft, Dr. Dorothee Wilms," in *Computer + Bildung, Eine Gemeinschaftsinitiative von Politik, Wirtschaft und* deemed necessary to speed up the introduction of computers into schools and to train a large enough number of teachers in informatics and programming. On the occasion of the action day “Computers and Education” on 19 March 1984, a number of companies in German computer industry made offers of support towards schools. A substantial amount of equipment was donated, and price reductions on computers and peripherals as well as support for the further training of teachers were offered to schools. To coordinate and intensify the initiatives and efforts of the private sector, the German Engineering Federation VDMA (*Verband Deutscher Maschinen- und Anlagenbau*) and the Central Association of the Electrotechnical Industry ZVEI (*Zentralverband der Elektrotechnischen Industrie*) initiated the formation of a support association, which would act as an intermediary between the federal states, individual schools, and representatives of the computer industry. It was formally established in September of the same year that the action day had taken place under the identical name of “Computers and Education”. In cooperation with the Ministries of Education in the federal states of Germany, the support association pledged to help in tailoring the efforts of the private sector to the actual needs and requirements of educational institutions. The support association was chaired by Karl Joachim Döring, managing director of the Hewlett Packard distribution centre in Frankfurt, and his deputy Hermann Stähler, who at the time was managing director of Philips Communication Industry. Managing director of the support association was Günther Möller, who also served as managing director of the Office and IT Association within the VDMA, and his deputy Paul-Albert Ruhr, managing director of the ICT Association within the ZVEI. The support association represented all member firms of both the VDMA and the ZVEI, and thus covered a large majority of the German electronics and ICT industry. However, the member companies did not make any formal commitment regarding the forms and extent of their involvement, nor was there a direct financial contribution to the support association envisaged. From the industry’s point of view, the main task of the support association was to publicly represent and communicate the private sector’s efforts and initiatives to support the introduction of ICT in schools, rather than having a dedicated budget at its disposal to take direct action and launch its own initiatives to equip the schools.

In addition to the promotion of charitable support from the private sector, the aim of the “Computers and Education” initiative was also to encourage education policymakers at the level of the federal states to address the issue of introducing

Wissenschaft. Bericht einer Tagung vom 19. März 1984 im Wissenschaftszentrum in Bonn, ed. BMBW/BMFT (Bonn: Arbeitsgemeinschaft für politische und wirtschaftliche Kommunikation, 1984), 17.

computer education into schools more seriously. In the federal system of Germany, the federal states have primary responsibility for legislation and administration in education. Thus, it is not the responsibility of the Federal Ministry of Education, but of the individual federal states to develop new pedagogical concepts and curricula for the introduction of ICT in schools to take measures for teacher training and to finance the equipment of schools with computers. To coordinate cooperation in the field of education and training, the federal states established the Standing Conference of the Ministers of Education and Cultural Affairs (KMK) in 1948. In addition, the Commission of the Federation and the federal states for Educational Planning and Research Promotion (BLK) served as a joint body to coordinate efforts between the federal states and the national government in the field of educational planning and policymaking.

The same year that the "Computers and Education" initiative was launched, the BLK adopted a framework concept for information technology education in schools and vocational training.[19] The framework concept distinguished between a basic computer education for all pupils, an in-depth informatics education and vocational education, and training in new information technologies. The proposed curriculum for a basic computer education in lower secondary schools focused on simple computer applications, as well as possible uses, risks, and the control of information technology. Moreover, pupils ought to be introduced to issues of privacy and data protection. The informatics curriculum for upper secondary schools was more strongly oriented towards computer science. It entailed the teaching of problem-solving strategies and programming skills and focused on the use of computers for the simulation of processes, graphical representations, and calculations. It also covered data structures and the use of microprocessors for process control. In addition, the framework concept also mentioned the use of computers as universal tools in all subjects where it was deemed appropriate.

Part of the concept also dealt with the hard- and software that schools needed to be equipped with, which had to be in line with pedagogical considerations and goals. It stated that not every device on the market was suitable for educational purposes.[20] Thus, a sensible choice had to be made from what was currently offered. Computer hardware had to be robust and versatile in use, equipped with widely used and compatible operating systems, and allowing for the use of higher programming languages. With regard to the purchase of software, it was argued that pupils should primarily develop their own programs and that the use of read-

19 BLK, "Rahmenkonzept für die Informationstechnische Bildung in Schule und Ausbildung," *Bildung und Erziehung* 38, no. 1 (1984): 123–129.

20 BLK, "Rahmenkonzept," 129.

ily available software was of subordinate importance. If such software was needed, it had to be designed in accordance with didactic principles and adapted to curricular guidelines. Consequently, educational administration had to decide on the suitability of specific computer programs for use in classrooms. In addition, a central institution was proposed to collect, document, and lend out software to schools, as well as to offer consulting and support to teachers and school administrators. Thus, individual schools would not have to be equipped with all the necessary and available software, but instead could borrow the programs they needed. However, the framework concept did not elaborate on who should develop the necessary educational software that met the requirements of schools. Instead, it was left to the initiatives of commercial software developers or committed teachers and educators to respond with tailored solutions to grade-level- or subject-specific needs.

Concurrently, the BLK established a funding program to make the integration of ICT and computer education into schools the focus of its state-funded pilot projects. The scheme allowed for the federal states to submit project proposals to the BLK, which were then evaluated by both national and federal state representatives. Accepted projects were subsequently jointly funded on a cost-sharing basis by the federal government and the applicant state.[21] For the federal states, these pilot projects provided an opportunity to experiment with computer education in schools, to purchase the necessary computer equipment, and to implement new teaching materials and teacher training, while the federal government bore half of the costs. For the federal government, the funding of pilot projects served as an effective lever to encourage the widespread introduction of computer education into schools without infringing on the sovereignty of the federal states in the field of education. In addition, this mode of governance allowed for the alignment of the conceptual work in the federal states with the BLK framework concept, which was required by the funding criteria for model projects. Selective funding of projects also helped to avoid duplication of effort and to focus on key developments and pressing issues that were of national interest for the implementation of computer education in schools.

21 Between 1983 and 1989, 69 pilot projects concerning the introduction of new ICT into schools were jointly funded by the federal government and the states with a total sum of over 35 million DM. Additional funding was provided for pilot projects in VET and continuing education (see Hans-Georg Rommel, *New Information Technology in Education in Germany* (Luxembourg: Office for Official Publications of the European Communities, 1992), 36).

Diverging Expectations and Conflicting Roles

At first, education policymakers and school authorities seemed to understand the "Computers and Education" initiative mainly as a charitable effort by the computer industry and as an opportunity to acquire computer equipment at a significant discount or even for free. But the two industry associations painted a different picture when they first announced their intention to form the "Computer and Education" support association. The support association "Computers and Education" saw its primary purpose as connecting schools in need with corporations eager to help. It vaguely stated its aim as "to support the relevant authorities in the integration of information technology education into schooling".[22] On the part of the federal ministries, the association was expected to coordinate and reinforce sponsorship and donation activities of the private sector. The president of the KMK, Georg-Berndt Oschatz, argued at the launch of the community action initiative on 19 March 1984 that the federal states desperately needed such support to tackle this task for the future and should proactively approach the support association and cooperate closely with it.[23] Oschatz expressed the hope that the support association would provide for an institution "without too many bureaucratic constraints and restrictive requirements which could operate and act in the common interest of everybody involved" and allow for educational authorities of the federal states to get involved directly in its activities.[24]

Against the backdrop of the concerns regarding a growing corporate influence over German schools, the support association was meant to act as an intermediary between educational authorities and the computer industry in bringing computers into the classrooms. The setting of coordination meetings with the support association within the BLK and regular bilateral discussions with representatives of the federal ministry of education was meant to assure that the latter would keep a certain degree of control and oversight over the activities of the support association and its negotiation with individual federal states. Moreover, the federal minister of education Dorothee Wilms considered the regular joint discussions with the support association within the BLK as the preferable mode of cooperation, in order to avoid that computer manufacturers would pursue their own implementation

22 BArch B 138/70110, Brochure "Fördergemeinschaft Computer + Bildung," 7.

23 BArch B 138/70110, BMBW press release 30/1984, March 19, 1984.

24 Oschatz "Einführung," 29.

policy without any consideration for the schools' needs.[25] Wilms also stated that future collaboration with the support association could not be aimed at the development of concepts for the content or the organization of instruction in schools as this clearly fell into the competence of the federal states. Nevertheless, the support association was meant to provide them with the opportunity to draw on the expertise and advice of the private sector in these matters too. Especially regarding the training of teachers in IT, the equipment of schools with computers, and the development of software suitable for the use in classrooms, Wilms hoped that the federal states would join forces with industry to draw upon the private sector's extensive material, technical and personal resources.[26]

At first, the focus of the support association was on the equipment of schools with computers. The ZVEI and the VDMA estimated, that roughly 25'000 schools in the federal republic of Germany and West Berlin lacked the necessary hardware. The ZVEI and VDMA's conservative estimate of the necessary investment amounted to 400 to 600 million DM, which was equal to approximately 1% of total public spending on schools in West Germany in 1985.[27] The two founding organizations of the support association assured that industry would, within the limits of their abilities and resources, participate in meeting this need. However, the chairmen of the support association made their standpoint clear, that the issue at hand was to be primarily solved by the state.[28] Namely, the financing of computer equipment as well as the necessary conceptual and organizational tasks to introduce basic computer education into schools were considered to be the responsibility of the state. Nevertheless, due to the "high economic importance and urgency of including new technologies into schooling", the VDMA and ZVEI as well as their member companies saw a need to become involved in a joint effort between

25 BArch B 138/51176, Speaking note of Dorothee Wilms for the meeting within the BLK on the results and further proceedings of the community action "computers and education" on March 30, 1984.

26 BArch B 138/51176, Speaking note of Dorothee Wilms for the meeting within the BLK on the results and further proceedings of the community action "computers and education" on March 30, 1984, 3–4.

27 In 1985, total public expenditure in West Germany for schooling amounted to 48,503 million DM (Gabriele Franzmann, *Bildung in Deutschland: Bildungsstatistische Zeitreihen von 1960 bis 2000 zur Schüler- und Studentenzahl, zum Lehrpersonal und zu den Bildungsausgaben. GESIS-Datenkompilation auf Grundlage der amtlichen Statistik* [Köln: HISTAT, 2006]). The cost estimate by the ZVEI/VDMA only covered the initial investment for acquiring a minimum computer equipment of 8 to 10 computers per school and did not include software or follow-up costs for maintenance, repairs and replacements.

28 BArch B 304/3136, ZVEI/VDMA press release on the proposition to establish a support association, March 19, 1984.

state and private actors. Initiatives by private actors could support and provide impulses for the introduction of computers into education, but a systematic effort to achieve the necessary broader impact that would reach all educational institutions needed to be taken by the state or through state resources. In addition, representatives of the information technology industry had expressed their hope that the state would encourage private-sector sponsorship of technical equipment for schools through tax incentives, instead of meeting their offers of cooperation with mistrust.[29]

A first coordination meeting between representatives of the German ministry of education, the federal states, and the support association took place in the summer of 1984. On this occasion, it was decided that the activities of the support association should at first focus primarily on the pilot projects aimed at introducing new information and communication technology into general and vocational education.[30] The federal states were asked to submit a list of their demands and needs regarding computer equipment and teacher training. The support association would then try to mobilize and coordinate further aid from firms to cover unmet needs. Giving priority to pilot projects in distributing donations meant that neither the support association, nor its member firms had a say with regard to the aims, contents, and implementation of these projects that had been designed by education policymakers and pedagogues within the federal states and recommended for funding by the BLK. The support association was meant to merely reduce the budget required for the realization of approved pilot projects by providing the necessary computer equipment and teacher training opportunities offered by its member companies. Thus, by focusing private sector involvement on pilot projects that were already fully developed and approved by the state, the German government sought to ensure that strategic guidance on how and for what purpose computers should be used in schools would remain solely with state education authorities.

On the occasion of the well-publicized community action launch day on 19 March 1984, a number of firms had already committed to a variety of sponsoring offers which now needed to be allocated to projects in the federal states. The launch of the community action had provided private actors with a platform to make education initiatives by the computer industry particularly visible, while local efforts of schools, teachers, and governments of certain federal states re-

29 BArch B 138/70110, Statement by Dr. Helmut Lohr, Chairman of the Executive Board ZVEI, at the press briefing with Federal Minister Dorothee Wilms on January 13, 1987, 4–5.

30 BArch B 138/51176, Speaking note of Dorothee Wilms for the meeting within the BLK on the possibilities of cooperation with the private sector regarding the “Impacts of new media and technology on education and science” on May 16, 1984.

ceived far less public attention.[31] This somewhat distorted representation provided context for the accusation that the state had remained idle for too long and had not responded with timely measures on a larger scale to introduce computer technology into schools, which was why some private actors had gotten involved locally. IBM Germany had just started a new program in 1983 to support educational projects in Baden-Wuerttemberg, Hesse, and Rhineland-Palatinate with 150 personal computers and software to give a boost to the use of computers in schools.[32] Leybold-Heraeus had donated six Computer-Aided-Physics-Interfaces and personal computers to upper secondary schools in Cologne and Hanau.[33] Siemens had allowed for the free training of Bavarian teachers in its data technology schools since the summer of 1983 and gifted 140 personal computers to schools in Bavaria.[34] Following the call to action by the BMBW and the BMFT, these activities were expanded and other companies, such as Commodore, Apple, Triumph-Adler, Standard Elektrik Lorenz and Digital Equipment joined in with discount offers, donations of equipment, and offers of free computer training for educational institutions.

A first conflict between the support association and educational authorities already arose at their second meeting in September 1984; differences in expectations and responsibilities between educational authorities and the support association became clearly perceptible and evident. The association's chairmen declared that they would not be raising or allocating donations as they rejected the role of the support association as a fundraiser or a distributor of charitable donations. Rather, they defined the competencies of the association primarily along the lines of a platform for the exchange of views and ideas, as well as for the reconciliation of interests between stakeholders in education and industry. This clarification raised profound dismay and disappointment among the education delegates within the BLK. They interpreted this statement as a breach of the agreement that had been reached at the first meeting where it had been established that the support association would raise and distribute donations from private companies. The chairmen of the support association declared that for reasons of competition

31 By June 1984, the BMBW together with the federal states had jointly funded over 50 pilot projects with 52 million DM since the early 1970s to introduce computer technology into education and training (BArch 138/51178, Press release of the BMBW "Gemeinschaftsaktion ‚Computer und Bildung' erfolgreich", July 12, 1984, 2)

32 BMBW/BMFT, *Computer + Bildung. Eine Gemeinschaftsinitiative von Politik, Wirtschaft und Wissenschaft. Bericht einer Tagung vom 19. März 1984 im Wissenschaftszentrum Bonn* (Bonn: Arbeitsgemeinschaft für politische und wirtschaftliche Kommunikation, 1984), 54.

33 BMBW/BMFT, *Computer + Bildung*, 55.

34 BMBW/BMFT, *Computer + Bildung*, 61.

law and association policy, the central coordination of private sector donations was neither possible nor desirable. Instead, the current and prospective donations would have to be handled bilaterally between individual firms and donation recipients.[35] As a result of the association's reluctance to organize the distribution of the donations pledged on 19 March 1984, some firms had already chosen the recipients on their own,[36] which conflicted with the federal ministry's concern for a fair and equal distribution of donated computer equipment, as well as with the consensus to prioritize pilot projects. Nevertheless, the representatives of the federal states in the BLK were willing to continue cooperation with the support association as they still hoped for discounts and donations of computer equipment for their pilot projects. Moving forward, it was decided that a list of approved pilot projects under the BLK's "New Information and Communication Technology in Education" funding scheme would be made available to the support association and its member firms. The association would then establish contact between interested firms and the concerned federal state to initiate public-private cooperation in specific projects. Nevertheless, the issue had undermined the educational authorities' trust in the value and usefulness of cooperating with the support association. Possible areas of cooperation such as the development of educational hard- and software as well as consultations regarding didactics and methodology in teaching with and about computer technology were deferred at the request of the federal states. The federal ministry of education noted in an internal letter to Dorothee Wilms, dated September 1984, that the support association had failed to meet the expectations it had raised. It had "clearly distanced itself from its previous promises and declarations of intent with regard to its activities for the mobilization and coordinated mediation of donations. According to the information available to us, this is in response to pressure exerted by the member companies, which apparently do not want to grant such coordinating power to the association. Association policy and competition law are claimed to be the reasons. However, the true reason is probably that the companies use the donation activities primarily as part of their market strategy and therefore do not want to be involved in a coordinated action with competing companies".[37] The Ministry of Education insisted that the support association had to think of itself more as a representative of the interests of the education system if it wished to collaborate successfully with the federal and state governments. It would only be accepted as a partner of the federal and state

35 BArch B 138/51178, "Vermerk betr. Ergebnis des Gespräches Bund/Länder/Kommunale Spitzenverbände/Fördergemeinschaft ‚Computer und Bildung' am 5.9.1984 im BMBW," September 17, 1984.
36 BArch B 138/51178, "Aktion ‚Computer und Bildung' am 19.3.1984 – Spenden und sonstige Angebote von Firmen," status as of June 28, 1984.
37 BArch B 138/51178, Letter from the BMBW to Dorothee Wilms, September 21, 1984.

governments if more could be achieved with its help than in bilateral contacts with individual companies: "The ministry of education did not bring the support association together with the federal states in order to make it easier for industry to sell equipment".[38]

In the following year, the support association made little progress regarding the support of pilot projects by the private sector. The BLK had submitted a list of approved projects that contained merely the titles of the pilot projects and listed the respective applicant federal state. The support association complained in several letters to the BMBW that it needed more details on the contents, aims, and necessary equipment of the projects to be able to mobilize the support of its member companies. The federal states, however, shielded their detailed plans and concepts to introduce computer technology into schools from private industry and denied this request. Firms would only be granted access to the full application file if they displayed a serious interest in supporting a specific pilot project. Even though the support association warned that it would be practically impossible to spark its member companies' interest in supporting a project if they did not have more detailed information on it, the federal states remained firm in this matter. The support association had to accept defeat in this matter and focused on a different area of activity, namely the training of teachers for the use of computers in the classroom. The support association declared itself willing to gather a list of computer education and training offers for teachers in collaboration with its member firms but declined to centrally administer the matching of interested parties. The list would be made available to the educational authorities in the federal states who then could engage in bilateral negotiations with the providers of ICT training courses. However, the BMBW urged that the issue of teacher training would be dealt with by the joint discussion group within the BLK in order to prevent such issues from being negotiated bilaterally between the federal states and industry to the exclusion of the federal government.[39] A working group on teacher training measures in ICT was set up to discuss concepts and organization of in-service and further training measures for teachers. Meanwhile, the association put together a list of offers that was subsequently discussed within the BLK and made available to the federal states.

Despite these efforts, none of the federal states responded to the member companies' offers to support teacher training in informatics and the use of computers

38 BArch B 138/51179, "Vermerk betreffend Fördergemeinschaft ‚Computer und Bildung' des VDMA und ZVEI; Gespräch von Herrn Staatssekretär mit den Herren Stähler (VDMA) und Döhring (ZVEI) am 24.10.1984," October 22, 1984.

39 BArch B 138/51179, "Vermerk betr. Vorbereitung der Sitzung des Ausschusses Bildungsplanung der BLK am 13.11.1984," November 5, 1986, 3–4.

in the following months.[40] Instead, the federal states had begun to rapidly expand their existing facilities for further teacher training and to establish their own courses to introduce teachers to new information technology and its use in education. The federal ministry of education and science criticized many of the offers made by computer companies that the support association had gathered in its list were not specifically designed to meet the needs of teachers, but rather consisted in generic computer courses for clients. In addition, most training courses were not offered to teachers for free. The associated costs were estimated to be at least as high as those of the federal states' own in-service teacher training measures which were tailored to the specific needs of schools.[41] The low popularity of the support associations' list of teacher training courses in IT among the federal states, thus came as no surprise.

Instead of retreating, the support association took a last step forward and became more directly involved in offering its own courses and seminars. A three-day seminar for teachers was prepared and offered to the federal states that encompassed a visit to a local company or computer centre, as well as lectures on the current state of ICT, its socioeconomic and -cultural implications, and its opportunities and limitations regarding the use in school. But only a few federal states showed interest in the seminar. The first seminar was attended only by school authorities and not teachers. The support association also expressed its interest to collaborate both with the ministry of education and science as well as the federal states to develop educational software for schools. The idea was to develop simple tutoring systems not for informatics education itself, but for the use of computer technology as a means of instruction in other subjects.[42] However, no new projects developed from these ideas within the organizational framework of the support association. Interested companies, local educational policymakers, and school authorities started their own initiatives and collaborations without the support association as an intermediary. What had been heralded only three years ago as a hub for public-private partnerships, which would lessen the financial burden of the federal states and open school doors to computer businesses, had faded into insignificance.

Consequently, the support association informed the ministry of education and science at the beginning of August 1988 of its dissolution as its mission had been

40 BArch B 138/70110, "Vermerk betr. Fördergemeinschaft Computer und Bildung," August 28, 1986.
41 Landtag Nordrhein-Westfalen, "Antwort der Landesregierung auf die Kleine Anfrage 704 des Abgeordneten Hilgers SPD (Drucksache 10/1748)," March 26, 1987, https://www.landtag.nrw.de/portal/WWW/dokumentenarchiv/Dokument/MMD10-1865.pdf.
42 BArch B 138/70110, Letter from Döring to state secretary Piazolo, August 15, 1986.

accomplished.[43] While the federal authorities acknowledged the association's descent into relative unimportance, they also pointed out that the task of introducing a basic computer education into schools could by no means be considered accomplished. The state-funded pilot projects and various private-sector initiatives had helped to lay the foundation and to tackle some of the conceptual questions that needed to be clarified. However, the practical implementation on a broader scale to reach all schools and pupils was expected to take full effect only in the early 1990s. In a letter to the chairman of the support association, the new German minister of education, Jürgen Möllemann, expressed his hope that companies, private organizations, and associations would continue to support educational efforts in the field of information technology despite the discontinuation of the support association as a coordinating institution.[44] After all, the private sector was considered an important partner in the state's efforts to introduce computers into schools – not least regarding vocational education and further training.

Conclusion

The case of the support association "Computers and Education" illustrates how continuous efforts to bring significant technological innovations into schools on a broad scale have triggered both increased national government involvement in education, as well as attempts to establish extensive public-private partnerships beyond bilateral contracts at the local or regional level in the Federal Republic of Germany. The dominant public discourse in the early 1980s was characterized by a sense of urgency to push ahead with the introduction of computers into classrooms in order not to fall behind in the struggle for global economic and technological competitiveness. This perceived need for quick and decisive action prompted the federal government to increase its involvement in promoting and harmonizing efforts in the federal states to introduce computer education into schools. From the perspective of the federal government, two instruments were of decisive importance in this process. On the one hand, the BLK framework concept for ICT in schools served to establish a common ground and provide general guidelines for the conceptual and curricular developments in the federal states. On the other hand, the BLK arranged a funding program in 1984 to make the integration of computer education into schools the focus of their mutual pilot projects. The federal ministry of education covered half of the cost of pilot projects which were recom-

43 BArch B 138/70110, Letter from Döring and Möller to Möllemann, August 1, 1988.
44 BArch B 138/70110, Letter from Möllemann to Döring, August 23, 1988.

mended by the BLK and aligned with its framework concept in order to promote cooperation and coordination between the federal states in the introduction of basic information technology education.

An in-depth analysis of archival documents by the Federal Ministry of Education and Science and its correspondence with the support association revealed how the introduction of computer technology into German schools was accompanied by debates over financial, state, and corporate social responsibilities. Moreover, it was a process marked by power struggles over the choice and acquisition of technical equipment for schools and the design of curricula and educational policies to introduce computer education in public schooling. The Federal Ministry of Education and Science saw an opportunity in the creation of the support association as an intermediary under its own influence to maintain control and oversight over the federal states' negotiations with computer manufacturers. Its key concern was to balance the uneven progress across the federal states in equipping schools with computer technology and in developing new policies for school-based computer education. Private sector sponsorship and support were to be evenly distributed across the states in order to not further exacerbate the uneven playing field. Thus, by taking a seat on the advisory board of the support association, the Federal Ministry of Education wanted to ensure that the interests of the federal government were represented and that a balanced distribution of donations could be achieved. The advisory board was to decide on all projects supported by the support association. Thereby, the Federal Ministry of Education sought to rule out purely bilateral contracts between the support association and interested partners, about which the advisory board would only be informed after the fact and would hence not be able to intervene. In addition, the Federal Ministry of Education insisted that the activities of the support association be concentrated on the financial and material support of BLK pilot projects.

The federal states, however, cautiously guarded their competencies in developing policies and project plans for the introduction of computers into schools from unwarranted influence by industry and businesses. They expected both the federal government as well as the private sector to substantially contribute to the equipment of schools with computers while at the same time remaining in complete control over how this new technology was to be used in teaching and learning. However, computer businesses were not willing to take on such a large financial burden, which they considered to be the responsibility of the state. Rather, companies saw the creation of the support association as a means to gain access to schools as a new and budding market for the sale of hard- and software. In addition, it posed an opportunity for them to gain valuable insights into the federal states' plans, needs, and demands regarding educational computer technology. However, the individual companies proved reluctant to coordinate their charitable actions and discounted offers to schools through a common body such as the support association. In doing so, they would not only have given up some of their negotiating leverage with individual states and schools, but they would also have compromised their ability to support and implement pilot projects according to their own ideas and preferences for computer education in public schools that were not necessarily in line with those of other businesses or the federal government. The lack of funding provided by the member companies of the VDMA and the ZVEI meant that the support association was unable to orchestrate a community effort among the private sector to launch its own larger model projects and initiatives independently of the objectives and priorities set out in the BLK framework concept.

Computer industry representatives, as well as educational policymakers and government authorities on both the national and local levels all shared the common goal of accelerating the introduction of computer technology into German schools. However, the different vested interests of the involved parties rendered the computer association's mission to kickstart and boost the introduction of computers into public education futile. This was because it failed to reconcile the various conceptions of responsibilities and competencies. To alleviate the financial burden, the federal states and schools were thus left with the possibility of conforming with the BLK framework concept to receive government funding by participating in pilot projects on the one hand, and negotiating more favourable prices with manufacturers of computer hard- and software on the other. The BLK framework concept largely achieved its purpose of exerting a harmonizing effect by pushing forward the introduction of computer science instruction into public schools in all federal states, albeit at different paces and following a range of approaches with regard to its implementation. However, without nationwide coordination of the equipping of public schools with computers and the central provision of funding to cover the associated costs, it was not possible to prevent notable differences in the level of equipment across the federal states and various school types. Only gradually did lagging states and schools catch up with the pioneers who had seized opportunities to participate in pilot projects and were able to invest significant resources to bring computers into their classrooms early on.

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Michael Geiss

Computer Education in Switzerland: Politics and Markets in a Highly Decentralized Country

Abstract: Switzerland is small, but each of its 26 cantons has its own school law. Thus, for public general education, the national government had no authority to adopt measures in computer education that would reach all schools. Accordingly, the history of computer education in Switzerland is characterized by a constant struggle with the country's decentralized political structure. However, different actors pushed for greater standardization and formed as interest groups that wanted to bring more computers into schools and advance computer education. Technology companies also tried to achieve a dominant position in the national market if possible. Only gradually did it become clear to the political stakeholders that the large corporations also posed new threats. With the dawn of more convenient office software and the World Wide Web, national political approaches emerged not to be dominated by technology companies, but to define for themselves the conditions under which computers should enter the classroom.

Keywords: Switzerland; interest groups; technology companies; computer education; political structures

Like other industrialized countries, Switzerland has gone through several phases of computer education. However, the historical developments in this small and rich country cannot be understood unless a specific political context is considered: Switzerland as a country has been – and still is – highly decentralized. This is particularly evident in education where each of the 26 cantons has its own school law. Tax laws, lay involvement in local government, and frequent referenda led to significant regional differences in schooling.[1] Thus, the role of the municipalities, can-

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1 Wolf Linder and Sean Mueller, "Federalism," in *Swiss Democracy: Possible Solutions to Conflict in Multicultural Societies*, ed. Wolf Linder and Sean Mueller (Cham: Springer International Publishing,

https://doi.org/10.1515/9783110780147-007

tons, and language regions cannot be overstated in Switzerland's history of public education.[2]

Due to the decentralized political structure of Switzerland, there are various historical pathways of computer education. The debates, actor constellations, and political initiatives differ considerably for the individual levels of the education system and geographical regions. At the same time, the implementation of computers in the classroom forced educational stakeholders to cooperate across traditional boundaries. The history of computer education in Switzerland is thus characterized by a constant struggle with the decentralized political structure of the country.[3]

A national policy on computer education did not seem possible in the complex political structure of Switzerland. Nevertheless, the reference to technological change and the actual or perceived need for coordination allowed for a gentle harmonisation. The widespread use of computers became possible only on the basis of standardised programming languages and routines. The proponents of enforced computer literacy assumed that it would be similar with education. The history of computer education in Switzerland is therefore a history of attempts at standardization and centralization in a highly decentralized country.

The historical development of computer education in Switzerland has hardly been researched. For Geneva, a well-informed study exists, but it only goes back to the mid-1980s.[4] Only the significance of the new information technologies in Swiss vocational education and training policy and adult education governance has been

2021), 59–118, https://doi.org/10.1007/978-3-030-63266-3_3; Kurt Schmidheiny, "Emerging Lessons from Half a Century of Fiscal Federalism in Switzerland," *Swiss Journal of Economics and Statistics* 153, no. 2 (2017): 73–101, https://doi.org/10.1007/BF03399435; Lucien Criblez, "Vox populi – Zur Herausforderung der Bildungspolitik durch die halbdirekte Demokratie," *Zeitschrift für Pädagogik* 57, no. 4 (2011): 471–83.

2 Peter Nenniger, "Das Schulwesen in Deutschland und in der Schweiz – Über einige Unterschiede von scheinbar Gleichem," in *Reformprozesse im Bildungswesen: Zwischen Bildungspolitik und Bildungswissenschaft*, ed. Andreas Hoffmann-Ocon and Adrian Schmidtke (Wiesbaden: VS Verlag für Sozialwissenschaften, 2012), 17–37, https://doi.org/10.1007/978-3-531-93335-1_2.

3 See for attempts at strategic intervention by the federal government at the beginning of the new millennium Beat Hotz-Hart and Theo Nacht, "Der Bund als Impulsgeber und Katalysator: Medienkompetenz als Herausforderung für die Schulen," in *ICT und Bildung: Hype oder Umbruch? Beurteilung der Initiative Public Private Partnership – Schule im Netz*, ed. Beat Hotz-Hart (Bern: hep Verlag, 2007), 135–64, https://doi.org/10.5167/uzh-17929; Dominik Petko and Beat Döbeli Honegger, "Digitale Medien in der schweizerischen Lehrerinnen- und Lehrerbildung: Hintergründe, Ansätze und Perspektiven," *Beiträge zur Lehrerbildung* 29, no. 2 (2011): 155–71.

4 Dominique Felder, *La scolarisation de l'informatique à Genève.* Cahiers du Service de la recherche sociologique no. 22 (Geneva: Service de la recherche sociologique, 1987).

researched to a certain degree.[5] This article focuses on public schools at a primary and secondary level. In particular, political initiatives and the role of various corporate and individual actors are considered. University education or practical vocational training are mentioned only when they are relevant to understanding other developments. The entire extracurricular field, i.e., computer camps, youth clubs, awareness campaigns, informal learning, etc., are not part of this historical study.

The historical analysis draws on four different sources. First, it evaluates the files of the Swiss Conference of Cantonal Ministers of Education (EDK) in the State Archives of Lucerne. Second, other archives are consulted for contexts of single developments or events in computer education. Finally, journals and publications of teachers' associations and other educational stakeholders are analyzed. This is supplemented by less specific published documents like government reports and the daily press.

The Laboratory of Upper Secondary Education and the Government Machine

The first experiments with computer education in Switzerland beyond universities, state administration or vocational education and training took place at general upper secondary schools (Gymnasien, collèges, lycées). In Zurich, voluntary computer science courses at a Zurich upper secondary school started in 1964.[6] In 1967, another introductory course in computer programming took place at a (private) school in Zurich.[7] In Geneva, the first computer science course outside the university was held at Collège Calvin in 1967. The beginning of computer education in Geneva coincided with a massive expansion of higher education in which numerous new institutions were founded. By 1969, voluntary courses were offered in three Geneva upper secondary schools. The more advanced students learned the programming language FORTRAN and could add BASIC at a later stage. All in

5 Emil Wettstein, *Berufsbildung: Entwicklung des Schweizer Systems* (Bern: hep Verlag, 2020); Michael Geiss, "Trade Unions, Digital Technologies and the Skill Question in Switzerland," in *Transformationen von Arbeit, Beruf und Bildung in internationaler Betrachtung*, ed. Stefanie Dernbach-Stolz et al. (Wiesbaden: Springer Fachmedien, 2021), 79–95, https://doi.org/10.1007/978-3-658-32682-1_5.
6 StAZH/MM 3.177 RRB 1985/3915, Kantonsschule Rämibühl Zürich, Mathematisch-naturwissenschaftliches Gymnasium (Computer).
7 Heinz Bachmann, "Elektronisches Rechnen im Mittelschulunterricht," *Gymnasium Helveticum* 22, no. 2 (1967): 134–38.

all, the non-mandatory offer extended over two years and comprised two hours a week.[8]

These early computer science courses are situated in the context of mathematics and science education. Math or physics teachers wanted to experiment with the new digital technologies and invited their students to participate.[9] Upper secondary school students were seen as future students at university. The schools were attended by only a small part of the population and served as preparation for university studies.[10] The students already belonged to the elite group of Switzerland's academic community.[11]

While initial attempts to establish computer science courses at the upper secondary level were due to enthusiastic mathematics and physics teachers, another group provided the initial consolidation and expansion of computer science instruction: Felder has argued that the promoters of a pronounced computer education came primarily from management science.[12] Therefore, computer science courses are contextualized within government efforts to make data processing in state bureaucracy more efficient. The training of students was meant to benefit the computer as what Jon Agar has called the "government machine".[13] Public funding of the expensive IT infrastructure could only be justified if the machines would not only be used for research, but also for government administration. In Fribourg and Berne, the state administration and the universities always considered the joint use of the purchase or rental of the first mainframes.[14]

8 Felder, *La scolarisation*, 20–21.

9 Felder, *La scolarisation*, 33; "Kantonsschule Limmattal in der Aufbauphase," *Neue Zürcher Zeitung*, October 15, 1976: 52; StAZH/MM 3.129 RRB 1970/3827, Kantonsschule Winterthur (ausserordentlicher Kredit).

10 Franz Eberle and Christel Brüggenbrock, *Bildung am Gymnasium.* Studien + Berichte/Schweizerische Konferenz der Kantonalen Erziehungsdirektoren 35 A (Bern: EDK, 2013); Lucien Criblez, "Das Schweizer Gymnasium: ein historischer Blick auf Ziele und Wirklichkeit," in *Abitur und Matura zwischen Hochschulvorbereitung und Berufsorientierung*, ed. Franz Eberle, Barbara Schneider-Taylor, and Dorit Bosse (Wiesbaden: Springer Fachmedien, 2014), 15–49, https://doi.org/10.1007/978-3-658-06090-9_1.

11 In Zurich, there was also an introduction to the FORTRAN programming language and electronic data processing at the upper girls' school. See StadtA ZH/V.B.b.43.:2.95, Geschäftsbericht der Zentralschulpflege, 1971–1972; "Datenverarbeitung an der Töchterschule II," *Neue Zürcher Zeitung*, June 24, 1971, Lunchtime edition: 21.

12 Felder, *La scolarisation*, 41.

13 Jon Agar, *The Government Machine: A Revolutionary History of the Computer* (Cambridge, MA: MIT Press, 2003).

14 "Eine elektronische Rechenanlage für die Universität Bern," *Der Bund*, November 15, 1956: 3; "Erneuerung: Elektronische Datenverarbeitungsanlage von Staat und Universität," *Freiburger Nachrichten*, January 21, 1972: 3.

In Geneva, this meant that the beginnings were followed by a phase of centralization. There was no other way to justify the horrendous costs. The technocrats now replaced people with a liberal education in key public functions. The electronic computer suited the technocrats' understanding of efficient management and control.[15]

In Zurich, the expansion of computer science education was driven by a representative of a specific orientation of management science, "operations research". Hans P. Künzi, Professor of Operations Research and Electronic Data Processing, had lobbied in the early 1960's for the IBM 1620 to be installed at the University of Zurich. This was to catch up with other Swiss universities that already had their own computer facilities.[16] In 1969, the steadily increasing demand for computing power led to acquisition of a new computer for the university. In the early 1970s, the new IT equipment at the University of Zurich explicitly targeted students at upper secondary schools in addition to researchers, technical schools, and university training.[17]

The cantonal government in Zurich now provided schools with desktop computers. In addition, cooperation between upper secondary schools with the University of Zurich in terms of computer use was standardized. The state invested in the acquisition of and supported the implementation of appropriate infrastructure not only in universities, but also in schools. The goal was to give all upper secondary schools in Zurich access to computer technology.[18]

These early experiments with computer instruction in upper secondary schools remained limited in their impact. The courses were initiated by individual, sometimes highly influential local players. However, it quickly became clear to some of the stakeholders that at least a soft political coordination of the various efforts was needed if computer education was to be implemented on a broad scale. Now soft coordination began at a national level. In 1973, Pierre Banderet, a Swiss physicist who had learned about scientific computing in London in the 1950s, then worked for an important Swiss industrial company and set up the com-

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15 Felder, *La scolarisation*, 39–42.

16 "Ein Rechenzentrum an der Universität," *Neue Zürcher Zeitung*, January, 23 1963, Evening edition, sec. 6.

17 "Ein neues Computersystem für die Universität Zürich," *Die Tat*, December, 11 1971: 49.

18 StAZH/MM 3.133 RRB 1971/5302, Kantonsschule Rämibühl (ausserordentliche Kredite); StAZH/MM 3.151 RRB 1977/4344, Universität Zürich-Irchel (I. Bauetappe); StAZH/MM 3.133 RRB 1971/6219, Universität (Institut für Elektronische Datenverarbeitung, Stellenplan); "Elektronische Datenverarbeitung an der Mittelschule," *Neue Zürcher Zeitung*, March 8, 1972, Lunchtime edition: 27.

puting center at the University of Neuchatel,[19] conducted a survey devoted to computer science education in Switzerland's upper secondary schools. The patronage for this survey had been taken over by the Swiss Center for Continuing Education in Lucerne (WBZ), which was particularly concerned with the continuing education of upper secondary school teachers.[20]

Banderet's nonrepresentative survey described the use of electronic computers and calculators and numerous activities in computer science classes in the nation's upper secondary schools. A list of names compiled as part of the survey included a total of 106 teachers and administrators who had previously dealt with the issue of electronic computers. Although it was incomplete, the field of computer education seemed to be the concern of a small, dedicated interest group that was becoming increasingly networked.[21]

Banderet emphasized the role of the OECD's efforts in computer education, which would also guide Swiss experts. At a national seminar in the field of computer education in 1975, participants envisioned different applications for the classroom and established a coordination group to address the implementation of computer education in upper secondary schools throughout Switzerland. The task was to identify the educational as well as the political and administrative challenges that would stand in the way of a comprehensive introduction of computer science courses in schools.[22] The coordination group was chaired by Raymond Morel, who had already been engaged in the introduction of computer science courses in Geneva. Besides Morel and Banderet, teachers from various upper secondary schools in French- and German-speaking Switzerland were members of the group. The Swiss Center for Continuing Education in Lucerne (WBZ), the state authorities and the Swiss Federal Institute of Technology in Zurich (ETH) were also represented.[23]

The steering committee of the WBZ tasked the coordination group with writing a report for the state authorities, networking with other stakeholders in the field of computer education, coordinating and promoting ongoing initiatives, and organizing continuing education courses. It concluded that the core content of computer education could be taught in 24 hours. This introductory course was meant to be compulsory for all students in upper secondary schools and not related to specific

19 Alain M. Robert, "Pierre Banderet (1919–2008)," *Bulletin de la Société des enseignants neuchâtelois de sciences*, no. 34 (2008).

20 Pierre Banderet, "L'enseignement de l'informatique au niveau secondaire en Suisse," *Gymnasium Helveticum* 30, no. 2 (1976): 114–17.

21 Banderet, "L'enseignement."

22 Banderet, "L'enseignement."

23 Schweizerische Konferenz der Kantonalen Erziehungsdirektoren EDK, *L'introduction de l'informatique dans l'enseignement secondaire* (Geneva: Secrétariat CDIP, 1978), 26.

hardware or programming languages. Computer education was meant to be taught from the tenth grade onwards.[24]

The program "computer science in 24 hours" was now implemented in a pilot project. Furthermore, the coordination group, which had developed the curriculum and initial proposals for implementation, remained on the subject. The WBZ had course materials prepared. It was financially supported by the Association of Swiss General Upper Secondary School Teachers.[25]

However, the developments in the cantons and regions were still poorly coordinated. During a seminar in Davos in 1980, the challenge of implementing computer education nationwide in a decentralized country like Switzerland was discussed. In a study of developments in 11 cantons of German and French-speaking Switzerland, it was found that almost all upper secondary schools now offered some form of introduction to computer science. These courses were often voluntary. In total, 230 courses per year could be identified, involving more than 3000 students and 200 teachers at upper secondary schools.[26]

New Markets in a Decentralized Political System

As long as computers were expensive and large, no school could afford its own device. Public education only became an interesting market with the invention of smaller and cheaper digital devices. Announcements for the best hardware to use in schools were now increasingly appearing in the educational press. An early example is a 1976 advertisement by Digital Equipment Corporation (DEC) promoting its school computer called "CLASSIC".[27] The acronym CLASSIC stood for "Classroom Interactive Computer", and it comprised a PDP-8/A minicomputer as well as a floppy disk, a video terminal, a copier, and an operating system. The offer also included software and curricular materials.[28] DEC was an American company that had become very successful, especially in the minicomputer mar-

24 Schweizerische Konferenz der Kantonalen Erziehungsdirektoren EDK. *L'introduction*, 20–21.

25 WBZ, *Die Einführung der Informatik an den Mittelschulen: Zwischenbericht*. Informationsbulletin/Schweizerische Konferenz der kantonalen Erziehungsdirektoren = Bulletin d'information/conférence suisse des directeurs cantonaux de l'instruction public 29 (Geneva: Centre suisse pour le perfectionnement des professeurs de l'enseignement secondaire, 1982).

26 WBZ, *Die Einführung der Informatik*.

27 The advertisement appeared in the Schweizerische Lehrerzeitung on January 15, 1976.

28 Digital Equipment Corporation, *Digital Equipment Corporation: Nineteen Fifty-Seven to the Present* (Maynard, MA: Digital Equipment Corporation, 1978), 54.

ket.[29] In the USA, it provided the computer citizen movement with the necessary hardware infrastructure, programs, and a BASIC (Beginner's All-purpose Symbolic Instruction Code) primer.[30]

DEC's 1976 advertisement indicated the shift in the usage of smaller and cheaper devices for computer education. The advertisement had been published in the journal for elementary school teachers in German-speaking Switzerland, not in the journal for upper secondary schoolteachers. The accompanying text announced that with the CLASSIC even the "smallest school" would be able to afford a computer. Even though the price was still exorbitant compared to today's computer systems, it was significantly lower than that for early electronic computers. According to the provider, the CLASSIC was easy to use, contained the necessary hardware and software, mastered FORTRAN and BASIC, and could be used in the classroom as well as in school administration.[31] DEC's offerings were attractive because they came to schools as ready-to-go packages. In the mid-1970s the company even presented itself at the European Didacta education trade fair with school computers that could be connected to numerous peripheral devices and accessed simultaneously with several terminals.[32]

However, DEC's minicomputers were not the breakthrough for the computer as an educational device. The machines were still too bulky and expensive for a widespread sale. Computers didn't really become affordable for schools or municipalities until they made their way into private households as well.[33]

Since the early 1980s, experimentation with computers in elementary and upper secondary schools steadily increased. In the canton of Zurich, the cantonal school authority was charged with conducting an annual survey of computer use in lower secondary schools. In 1983, there were just 10 municipalities in which computers were used. In 1986, there were already 66 of them. Half of the municipalities had procured so-called home computers, 10 % implemented personal computers, and the remaining schools used programmable calculators.[34]

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29 For the history of Digital Equipment Corporation, see Glenn Rifkin and George Harrar, *The Ultimate Entrepreneur: The Story of Ken Olsen and Digital Equipment Corporation* (Rocklin, CA: Prima Pub, 1990).

30 Joy Lisi Rankin, *A People's History of Computing in the United States* (Cambridge, MA: Harvard University Press, 2018), 96, 100–101.

31 Schweizerische Lehrerzeitung on January 15, 1976, without pagination.

32 "Didacta Eurodidac Basel: 23.–27. März 1976," *Schweizer Schule* 63, no. 6 (1976): 173–199.

33 Gleb J. Albert, "Der vergessene ‚Brotkasten'. Neue Forschungen zur Sozial- und Kulturgeschichte des Heimcomputers," *Archiv für Sozialgeschichte* 59 (2019): 495–530.

34 StALU/A 1270/1738, Informatik in der Oberstufe der Zürcher Volksschule. Empfehlungen des Zürcher Erziehungsrates zuhanden der kommunalen Schulbehörden. Ausführliche Fassung gemäss Beschluss des Erziehungsrates vom 28. Oktober 1986, 3.

Among the cantons, the implementation of microcomputers in the schoolhouses in the first half of the 1980s was almost uncoordinated. Even within the cantons, many municipalities themselves ensured that their schools were provided with the appropriate infrastructure. However, this also meant that the procured computer types varied widely, and numerous providers competed with each other in this limited market. In a survey, the "Schweizerische Arbeitsgemeinschaft für Bildungsmittel"[35] asked its member schools in 1986 which hardware and software they had. Only vocational schools and upper secondary schools took part in the survey.[36]

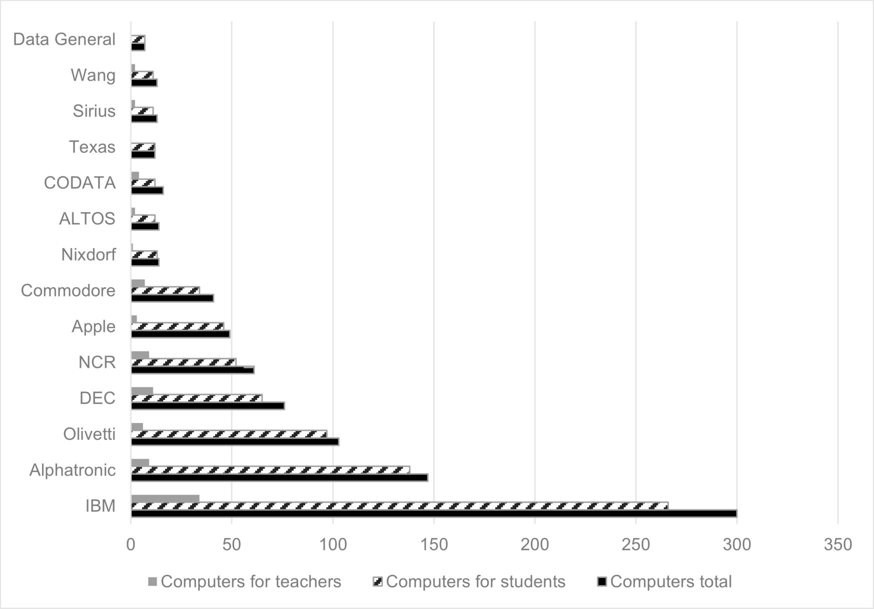

Fig. 1: Computers in Schools 1986. Source: StALU/A 1270/ 1710, SAB Umfrage vom 1. September 1986, Computer Hardware und Software in unseren Mitgliedschulen.

35 The "Schweizerische Arbeitsgemeinschaft für Bildungsmittel" SAB (= Swiss Association for Educational Media) was affiliated with the "Schweizerischer Kaufmännischer Verband" (=Swiss Commercial Association), the main umbrella organisation for white collar employees in Switzerland. See "Computer für Berufsausbildung," *Computerwoche*, October 15, 1982.
36 The responses came from 72 schools belonging to a total of 13 cantons in German-speaking Switzerland. The French- and Italian-speaking cantons and the elementary schools were not represented in the survey. See StALU/A 1270/1710, SAB Umfrage vom 1. September 1986, Computer Hardware und Software in unseren Mitgliedschulen.

According to this survey, the market in upper secondary education was dominated by three providers who had already been popular in the pre-digital age (see tab. 1). IBM had been successful with its tabulators and punched cards, and was then an important supplier for the mainframe computers that also found their way into state administration and universities in Switzerland. Triumph-Adler (Alphatronic) and Olivetti originated from typewriter manufacturers.[37] Only in fourth place was an original computer company. In fifth place was NCR corporation, another provider that had been established in the pre-digital age. This was followed by the computer manufacturers Commodore and Apple, and numerous other technology providers, which hardly carried any weight in these statistics (see fig. 1).

However, the companies were not only aiming for short-term profit, but also tried to establish themselves as hardware providers in the long term. This is evidenced by the donations of computers to schools and universities by a private company like IBM.[38]

The technology brands even found their way into public educational policies: in 1986, the Zurich Education Council, the main advisory body to the highest cantonal education authority, recommended that schools purchase "Apple Macintosh computers". This recommendation caused protests in the cantonal parliament. Apple computers were considered an expensive gimmick. Thus far, computer training for teachers had been done on IBM machines. Many municipalities had already purchased school computers that were at the bare minimum, IBM-compatible. It also seemed questionable whether Apple Macintosh, with its exclusive and incompatible offerings, would have any chance of surviving in the global market in the long run.[39]

In 1984, the intercantonal board of education ministers (EDK) began to address the issue of computer education.[40] The differences in computer education between cantons and municipalities were considerable in the 1980s. Due to the lack of legal competencies at a federal level, it was up to cantonal governments or even local school boards to initiate computer courses or equip schools with computer infra-

37 The same year the survey was conducted, Triumph-Adler was merged with Olivetti. Cf. Leonhard Dingwerth, *Die Geschichte der deutschen Schreibmaschinen-Fabriken: 1. Große und mittlere Hersteller* (Delbrück: Verlag Kunstgrafik Dingwerth, 2008), 29.

38 "140 Personal-Computer geschenkt," *Neue Zürcher Nachrichten*, November 14, 1984: 2; "Kollegi Stans erhält fünf Computer geschenkt," *Nidwaldner Volksblatt*, November 27, 1984: 3; "Die Informatikausbildung fördern," *Thuner Tagblatt*, September 11, 1985: 5; "Fünf Computer gratis!," *Walliser Bote*, February 26, 1985.

39 StAZH/MM 24.119 KRP 1987/221/0008, Interpellation Andreas Ganz (SVP, Wädenswil) vom 5. Januar 1987 betreffend Schulcomputer (schriftlich begründet, Antwort vom 4. Februar 1987).

40 StALU/A 1270/1732; Antonio Palmier, *Informatik in der Schweiz, Stand und Trends* (Bern: EDK, 1986), 1.

structure. Where government initiatives were missing, hardware and software were implemented only where the municipalities or the schools and individual teachers were active participants. In this political context, only soft governance approaches seemed possible. EDK's soft governance of computer education was institutionalized through various committees. The "joint committee on computer science" was intended to ensure that general and vocational education did not diverge too much. In addition, there was an "Elementary School Working Group" and a "Secondary School Working Group" for general education. Once a year, a colloquium was held in Interlaken and a study week in Davos, where the central challenges of computer education throughout Switzerland were discussed.[41]

However, hardware in the classrooms did not guarantee the use of these new technologies. In the spring of 1985, the EDK started a monitoring to determine the status of computer education in the cantons. Already in the fall of the same year, a second, similar survey was conducted, which was then supplemented again in 1986. The rapid succession of these surveys indicate how dynamic developments were in the mid-1980s.[42] Even between these close survey dates, the EDK noted an increase in activities in the elementary school sector. In some reports, amplified intercantonal cooperation was reported. In many places, action committees were formed and pilot projects were started. Again, the use of products from a whole range of computer manufacturers in elementary schools is striking, from Olivetti and IBM, to Apple and Commodore, and the Swiss school computer SMAKY, which was used primarily in French-speaking Switzerland.[43]

While the proliferation of elementary schools could only be gently harmonized for constitutional reasons, other solutions were available for vocational schools and general upper secondary education. In vocational schools, apprentices in all trades throughout Switzerland since 1985 had to receive at least 20 lessons of introduction to computer science. As a rule, this already took place in the first year. In addition, there were opportunities to voluntarily go deeper and learn a programming language such as BASIC. However, in the vocational schools', computer science was not taught as a separate school subject, but could be integrated anywhere.[44] The "Computer Science for All" program for vocational schools was

41 Schweizerische Konferenz der kantonalen Erziehungsdirektoren EDK. *Jahresbericht 1984/85*. Berne: EDK, 1985, 18.

42 StALU/A 1270/1732; Palmier, *Informatik*.

43 StALU/A 1270/1732; Palmier, *Informatik*, 5–7. The acronym "SMAKY" stood for "SMArt KeYboard". See "La Suisse et l'aventure Informatique," *Tracés: Bulletin Technique de La Suisse Romande* 128, no. 18 (2002), 31.

44 "Informatik im Berufsschulunterricht," SMUV-Zeitung, August 27, 1986; "BIGA-Projekt ‹Informatik für alle›," *Schweizerische Blätter für beruflichen Unterricht* 109, no. 12 (1984): 339–342.

first rolled out in the German-speaking part of Switzerland, afterwards the other language regions followed suit. In March 1986, the Swiss government was informed that at least one teacher per school had now been sufficiently qualified at all vocational schools in Switzerland. This candidate was then to instruct their other colleagues in a so-called "snowball system".[45]

Computer education was now declared compulsory in general upper secondary education. Almost every school in upper secondary education already offered some form of a mandatory 30-lessons introduction into computer science.[46] Policy stakeholders and educational experts set out to revise the pilot program of the 1978 "Computer Science in 24 hours". The opportunity arose due to the reformation of the upper secondary school curriculum. Since 1986, all upper secondary schools were required to offer an introduction to programming and computer science.[47] However, the government declined to create a separate computer science subject for upper secondary schools. It was to be left to the schools or the cantons to decide at which level they would offer an introduction to computer science. The introduction could be integrated with the mathematics lessons, but this was not compulsory.[48]

These tentative attempts of a central implementation of computer education show that the new challenges were recognized, but that policy stakeholders did not yet know how to respond. However, the statistics show that at least the technical infrastructure in the school buildings was slowly improving. A comprehensive national survey in the late 1980s illustrates that computer hardware was increasingly finding its way into schools. The percentage of computers per school was highest in vocational education, followed by general secondary education. Lower secondary schools had the fewest devices per school (see table 1).

45 BAR/E7001C#1997/2#1229*, Notiz für Herrn Bundesrat Kurt Furgler, Referentenkurse Informatik für alle (Medienverbundpaket Blackbox), March 5, 1986.

46 StALU/A 1270/1732; Palmier, *Informatik*, 8–9.

47 Schweizerische Konferenz der Kantonalen Erziehungsdirektoren, *Informatik-Einführungskurse an den Maturitätsschulen = Cours d'initiation à l'informatique dans les écoles de maturité.* EDK-Reihe Dossier 6 (Bern: Sekretariat EDK, 1987).

48 Eidgenössische Departement des Innern, "Kommentar zur Teilrevision der Maturitätsanerkennungs-Verordnung (MAV) vom 2.6.86, 2.2 Informatik," *Gymnasium Helveticum* 40, no. 4 (1986): 215–216.

Tab. 1: Computers per school in Switzerland.[49]

	Lower secondary schools		Upper secondary schools		Vocational schools (industry and crafts)		Vocational schools (office professions)		
	total	**average per school**	**total**	**average per school**	**total**	**average per school**	**total**	**average per school**	**total**
1985	1012	2.8	976	7.5	547	9.9	550	9.4	3085
1986	1553	4.0	1311	9.9	837	14.8	751	13.1	4452
1987	2078	5.2	1777	13.2	1092	19.0	1057	18.1	6004
1988	2768	6.5	2085	15.1	1356	23.6	1441	24.7	7650
1989	4009	9.1	2490	17.6	1677	29.2	1947	32.3	10123
1990*	4749	11.1	3144	22.8	2060	36.5	2298	38.8	12251

Educational Software and the Promise of the Internet

However, the survey was not solely about the hardware present in schools. It also questioned the use of software, which was now more central to the general discussion on computers in education. The most popular software were word processing programs, database software, programs for spreadsheets or for learning programming languages. The authors of the report noted that the availability of specialized software for individual school subjects was not the central concern. Rather, advanced computer education often seemed to fail because of the missing implementation of the software in classroom teaching.[50]

It seemed clear to the educational stakeholders that they had to become engaged in software issues. Evaluation by the public authorities or even standardization of educational software, however, had no strong lobby in Switzerland. When the director of the "Swiss Agency for Information Technologies in Education" (SFIB),

49 Ruedi Niederer and Eidgenössische Technische Hochschule Zürich Departement Informatik, *Computernutzung im Fachunterricht: Obligatorische Schulen, Mittelschulen, Gewerblich-Industrielle Berufsschulen, Kaufmännische Berufsschulen* (Zürich: Departement Informatik ETH Zürich, 1992).
50 Ruedi Niederer, *Informatik und Computernutzung im schweizerischen Bildungswesen: Bestandsaufnahme 1989 = Informatique et utilisation de l'ordinateur dans les écoles suisses: état de situation 1989.* Informatik und Computernutzung im schweizerischen Bildungswesen, Band 1 (Zürich: ETH Eidgenössische Technische Hochschule Informatikdienste, 1990), 15, 55.

founded in 1988, was asked in an interview about his political agenda, he first made a commitment to Swiss federalism and then emphasized that even the agency's own comprehensive database for educational software, called "Logithèque", was a mere inventory, which was not accompanied by any evaluation.[51] The database intended to help teachers find the right computer programs for their purposes; it did not have to be built from scratch. The new database exploited other databases from cantonal authorities or documentation centers that already existed. SFIB now wanted to make the information available to those cantons and regions that lacked the money or the will to list the existing and suitable educational software themselves. The Logithèque database initially could only be used on Mac computers as it had been developed for Filemaker. However, SFIB also announced a DOS version and even offered to provide an extract on paper.[52]

SFIB's engagement in software issues reflected a more general trend: the focus in computer education in the 1990s moved away from teaching programming skills to the use of application software. This change is also reflected in the curriculum reforms. The compulsory introductory courses in computer science at general upper secondary schools were abolished in 1994 in favour of a more transdisciplinary approach. The protest of computer science and computer science teachers had not been able to prevent this.[53]

Schools needed programs that were also used in offices and homes to prepare students for future tasks. The software producers and IT vendors, on the other side, had an interest in ensuring that their products would also be paid for. In this context, teachers suddenly found themselves accused of illegal piracy.[54] Many schools, however, could not or did not want to afford the software licenses, especially for commercial office software. In the 1990s, the SFIB therefore inspected the problem of copyright in the software sector.[55]

A Switzerland-wide solution could now be found regarding the piracy problem in education. However, it had to be clarified first who had the competence to ne-

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51 "Interview mit dem Leiter der SFIB," *Interface*, no. 2 (1992): 8–9.

52 "La Logithèque," *Interface*, no. 3 (1992): 8; "LOGItheque," *Interface*, no. 2 (1996): 41.

53 Michael Geiss, *Gymnasiale Bildung in der digitalen Gesellschaft: réflexions et recommandations du Conseil suisse de la science CSS = Überlegungen und Empfehlungen des Schweizerischen Wissenschaftsrates SWR: Expertenbericht.* SWR Schrift 1/2021 (Bern: Schweizerischer Wissenschaftsrat SWR, 2021), 37.

54 Carl August Zehnder, "Darf man Software kopieren? Einige Gedanken zum Software-Schutz und seinen Folgen," *Interface*, no. 1 (1992): 21–22; Carl August Zehnder, "Rechtsschutz von Computerprogrammen: Das neue Urheberrecht aus der Sicht der Informatiker," *Informatik*, no. 2 (1994).

55 StALU/A1427/2054, Minutes of the SFIB Board Meeting of 15 September 1993, 3–4; StALU/A1453/556, SFIB Annual Report 1994, 2, 5; SFIB Annual Report 1995, 5; StALU/A1453/557, EDK & BIGA, Software: Rahmenvereinbarungen für die Schulen.

gotiate a framework agreement with the software companies for all types of schools in this highly decentralized country.[56] The schools themselves were to invest cautiously in software while the negotiations were still underway.[57] There was a risk that individual schools or cantons would thwart the attempt to find a central solution.[58]

Since 1994, the SFIB negotiated with numerous software providers to conclude framework agreements with them. The aim was not simply to use the companies' existing educational licenses, but to negotiate better conditions for all schools at all levels of study. SFIB wanted to reduce the effort and cost of software use in schools. While the smaller providers were quickly willing to reach agreements, the negotiations with the market leader Microsoft turned out to be more complicated.[59] The first framework agreements were concluded with the companies WordPerfect and Lotus. These applied to all "public and state-subsidized schools".[60]

It took until 1996 for SFIB to finally announce that they had also reached a framework agreement with Microsoft. The head of SFIB took the opportunity to point out to the educational authorities that it was their responsibility to push computer education in the classrooms.[61] Teachers would now be allowed to install the software on their private devices. Schools were allowed to equip ten personal computers with each license purchased. Compared to the usual market prices for individual licenses in private households, this meant only a tenth of the costs. These conditions applied until the end of 1999 and then had to be renegotiated.[62]

Since the late 1980s, another topic had already become the focus of some educational experts in the public authorities and professional associations. The growing number of databases that could be accessed via telephone lines increasingly served not only as information storage, but also for communication and self-promotion. Some electronic databases, such as the educational documentation center "Resedoc", the "Réseau suisse de documentation éducationnelle", had a history that even reached into the pre-microcomputer period.[63]

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56 StALU/A1453/135, SFIB Annual Report 1993, 3.

57 "Bewegung in der Softwareszene," *Interface*, no. 4 (1993): 11.

58 "Software für den Schulunterricht," *Interface*, no. 1 (1994): 57.

59 StALU/A1453/556, SFIB Annual Report 1995, 2.

60 "Rahmenvereinbarungen WordPerfect und LOTUS," *Interface*, no. 2 (1994): 62–63.

61 "Microsoft Schweiz schliesst Vertrag mit der SFIB ab," *Interface*, no. 1 (1996): 38.

62 "Schulen gegen Microsoft," *Swiss IT Reseller (online)*, no. 3 (2000). https://www.itreseller.ch/Artikel/2227/Schulen_gegen_Microsoft.html.

63 The history of Resedoc is currently being researched by Fabian Grütter and will also be presented in a forthcoming article. For the idea behind the documentation center, see "[Editorial and Overview]," *Schweizerischer Dokumentationsverbund im Bildungswesen: Bulletin* 0, no. 1 (1988); Urs

In 1987, the Swiss government announced “Videotex”, after “Bildschirmtext” had already been launched in Germany and “Minitel” in France.[64] For the various educational institutions and stakeholders, however, the information and communication offer of the private Zurich based company “ComNet” became the playground of progressive and technology-savvy actors. “ComNet” and the “Data Star” package offered by the Bernese company “Radio Schweiz” dominated the Swiss market for database access at the end of the 1980s. ComNet had the advantage over Videotex and other providers that it did not require a personal computer with Vtx functionality and offered both telecommunications and database access.[65]

While these services were already being used in a few business sectors, their use by ordinary consumers remained too expensive, too cumbersome and also too uninteresting.[66] Since 1986, the Swiss intercantonal board of education ministers (EDK) organized an electronic mailbox system via Comnet, which by 1989 was already serving as an online contact point for about 100 institutions.[67] In Zurich, individual vocational school teachers were seconded to learn about telematics and were accompanied by other experts since 1986. The focus here was on electronic communication and database use, but also on setting up so-called “wide area networks”. The members of this study group were to try out the applications themselves and then pass on their knowledge to other vocational schoolteachers as multipliers in the form of courses and publications. By using ComNet, they wanted to involve others who lived further away.[68]

At the end of 1989, ComNet agreed with the intercantonal board of education ministers EDK and the SFIB to launch a pilot project for trial in the field of telematics, called “ComNet-B”. On the one hand, the project was to serve the development of its own information channels. On the other hand, it was also planned to establish a “nationwide ‘closed user group’ of all persons and institutions from the education sector”. However, the project should not only focus on building this electronic network for others. Rather, the electronic means of information and commu-

Hochstrasser, “Der Bund und die Bildungsforschung in einem föderalistischen Staat,” *Bildungsforschung und Bildungspraxis: Schweizerische Zeitschrift für Erziehungswissenschaft* 8, no. 1 (1986): 84.

64 Marielle Stamm, “La saga du Vidéotex,” *Geschichte und Informatik – Histoire et informatique* 17 (2009): 143–164.

65 “Das globale Dorf rückt näher,” *Interface*, no. 1 (1987): 48–51.

66 “Für Datenbank-Abfragen gilt die Hauptregel: Gewusst Wo,” *Der Bund*, April 26, 1988: 8.

67 StALU/A1427/92, Nouvelles technologies de l’information et de la communication en Suisse: Formation, recherche et développement. Mise à jour du rapport. Formation à l’informatique en Suisse, 7.

68 “Arbeitsgruppe Telematik,” *Interface*, no. 1 (1987): 45.

nication should be tested right away by the project team and, if possible, the project itself should be handled as far as possible via ComNet.[69]

The EDK published information on ongoing cantonal IT school projects, announced events and teaching materials via ComNet. The content also came from other computer-centred projects. For example, the catalogue of the "Schulfilmzentrale Bern" with about 3,000 entries could be accessed via ComNet. Teachers could not only browse through the belongings of this public film provider via ComNet, but also order the required school film straight away.[70]

The mailbox system was also increasingly used for electronic communication between the participants. By 1990, there were already 130 participants who helped each other with technical questions and maintained their network via ComNet.[71] Access to a personal computer, a telephone connection, and a modem were required. The EDK advised against using a cheaper acoustic coupler instead of a modem. Some of the necessary software could even be obtained free of charge or would be part already of other software packages. For the use of ComNet, a connection fee and a monthly fee had to be paid, whereby more affordable rates were offered for educational institutions.[72]

Other databases or communication systems were much more focused on education than ComNet and they pursued a more focused educational agenda. In the canton of Bern, the so-called "Middle School Information System" (MIS) was created, which was to be particularly oriented towards the needs of teachers and was also driven by teachers. After a development period in the years 1986–1988, the MIS was managed from Berne for several years. The system should be used for communicating and publishing. It would provide information and make databases accessible for students from upper secondary schools as well as teachers.[73] The use of the MIS itself was free. However, telephone costs were incurred all the way to Berne and the hardware had to be procured.[74]

In the late 1980s, ambitious database projects were also launched in career counselling. In the canton of Zurich, the government approved a loan of two million francs in 1988 for the development of an information system, which was given

69 StALU/A1427/93, Agreement on the project ComNet-B, December 7, 1989.

70 StALU/A1427/1180, Leaflet ComNet-B [1990].

71 "Die ‹SLZ› via Modem?," *Schweizerische Lehrerzeitung* 135, no. 2 (1990): 37–39.

72 StALU/A1427/89, Correspondence EDK Commissioner for IT to Head of Commercial Vocational School Meiringen, October 9, 1989.

73 "MIS – Berner Mittelschulen auf Draht," *Interface*, no. 4 (1992): 44–45.

74 "Sonderbulletin MIS," *Informatik und Unterricht: Informationsbulletin zur Informatik an Höheren Mittelschulen des Kantons Bern,* no. 16 (1992); "Das Mittelschul-Informationssystem (MIS)," *Interface*, no. 2 (1995): 46–48.

the acronym ZEUS.[75] In parallel, the national government was already making extensive efforts to establish a national career guidance information system to be run under the acronym CH-OR, "CH-Orientation".[76] In addition, a continuing education exchange (WAB) was to be established. Many of these database projects turned out to be much more complicated, costly, and personnel-intensive than initially planned.[77] But online databases and telematics remained on the agenda of the educational experts.[78]

All the elaborate projects to create local or national networks through which to communicate and provide information suddenly looked old when the World Wide Web (WWW) began to take hold in Switzerland and E-mail services became more affordable. At the same time, general internet use in Switzerland rose only very gradually at first. In 1997, just 17 percent of respondents said they had used Internet services at some time in the past few months. In some service sectors, on the other hand, there was already a veritable Internet boom in the mid-1990s.[79]

However, the educational experts were unable to resist the general internet euphoria. The wider use of the World Wide Web (WWW) seemed to make many of the problems of previous software in education seem solvable at once. From now on, digital learning services that functioned independently of the operating system seemed possible. Software piracy became less likely when courses and learning tools were offered online. The integration of different media and the hypertext structure also seemed to fit perfectly with the contemporary requirements for educational software. Learning analytics now also seemed much more feasible on digital learning platforms as much larger amounts of data could be collected and analyzed centrally. The dawn of the Internet brought on a new era of envisioned "computer-based training".[80]

This platform-independent centralization was not only found as an educational vision in software development, but also as a political program. The internet seemed to enable new modes of educational governance that were previously hardly imaginable in the highly decentralized country. These were much more ori-

75 "Projekt CH-OR," *Berufsberatung und Berufsbildung*, no. 1 (1989): 44–47.
76 BAR/E3340B#2011/57#509*, Projekt CH-OR: EDV in der Berufsberatung. Schlussbericht: Voranalyse, Bd. 1–3.
77 StAZH/MM 3.203 RRB 1994/0338, II. Mitteilung an die Mitglieder des Kantonsrates und des Regierungsrates sowie an die Direktion des Erziehungswesens; StAZH/MM 3.203 RRB 1994/0339, Interpellation (EDV-Projekt "Zeus" der Allgemeinen Berufsberatung).
78 StALU/A1453/955, SFIB Annual Report 1996, 5.
79 Peter Haber and Jan Hodel. "Internet," *Historisches Lexikon der Schweiz (HLS)*, December 20, 2018. https://hls-dhs-dss.ch/de/articles/048816/2018-12-20/.
80 "CBT via Internet," *Interface*, no. 2 (1995): 10–13.

ented to the idea of the “network” than to traditional concepts of a decentralized federalism or liberal corporatism.[81] In 1995, the Educational Technology Unit (TECFA) and the University of Geneva joined forces with the Swiss Centre for Information Technology in Education (SFIB), the Swiss Coordination Centre for Educational Research (SKBF), the Geneva “Service de la recherche en education” (SRED), and the Central Office for the Continuing Education of Secondary School Teachers (WBZ) to install a server in Geneva. The aim of this pilot project was to create a national “virtual research community”. The project was financed by the Swiss National Science Foundation. For the Swiss Centre for Information Technology in Education (SFIB), AGORA provided the opportunity to learn from previous experiences with database projects and to feed its products and platforms into a new system. The central issue was to keep the information as up-to-date as possible. AGORA was seen as a way for schools to embrace the internet across Switzerland.[82] The latest versions of the framework agreements with the software providers were also made available on the AGORA website.[83]

In June 1997, SFIB launched a so-called “offensive” to bring “schools to the Internet”. On the one hand, the aim was to improve the supply of schools with Internet access. But then, above all, the educational use of the Internet was to be promoted.[84] To this end, the SFIB took its cue from initiatives already underway in other countries. It organised so-called “Netd@ys”, as they had already gained the support of President Bill Clinton and his Vice President Al Gore in the USA in 1996 and were also imitated by the European Communities.[85] This action program was all about public-private partnerships. The aim was to find companies that wanted to participate in the initiative. In Switzerland, the first “Netd@ys” were sponsored by Microsoft, Cisco Systems or Apple, but also by the national telecommunications company Swisscom and several Swiss traditional publishers of teaching materials.[86]

The Internet, like the electronic computer before it, was seen by educational experts as a future technology with which pupils should be familiarized as early

81 Michael Geiss, “In Steady Search for Optimization: The Role of Public and Private Actors in Switzerland’s Political Economy of Adult Education,” *Journal for Research on Adult Education* 43, no. 2 (2020): 227–239, https://doi.org/10.1007/s40955-020-00157-0.

82 StALU/A1453/955, Minutes of the SFIB Board Meeting of 20 September 1996.

83 StALU/A1453/955, SFIB Annual Report 1996, 2.

84 StALU/A1453/1395, SFIB, Lernen ohne Grenzen. Schweizer Schulen ans Internet. Eine Offensive der Schweizerischen Fachstelle für Informationstechnologien im Bildungswesen SFIB, June 4, 1997.

85 Victoria Cain, *Schools and Screens: A Watchful History* (Cambridge, MA: MIT Press, 2021), 166–167; European Commission, *General report on the activities of the European Union 1997* (Brussels and Luxembourg: European Commission, 1998),129.

86 “Bilanz der Netd@ys97,” *Interface*, no. 4 (1997): 34–35.

as possible. At the same time, the different stakeholders worked towards exploiting the educational potential of the internet. The internet seemed to be a global encyclopaedia with an almost inexhaustible and constantly growing pool of knowledge that schools could finally make use of. In a report for Switzerland's public TV channel from 1997, for example, all representatives of the political authorities and private associations confirmed the great importance of the internet.[87] At the same time, SFIB was concerned that a problem that had already occurred with "ComNet" could repeat itself: if the information on the Internet was sparse or outdated, users would quickly turn away and the educational potential would not be unleashed.[88]

The Urge to Centralize in an Emerging Digital Society

The results of all the various initiatives from the 1980s and 1990s were mixed. At the millennium, a representative survey for Switzerland concluded that at the lower secondary level, 93 percent of schools had Internet access. At the primary level, this was still 53 percent. At the same time, computers were available to students in nearly all lower secondary schools. At the primary level, this was still the case in 73 percent of schools. However, computer equipment in these schools was still modest. There was just one computer for every 12.8 students in compulsory education.[89]

The digital journey was far from over. In 1998, the Swiss government launched a "Federal Council Strategy for an Information Society in Switzerland" in which it considered the information and communications technologies as a political priority.[90] Among other things, the strategy paper resulted in different endeavours in the field of education, which, in addition to technical infrastructure of the schools and educational materials, were to include the further qualification of teachers.[91]

87 "Schulen ans Internet," *Schweiz Aktuell*, June 12, 1997, https://www.srf.ch/play/tv/-/video/-?urn=urn:srf:video:9fda53b7-c689-4815-823c-9c4df95bb5f0.

88 StALU/A1453/955, Minutes of the SFIB Board Meeting of September 20, 1996.

89 Schweiz Bundesamt für Statistik, *Informations- und Kommunikationstechnologien an den Volksschulen in der Schweiz: Untersuchung im Auftrag des Bundesamtes für Statistik*. Statistik der Schweiz. Fachbereich 15, Bildung und Wissenschaft (Neuchâtel: Bundesamt für Statistik, 2002).

90 Schweizerischer Bundesrat, "Strategie des Bundesrates für eine Informationsgesellschaft in der Schweiz," February 18, 1998 (Bundesblatt 1998 III 2387).

91 Schweizerischer Bundesrat, "Botschaft zum Bundesgesetz über die Förderung der Nutzung von Informations- und Kommunikationstechnologien in den Schulen," August 22, 2001 (Bundesblatt 2001 5957).

However, the situation had already changed. The age of digital platform economies was dawning, which would once again present digital societies with entirely new challenges.[92] With the digital platform economy, the question of centralization and decentralized political structure in Switzerland presented itself in a completely new and different way. This had already been announced in connection with the national framework agreements with Microsoft and other companies in the mid-1990's. The threat now seemed to originate in the enormous market power of individual global software providers, who could thus put their stamp on education and dictate their terms to educational administrations and public schools.[93]

The challenges for a decentralized education system like Switzerland's now came from the outside and no longer from overambitious national education reformers. In the reform initiatives since the late 1970s, the political stakeholders in Switzerland had always made it a point not to use the computer to unhinge the decentralized system. At the same time, widespread implementation of the computer in the classroom necessitated a degree of standardization. Computer education had to be based on shared school subject standards. Educational software asked for shared hardware standards, while digital networks required shared technical protocols. This urge to centralize was established from the early history of "digital federalism".[94] However, Switzerland's educational stakeholders did everything in their power not to submit to technological determinism. They made use of their political leeway.

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BAR = Federal Archives Berne
StALU = State Archives Lucerne
StAZH = State Archives Zurich
StadtA ZH = Zurich City Archives

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93 Julian Sefton-Green and Luci Pangrazio, "Platform Pedagogies – Toward a Research Agenda," in *Algorithmic Rights and Protections for Children* (2021), https://doi.org/10.1162/ba67f642.646d0673.
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Part II: **Trans- and Supranational Perspectives**

Karin Priem

Entangled Media Ecologies: The Nexus of Education and Mass Communication from the Perspective of UNESCO (1945–1989)

Abstract: This chapter posits that textbooks, radio, TV, film and computers served as interconnected elements in UNESCO's educational mission. By looking at these media ecologies, the chapter connects research into the history of education with research into UNESCO's media policies. This conceptual history approach demonstrates that education is not only based on ethical norms, teaching and learning but is also connected to technological properties that offer access to knowledge and its acquisition. In addition, when studying UNESCO, it is evident that the organization's education-technology nexus is also closely linked with the media and publishing industries. UNESCO's initiatives testify to the organization's commitment to innovating education by blending old and new technologies. The chapter therefore highlights not only changes but also continuities when it comes to educational technologies and their promotion. Each type of educational medium had its place and contributed to UNESCO's mission to become a mediator and world leader in education.

Keywords: media ecologies; multimedia environments; media policies; education-technology nexus; UNESCO.

Introduction

In the field of history of education, numerous studies are devoted to the history of educational media and the evolution of educational technologies.[1] This chapter focuses specifically on the implications and conceptual background of the technolo-

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1 E. g., Larry Cuban, *Teachers and Machines: The Classroom Use of Technology* (New York and London: Teachers College Press, 1985); David H. Jonassen, ed., *Handbook of Research for Educational Communications and Technology*, 2nd ed. (London: Laurence Erlbaum, 2004); Paul Saettler, *The Evolution of American Educational Technology*, 2nd ed. (Greenwich: Information Age Publishing, 2004); David W. Kritt and Lucien T. Winegar, eds., *Education and Technology: Critical Perspectives, Possible Futures* (Plymouth: Lexington Books, 2007); J. Michael Spector et al., eds., *Handbook of Research on Educational Research and Technologies*, 3rd ed. (New York: Routledge, 2008); Bill Ferster, *Teaching Machines: Learning from the Intersection of Education and Technology* (Baltimore, MD: John Hopkins University Press, 2014).

https://doi.org/10.1515/9783110780147-008

gy-driven idea of education developed by the United Nations Educational, Scientific and Cultural Organization (UNESCO), which had already taken shape before the 1957 Sputnik shock. By the late 1940s, eager to establish strong bonds between mass communication and education, UNESCO had already begun to establish a powerful internal apparatus for media policy which soon collaborated closely with its Education Division. From the late 1970s, UNESCO set out to establish a "New World Information and Communication Order" to further stabilize its global role in education and media policies.

This chapter posits that textbooks, radio, TV, film and computers served as interconnected elements in UNESCO's educational mission. By looking at these specific technological ecologies of education, I connect research into the history of education with research into UNESCO's media policies. This conceptual history approach demonstrates that education is not only based on ethical norms, teaching and learning but is also connected to technological properties that offer access to knowledge and its acquisition. In addition, when studying UNESCO, it becomes evident that the organization's education-technology nexus is also closely linked with the media and publishing industries.

One of the core missions of UNESCO was to eliminate educational imbalances and to harness technological developments in mass communication and educational reforms to achieve the goal of changing attitudes and minds. Until the end of the 20th century, UNESCO's mission was focused on cooperation, solidarity and peace, fostering values rooted in Western philosophical traditions and beliefs.

UNESCO has always seen access to communication technologies for education (whether distance or in-person learning) as crucial, not only to overcome social, technological and economic divides but also to cope with the effects of various crises including epidemics and pandemics.[2] To this day, UNESCO envisions education as essential for the transformation of a fragile and uncertain world; it explicitly and uniquely connects issues of communication technology and education, focusing in particular on various media and devices.[3]

This chapter suggests that UNESCO-supported distance education via radio, film, television and computer-based learning and teaching should be analyzed as a series of entangled media ecologies designed to support humans and societies in their development by offering access to knowledge and the wider (Western) world. Many of UNESCO's initiatives testify to the organization's ongoing commitment to innovating education by blending old and new technologies. Educational

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2 See "Learning through Radio and Television," UNESCO, last modified April 21, 2022, https://en.unesco.org/news/learning-through-radio-and-television-time-covid-19.

3 See e. g., the following article that appeared in the *UNESCO Courier* at the beginning of the COVID-19 crisis: "Radio: Stronger and More Vibrant than Ever," https://en.unesco.org/courier/2020-1.

media, including textbooks, continue to co-exist rather than replacing each other; current multimedia and multimodal learning environments include diverse channels of communication and interaction among learners as well as between learners and teachers. The chapter therefore highlights not only changes but also continuities when it comes to educational technologies and their promotion. Each type of educational medium had its place and contributed to UNESCO's mission to become a mediator and world leader in education.

To better understand UNESCO's specific way of connecting education and mass communication, I will first look at its media policies after the Second World War. Viewing educational media as interconnected technologies, I will then focus on the educational and technological components of UNESCO's involvement in textbook revision and education by means of radio, television and film. Finally, I will examine how UNESCO supported the spread of computer-based learning technologies. I will also offer a brief overview of how UNESCO promoted its work, mission and vision through word, sound and (moving) images in order to engineer and achieve global and local consent.

UNESCO's Media Policy

UNESCO was founded in 1945 as a specialized agency of the United Nations (UN). Its media and educational policies were established within the wider context of the Universal Declaration of Human Rights adopted by the United Nations in December 1948. UNESCO aimed to foster education, cultural exchange and the circulation of knowledge based on universal ethical standards that in turn would enable the "translation" and "communication" of human rights in politically, culturally and economically diverse world regions.

The Declaration of Human Rights originated from ideas of the European Enlightenment and from Anglo-Saxon liberal thinking and inherent anthropocentric world views that were based on human freedom and sovereignty without distinction of race, sex, language or religion.[4] Accordingly, article 19 of the Declaration of Human Rights also specifies that "Everyone has the right to freedom of opinion and expression" and that "this right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers."[5] Over time UNESCO developed a specific

4 UNESCO Constitution, November 16, 1945, plus amendments, https://www.unesco.org/en/legal-affairs/constitution.

5 See https://www.un.org/en/universal-declaration-human-rights/.

style of thought that was very much based on its claim to be a world leader in education and a moral authority that represented universal values. UNESCO shared this aspiration for moral and cultural world leadership with US cultural policies. During the Cold War, one of the most prominent examples of North American cultural diplomacy – centered around what was perceived in the US at that time as universal human values – was the traveling exhibition The Family of Man, first shown at the Museum of Modern Art in New York in 1955.[6] UNESCO's Human Rights Exhibition, which opened at the Musée Galliéra in Paris in October 1949, is said to be the forerunner of The Family of Man. It also traveled the world as an example of cultural diplomacy and claimed moral supremacy.[7]

UNESCO's Human Rights Exhibition showed and propagated the results of a long-lasting process of canonization that silenced the controversial debates, disagreements and fundamental intellectual differences that had developed around the United Nation's Human Rights Project and a related UNESCO survey. In "Letters to the Contrary: A Curated History of the UNESCO Human Rights Survey," edited by anthropologist Mark Goodale, we find an abundance of survey responses and related historical documents that testify to the diversity of human values among intellectuals around the globe.[8] The survey was conducted between early 1947 and late 1948 and the idea of human rights at the time was "associated by its critics with a small cluster of Western national traditions (notably the American and French)" and "viewed as the unmistakable normative underpinning of capitalism."[9]

UNESCO's rights-based approach has emphasized freedom as a universal central value of humanity. However, the idea of freedom has also underpinned and justified national policies, armed conflicts, the sovereignty of empires and colonial powers, the exclusion of indigenous knowledge and experience, geopolitical imbalances, and national borders – all of which represented obstacles to accessing un-

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6 Eric J. Sandeen, *Picturing an Exhibition: The Family of Man and 1950s America* (Albuquerque, NM: University of New Mexico Press, 1995); Jean Back and Victoria Schmidt-Linsenhoff, eds., *The Family of Man 1955–2001 – Humanism and Postmodernism: A Reappraisal of the Photo Exhibition by Edward Steichen* (Marburg: Jonas, 2004); Karin Priem and Geert Thyssen, "Puppets on a String in a Theatre of Display? Interactions of Image, Text, Material, Space and Motion in The Family of Man (ca. 1950s–1960s)," *Paedagogica Historica* 49, no. 6 (2013): 828–845.

7 Stefanie Kesteloot, "Mediating the Rights to Education: An Analysis of UNESCO's Exhibition Album on Human Rights and Its Global Dissemination in 1951," in *Media Matter: Images as Presenters, Mediators, and Means of Observation*, ed. Francisca Comas Rubí, Karin Priem and Sara González Gómez (Berlin: De Gruyter, 2022), 141–166.

8 Mark Goodale, ed., *Letters to the Contrary: A Curated History of the UNESCO Human Rights Survey* (Stanford, CA: Stanford University Press, 2018).

9 Goodale, *Letters to the Contrary*, 8.

biased information and education.[10] Additional barriers for participation in what UNESCO called the "free flow of information" were import and export regulations and the need for technological know-how.[11] In a nutshell, UNESCO's fight for the "free flow of information" can be linked to political liberalism, capitalism and ideas of progress and growth, all of which are deeply rooted in US policies and the country's ambition to achieve cultural, economic and technological supremacy in the name of freedom.[12]

By the late 1940s, UNESCO had already begun to set up a powerful internal apparatus for media policy which soon collaborated closely with its Education Division.[13] From the late 1970s, UNESCO had set out to establish a "New World Information and Communication Order."[14] This initiative let to several crises between UNESCO and its member states in the East, the West and the so-called Global South. The conflicts highlighted lingering disagreements about cultural, technological and political control that were rooted to a certain extent in the Cold War, globalization and decolonization. Hence, UNESCO was forced time and again to adjust its media policies and ethics in the field of education in order to maintain its leadership role and to simultaneously satisfy its politically, economically and culturally diverse member states, many of which were on the cusp of emancipation from Western cultural hegemony.

UNESCO's focus was not only on balancing out technical, political and economic differences between countries; it also had to be flexible in its assumed role as a moral authority in defining universal ethical standards for media production, education, the dissemination and consumption of knowledge, and the work of the press.[15]

10 For a critical analysis of the political pursuit of human freedom see Pierre Charbonnier, *Affluence and Freedom: An Environmental History of Political Ideas*, trans. Andrew Brown (Cambridge: Polity Press, 2021).

11 Andreas Fickers and Pascal Griset, eds., *Communicating Europe: Technologies, Information, Events* (London: Palgrave Macmillan, 2019).

12 See Herbert I. Schiller, "Genesis of the Free Flow of Information Principles: The Imposition of Communications Domination," *Instant Research on Peace and Violence* 5, no. 2 (1974): 75–86; Layire Diop, "Free Flow of Information and Development," preprint (2019): 2, https://doi.org/10.13140/RG.2.2.27372.92806.

13 See Karin Priem and Eng Sengsavang, "Media Technologies for a Better World: UNESCO's Ethical Framework for Communication Infrastructures and Uses of Media after the Second World War," in *Framing Communication Infrastructures (1950–2020): Discours et imaginaires | Diskurse und Vorstellungen,* ed. Vlad Atanasiu et al. (Zurich: Chronos, 2022), 71–90.

14 Kolya Louis Abramsky, *The New World Information and Communication Order: An Historical Window Onto the Uneasy Nexus Between Archives, Records, Communication, and Information; and, Between Governance and Geopolitics* (London: London University College, 2019).

15 See Priem and Sengsavang, "Media Technologies for a Better World."

When looking at UNESCO we find evidence that education is not only based on ethical norms, didactics and a westernized understanding of learning and teaching rooted in the belief in supremacy of human intelligence; it is also connected to anthropocentric world views and related political, economic and technological approaches to the acquisition of knowledge.[16] In addition, when studying UNESCO's engagement with educational media after the Second World War, it becomes obvious that the education-technology nexus is also closely linked to the media production and journalism sectors in Western countries. The role of media industries, publishing companies and news and other media agencies is as important as issues such as technological infrastructure, professional training of journalists and teachers and the overall conditions governing the work of the press and international trade.

Entangled Technologies and Media Ecologies

The spread and revision of textbooks was a key dimension of UNESCO's overall strategy to establish mutual understanding and define the conditions and content of cultural exchange around the globe. In the early 1950s, UNESCO launched a program of textbook improvement, and over the next few years it organized several meetings and conferences with international external experts on this issue. During the second half of the 20th century, much emphasis was put on the book publishing industry and on the production and distribution of textbooks at the local, regional and international levels.[17]

In 1964 UNESCO launched a "Survey of the Present and Prospective Situation in Textbook Publishing" among its member states.[18] The survey explored practices of

16 The supremacy of human intelligence is questioned by James Bridle in his book *Ways of Being: Beyond Human Intelligence* (Dublin: Penguin Random House, 2022); see also David Graeber and David Wengrow, *The Dawn of Everything: A New History of Humanity* (New York: Farrar, Straus and Giroux, 2021).

17 E. g., Meeting of Experts on the Improvement of Textbooks, Paris, 1950. UNESCO Archives file code: ED/CONF.TB/3, WS/100.61 (https://unesdoc.unesco.org/ark:/48223/pf0000144271?posInSet=6&-queryId=N-EXPLORE-e74cf437–1203–47fc-ab8c-243d3ffa4963); Current Status of Production and Distribution of Textbooks: An Overall View, 1958. UNESCO Archives file code: ED/CIM/38, WS/088.68 (https://unesdoc.unesco.org/ark:/48223/pf0000144119?posInSet=1&queryId=a190c50e-eb9d-48b2-bd21–17d5cc8551a0); UNESCO Action in the Field of Textbooks. International Meeting of Educational Publishers, Geneva, 1961. UNESCO file code: ED/PUB/61/4, WS/0661.84 (https://unesdoc.unesco.org/ark:/48223/pf0000144498?posInSet=6&queryId=35a909b3-94b0-47fe-b153-b140e3a4c724).

18 Survey of Present and Prospective Situation in Textbook Publishing: Study of Replies to Questionnaire, International Meeting of Educational Publishers, Paris, 1964. UNESCO Archives file code:

textbook production and distribution and the needs of so-called developing countries, and collected international data on who wrote, distributed, edited and published textbooks. Much like the 1947 UNESCO "Survey on Technical Needs for the Free Flow of Information", which paved the way for UNESCO's involvement in education by means of radio, TV and film, this survey resulted in many meetings and conferences on educational publishing, some of which focused on specific regions. In addition, UNESCO issued recommendations for textbook design, language policies and translation, offered support to member states by dispatching UNESCO experts on textbook writing, initiated textbook lending systems and promoted the establishment of school libraries.

Another important concern for UNESCO was the presentation of content and the influence of publishers in this area. Related activities included an international meeting of educational publishers on "New Techniques and Their Effect on the Publication of Textbooks" (1964), a meeting on "How Educational Publishers Can Bring About Better Presentation of Africa, Asia and Latin America in Their Textbooks" (1964) and "An Experimental Project for the International Exchange and Review of Geography Textbooks" (1964).[19] These meetings and initiatives were followed by numerous others on history, literary and science education, which were seen as relevant for many country and regional missions.

Thus UNESCO focused not only on the pragmatic task of textbook distribution but also on becoming a worldwide textbook advisor and gatekeeper of textbook editing, design and production and a partner and editor of textbook research.[20] To fulfill both roles, UNESCO processed global data and place-based information and liaised with (inter-)national experts and producers, national and regional committees and associations and local stakeholders.[21] In doing so, UNESCO claimed to

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ED/PUB/64/10, CS/0664.89/ED.5(WS) (https://unesdoc.unesco.org/ark:/48223/pf0000144468?posInSet=2&queryId=080a76ec-a8c3-4561-b1a3-45ac60758dff).

19 New Techniques and Their Effect on the Publication of Textbooks: International Meeting of Educational Publishers, Paris, 1964. UNESCO Archives file code: ED/209 (https://unesdoc.unesco.org/ark:/48223/pf0000126354?posInSet=2&queryId=ce694d4a-9460-4404-aa58-fd1bb89b3980); How Educational Publishers Can Bring About Better Presentation of Africa, Asia and Latin America in Their Textbooks: International Meeting of Educational Publishers, Paris, 1964. UNESCO Archives file code ED/PUB/64/7, WS/0664.88/ED.5(WS) (https://unesdoc.unesco.org/ark:/48223/pf0000144473?posInSet=2&queryId=a06ceb25-777c-4b86-881f-6aa2c1318e77); An Experimental Project for the International Exchange and Review of Geography Textbooks: International Meeting of Educational Publishers, Paris, 1964. UNESCO Archives file code: WS/0664.8/ED.5/CS (https://unesdoc.unesco.org/ark:/48223/pf0000185320?posInSet=2&queryId=2a50759d-b42f-4738-a6e7-4ae16e538d79).

20 E.g., Falk Pingel, *UNESCO Guidebook on Textbook Research and Textbook Revision*, 2nd ed. (Paris and Braunschweig: UNESCO and Georg Eckert Institute for International Textbook Research, 2010).

21 Priem and Sengsavang, "Media Technologies for a Better World."

assume a neutral role while being deeply caught up in US cultural and commercial interests and ambitions for world supremacy.[22]

Even before embarking on its textbook initiatives, soon after it was founded, UNESCO initiated and published books on “Education by Radio” (1949), “Broadcasting to Schools” (1949), “Radio in Fundamental Education” (1951), “The Use of Mobile Cinema and Radio Vans in Fundamental Education” (1949), and “Choice and Care of Films in Fundamental Education” (1950).[23] The large number of UNESCO publications on audio and visual media use in education can be explained by the fact that the Technical Needs Commission (established in 1947) had detected high rates of illiteracy in the majority of countries in the so-called Global South and East Asia that had been surveyed for many years. The commission repeatedly recommended equipping schools with radio receivers, supporting community listening through mobile radio facilities, and encouraging local radio stations to devote programs to school broadcasts and mass education. Similar recommendations were made for TV and film. UNESCO supported these aims, acknowledging not only the need for professional training and mutual exchange by organizing conferences and expert meetings but also the importance of making public, school and ideally also home receivers and TV sets available at low cost. To this end UNESCO intensively and extensively lobbied member states and media industries to support tax reductions, technical standardization and mass production of affordable equipment. These efforts fostered the growth of mainly US media producers.[24] From the 1970s onwards, education by radio, TV and film played a key role in developing countries. The 1980 MacBride Report entitled *Many Voices, One World*, as well as the 1972 Faure Report *Learning to Be: The World of Education Today and Tomorrow* and the 1996 Delors Report *Learning: The Treasure Within* all stress the importance of communication technologies in education.[25]

Education by radio, TV and film has a long and ongoing history within UNESCO. These analog audio-visual educational media persisted over time and combined old and new roles to adapt to changing circumstances and various hu-

22 Priem and Sengsavang, “Media Technologies for a Better World.”
23 Priem and Sengsavang, “Media Technologies for a Better World.”
24 Priem and Sengsavang, “Media Technologies for a Better World.”
25 Seán McBride, *Many Voices, One World: Towards a New More Just and More Efficient World Information and Communication Order.* Report by the International Commission for the Study of Communication Problems (Paris: UNESCO, 1980); Edgar Faure et al., *Learning to Be: The World of Education Today and Tomorrow.* Report of the International Commission on the Development of Education (Paris: UNESCO, 1972); Jacques Delors et al., *Learning: The Treasure Within.* Report to UNESCO of the International Commission on Education for the Twenty-first Century (Paris: UNESCO, 1996).

manitarian and political crises. (Interactive) education by radio was (and still is) affordable in many regions of the world (e.g., in rural and nomadic areas of Africa and the Arabian Peninsula), allowing learners to connect with each other across distances.

UNESCO's initiatives in programmed instruction and computer-based learning date back to the early 1960s and thus began around twelve years later than its work on textbook revision and analog audio and audio-visual media. In 1962 UNESCO organized a first expert meeting on "New Methods and Techniques in Education." The outcome of the meeting was published in a booklet of the same title in 1963 and included an evaluation of education by means of radio, film, TV and machine- and computer-based learning, all of which were given their proper place within UNESCO's technology-driven cosmos of education.[26] The experts at the meeting agreed on immediate action to keep up with new machine- and computer-based technologies and coordinate worldwide access to these educational technologies over the next decades – especially with a view to fighting illiteracy and overcoming technological divides. When it came to technological innovation, the sky seems to have been the limit for UNESCO, and the organization continued to demonstrate urgency when mobilizing collaboration and research on new information technologies for education. UNESCO persistently concentrated on the educational value of programmed instruction and computer-based learning and teaching technologies and kept insisting on its role as a moral authority when it came to the question of how to use new media and digital technologies.

In the early 1960s, programmed instruction was seen as a method to enrich curricula, complement education by radio and TV and, most importantly, offer individualized learning facilities that also promised to compensate for a lack of qualified teachers in developing countries by facilitating remote education. Over the following years UNESCO increasingly concentrated on computational technologies, and after 1989 it organized several international congresses on education and informatics.[27] The international UNESCO Commission on Education and

26 *New Methods and Techniques in Education* (Paris: UNESCO, 1963), https://unesdoc.unesco.org/ark:/48223/pf0000001438.

27 Address by Frederico Mayor, Director-General of UNESCO, at the Opening Session of the International Congress on Education and Informatics: Strengthening International Co-operation; UNESCO, April 12, 1989. UNESCO Archives file code: DG/89/13. (https://unesdoc.unesco.org/ark:/48223/pf0000082698?posInSet=1&queryId=bca9d5e7-1982-42a5-8369-beffcf388b93); Contemporary Information and Communication Technologies and Education. Conference of the International Commission on Education and Learning for the Twenty-first Century, 1st session, Paris, 1993. UNESCO Archives file code: EDC.93/CONF.001/I.3 (https://unesdoc.unesco.org/ark:/48223/pf0000093991?posInSet=2&queryId=47176c29-d7f5-4d51-b133-a721e84acc43); International Congress on Education and Informatics (EI'96): Draft Declaration and Draft Recommendations, 1996. UNESCO Archives file

Learning for the Twenty-first Century collaborated on the impact and use of future information technologies in education, not only with international scholars, media experts and industries but also with regional and country representatives. These collaborations and related conferences resulted in many working papers, recommendations, reports and country missions which were the subject of further UNESCO discussions.

Country missions played a key role in UNESCO's numerous reform initiatives and were organized to promote and foster the use of what was perceived as "new" educational media at international level. These missions served to collect place-based information and to prepare for further steps in less accessible and less developed countries around the globe. Programmed instruction and computational technologies involved specific technological and financial challenges that UNESCO carefully addressed at various expert meetings before it embarked on its first missions in this domain. In internal UNESCO reports in the early 1970s, it was Francoist Spain that was referred to as the first developing country to start a pilot project on computer-assisted learning.[28] UNESCO had initiated a meeting of international experts in Paris from 16 to 18 March 1970. The report on this meeting was published by the end of October 1970 and stressed the need for developing countries to be given advice on how to use computers in education. It further mentioned that "experts were invited to consider a concrete situation in one member state, Spain" and that "a paper was presented by Spanish officials listing computer resources and educational plans which could be utilized in a large-scale CAI [computer-assist-

code: ED.96/ICE/4 (https://unesdoc.unesco.org/ark:/48223/pf0000104915?posInSet=1&queryId=6e49522d-3c13-4bb5-af19-028ab4b67f00); International Congress on Education and Informatics (EI'96): Educational Policies and New Technologies; Main Working Document, 1996. UNESCO Archives file code: ED.96/CONF.402/LD.2, ED.96/ICEI/3 (https://unesdoc.unesco.org/ark:/48223/pf0000104914?posInSet=3&queryId=5ee9500b-f457-444a-a418-645046a2ab45); Establishment of a UNESCO Institute for Information Technologies in Education (IITE), 1998. UNESCO Archives file code: DG/Note/98/19 (not available online).

28 Consultation on Computer-assisted Instruction for Developing Countries, Paris, March 16–18, 1970: Final Report. UNESCO Archives file code: ED/WS/198, EDS/MMT/CONS.CAI.TM (https://unesdoc.unesco.org/ark:/48223/pf0000003962?posInSet=1&queryId=79b83eac-58ca-4b88-92a3-a1c485d1d137). See also Mariano González-Delgado, Manuel Ferraz-Lorenzo, and Cristian Machado-Trujillo, "Towards an Educational Modernization Process: UNESCO Interactions with Franco's Spain (1952–1970)," *History of Education Review* 51, no. 1 (2022): 16–31. The paper describes how officials in Francoist Spain always kept in close contact with international organizations like UNESCO to prevent the Spanish dictatorship from being isolated from international trends in educational reform. Spain had already collaborated with UNESCO in several other projects on audio-visual media in education.

ed instruction] project."[29] After lengthy deliberations, the external experts consulted by UNESCO agreed to choose Spain for a pilot project and adopted the first recommendations.

UNESCO sent a pre-planning commission to Spain in June 1970, followed by a planning mission in November 1970. The pre-planning commission included four Anglo-American experts: Donald L. Blitzer from the University of Illinois who was famous for developing large-scale computer systems and for co-inventing the plasma display and touch-sensitive screens during the 1960s; Hector Correa, a Spanish-speaking economist and statistician from Tulane University; George Leith, a software and programming specialist from Sussex University; and Lawrence L. Stolurow from Harvard University who was a specialist in computer-aided instruction. The visit of the commission took place as a follow-up to a national seminar on computer-aided instruction at the Spanish Institute of Informatics and an international conference on new perspectives in education that was held in Madrid.

Although the UNESCO Secretariat had studied conditions in Spain carefully the organization seems to have concentrated on institutional, financial and technological dimensions and put to one side political issues of dictatorship and ethical concerns that may have violated human rights. Instead, the report highlighted a national education reform pursued by the Spanish government that "strongly supported elements of innovation and technological aid for instruction, for example audio-visuals, educational television and programmed instruction." Another important reason for selecting Spain to become a partner of UNESCO was its commitment to investing in computer technology:

> Spain owns about 500 computers from several manufacturers and has spent two hundred million dollars in 1969 on machines from one manufacturer alone. A wide variety of computers are currently in use including a large-scale multiprocessing computing system in the Instituto de Informatica of the Ministry of Education and Science. One foreign manufacturer is setting up six interconnected computer centres this year. The Spanish National Telephone Company has just modernized its communication network making interconnections more reliable and less expensive.[30]

These investments and additional studies carried out by Spanish education research centers on how to innovate teacher education by focusing on computer-assisted instruction made Spain highly attractive not only for UNESCO officials, but

29 Consultation on Computer-assisted Instruction for Developing Countries, Paris, March 16–18, 1970: Final Report.

30 Consultation on Computer-assisted Instruction for Developing Countries, Paris, March 16–18, 1970: Final Report.

also for US American external UNESCO experts and manufacturers. The pilot project in Spain obviously served multiple purposes and had an impact on future UNESCO missions around the globe, despite problematic political, cultural and ethical circumstances that could have resulted in a different and negative decision:

> The experts in this consultation were impressed by the many favourable factors in Spain for what could be a really large scale, high impact use of computers in an integrated programme of educational technology. They recognized the multiplying effect of concentrating on teacher training. Valuable experience could be documented in Spain for use in other developing nations. In addition to the generally applicable principles gained from this experience, some of the teacher training materials and computer-mediated instructional programmes might be directly usable in other Spanish speaking areas. At a minimum, these materials should provide a useful guide for the development of new materials particularly suited for local conditions and population needs in other areas.[31]

The report further stressed that the use of computers in the classroom and corresponding teacher training would generally support the use of audio-visual media and therefore create attractive learning environments for both learners and teachers.

In subsequent years UNESCO launched other country missions. After Spain it was Romania that successfully applied for UNESCO support in the field of computer-assisted instruction.[32] Other regions of the world followed throughout the 20th century, including South and Latin America, Asia and the Pacific region, Africa, India and the Arabian Peninsula.[33] Likewise, UNESCO programs in computer-assisted instruction were successively extended to young children and adult education.[34]

It was also towards the end of the 20th century when the Second International Congress on Education and Informatics took place in Moscow from 1 to 5 July 1996. This was an opportunity to reflect on past experiences and discuss "Educational

31 Consultation on Computer-assisted Instruction for Developing Countries, Paris, March 16–18, 1970: Final Report.

32 Round Table on Computers in Education, Bucharest, 1972. UNESCO Archives file code: ED.72/CONF.25/6 (https://unesdoc.unesco.org/ark:/48223/pf0000001980?posInSet=115&queryId=22bcc52e-adb3-4e0b-8cc4-a3f8a9a2e0a4).

33 For Asia and Pacific region see e. g., Computers in Education: An Outline of Country Experiences, 1985. UNESCO Archives file code: BKA/85/M/254–1200 (https://unesdoc.unesco.org/ark:/48223/pf0000065852?posInSet=18&queryId=22bcc52e-adb3-4e0b-8cc4-a3f8a9a2e0a4).

34 E. g., Betty Collis: The ITEC Project: Information Technology in Education of Children; Final Report of Phase 1. UNESCO Archives file code: ED.93/WS/17 (https://unesdoc.unesco.org/ark:/48223/pf0000096342?posInSet=2&queryId=98e27b13-c015-431d-b5bf-7d24c37dca8d).

Policies and New Technologies."[35] The working paper preparing this conference repeatedly refers to distance learning and various media ecologies of education that were seen as offering an abundance of new opportunities for teaching and learning while connecting different world regions. This implies that computers were perceived as components of digital learning environments that would also offer audio-visual content and new forms of communication. In addition, digital technologies were praised as devices that could abolish distance by "freeing learners from the constraints of time and place" and provide open access to programs of educational institutions in lower and higher education, lifelong learning and professional training.[36] It was further stressed that digital learning environments would emancipate learners, individualize learning processes and facilitate communication among peers during the learning process. However, the paper also points to technological and digital divides, explaining that in some countries neither analog nor digital telephone and television networks were available. The solution for UNESCO was to establish composite, mobile and flexible ecologies of learning that were able to compensate differences and technological divides as much as possible. Indeed, UNESCO acknowledged that IT technologies were "emerging primarily from the developed world" and that "the content and form of the message they carry typically reflect the cultural values, methodology and interests of that world."[37] This critical take on computers and IT technologies may have informed UNESCO's multi-technological approach to education but the organization also imagined that digital technologies would enable diversity and provide "powerful and easy to use tools to enable communities to develop their own culturally appropriate curriculum resources […] and to provide wide access to such materials and information."[38] However, there remained the question of how to encourage equal access to an interconnected digital world, to digital libraries and to "complex webs and links between nodes and layers of information."[39] Again, UNESCO was insisting that its universal ethical principles and multimedia approach would be an adequate response to the digital turn. In addition, the organization suggested that it should act as a catalyst between various stakeholders and reflected on how best to cooperate with hardware and software industries. The UNESCO Institute for Infor-

35 UNESCO Archives file code: ED.96/CONF.402/LD.2, ED.96/ICEI/3.
36 UNESCO Archives file code: ED.96/CONF.402/LD.2, ED.96/ICEI/3.
37 UNESCO Archives file code: ED.96/CONF.402/LD.2, ED.96/ICEI/3.
38 UNESCO Archives file code: ED.96/CONF.402/LD.2, ED.96/ICEI/3.
39 UNESCO Archives file code: ED.96/CONF.402/LD.2, ED.96/ICEI/3.

mation Technologies in Education (IITI) was finally established in Moscow in 1998.[40]

In sum, UNESCO played and still plays a crucial role in media ethics, in maneuvering the ongoing technological and cultural competition between different political powers, in fighting the technological divide, and in defining the content and aims of education and development. It is because of these three dimensions that the organization does not rely on one educational technology. Rather, it aligns its strategy to place-based conditions, flexibility of action, production industries and political crises while fostering the design of multimodal learning environments.

UNESCO's Propaganda Apparatus

The UNESCO Audio-Visual Archives testify to UNESCO's highly developed marketing and outreach strategies, which were maintained despite the organization's constant financial shortages. Indeed, the UNESCO archives hold a film collection of 12,500 cans containing approximately 3,445 titles; a photography collection comprising approximately 29,000 35 mm color slides, 140,000 35 mm b/w negatives, 1,000 35 mm color negatives, and 15,000 duplicate color slides; and more than 30,000 radio tapes and other audio recordings. In addition, UNESCO published a wide range of books, curated both local and international exhibitions, and edited the monthly journal *UNESCO Courier.* Many of these media appeared in three or more languages and/or with subtitles in various languages in order to reach as large an audience as possible, while their material-technological properties (e.g., their reproducibility) strongly determined the institutional production and management of visibility and knowledge. Unfortunately, the paper archives of UNESCO's Public Outreach Division have been destroyed and many of the above-mentioned audio-visual sources are at risk of decay, uncatalogued and/or inaccessible for researchers.

Visual media (e.g., photography, film and digital media) included in printed matter and multimodal productions such as exhibitions played a key role in UNESCO's promotion campaigns, because they strongly encouraged institutional production and management of visibility and consent. In his book *The Documentary Impulse*, Stuart Franklin explores the urge to document the world, and this description certainly applies to UNESCO, an organization that has always been eager and proud to present and showcase its work and activities to both local

40 The website of the IITO can be accessed at https://iite.unesco.org/. The institute does not seem to be affected by the war between Russia and Ukraine and is continuing to successfully pursue its overarching and universal role at a time of crisis.

and global audiences.[41] However, these documentary projects also have a second impulse – namely, the impulse to persuade and to manage and engineer consent by means of mass communication.[42] Public outreach by text, sound and (moving) images also implies that these promotional activities are part of a competitive fundraising marketplace that requires humanitarian organizations to present their causes in a convincing and appealing manner.[43] The sheer quantity of UNESCO's journalistic, audio-visual and digital productions testifies to the organization's desire to use mass communication technologies to promote its specific – that is, ethically grounded and technology-driven – understanding of education. UNESCO's media productions played an important role in the organization's image as a moral authority and world leader in education.

Conclusion: An Endorsement to Steer Multimedia Ecologies at Global Level

As an organization, UNESCO blended "old" and "new" media, while promoting educational reforms and balancing technological and digital divides. UNESCO acted as a moral authority and felt that it had an endorsement to steer mass communication at global level in a bid to educate the world. To this end, the organization was constantly (re-)mixing international and local expertise from different fields (e.g., education, technology, economics, finance and media production) by organizing programs, conferences, workshops, surveys, working papers and expert commissions to engineer and promote multimedia ecologies in the field of education. UNESCO navigated between opposing political currents and brought into proximity diverse voices on educational reform and media: by giving traditionalist sceptics and enthusiasts of information technologies in the classroom a common forum for debate, it was able to maintain its role as a catalyst and mediator, a cultural and technological translator and a leading educational organization within the anthropocentric age, while continuing to promote a rights-based approach, a focus on human intelligence and a specific understanding of freedom rooted in Western liberalism. This chapter suggests that it is important to look not only at "digital

41 Stuart Franklin, *The Documentary Impulse* (London and New York: Phaidon, 2016).
42 Edward Bernays, *The Engineering of Consent* (Norman: University of Oklahoma Press, 1955); Edward S. Herman and Noam Chomsky, *Manufacturing Consent: The Political Economy of Mass Media* (New York: Pantheon Books, 1988).
43 Robin Mansel and Marc Raboy, eds., *The Handbook of Global Media and Communication Policy* (Malden, MA, and Oxford: Wiley-Blackwell, 2011).

change" but also at how digital technologies interacted with analog or "old" media, thereby forging intermedia and transmedia relationships.[44] This also implies that production companies and international trade had a persistent influence on educational media and their uses over time.

Archival Sources

UNESCO Archives file codes: BKA/85/M/254–1200; ED.72/CONF.25/6; ED.93/WS/17; ED.96/ICE/4; ED/209; ED/CIM/38, WS/088.68; ED/CONF.TB/3, WS/100.61; ED/PUB/61/4, WS/0661.84; ED/PUB/64/10, CS/0664.89/ED.5(WS); ED/WS/198, EDS/MMT/CONS.CAI.TM; EDC.93/CONF.001/I.3; ED.96/CONF.402/LD.2, ED.96/ICEI/3; EDC.93/CONF.001/I.3; DG/89/13; DG/Note/98/19.

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44 Peter Burke, *A Social History of Knowledge* (Cambridge: Polity Press/Blackwell Publishers, 1997); Jay David Bolter and Richard Grusin, *Remediation: Understanding New Media* (Cambridge, MA: MIT Press, 1999).

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Michael Geiss, Carmen Flury, Rosalía Guerrero

Beyond the Classroom: Economic Policies and the Past Futures of Education and Training in the European Community, 1970–2000

Abstract: This chapter is concerned with how supranational educational policies in Europe were devised in the context of the emergence of new information technologies. By the 1970s, the heads of state and government of the European Communities (EC) had recognized the potential of new information technologies as a major source of economic growth and social development – and a crucial factor for the competitiveness of European industries in the world market. However, the wider social consequences and changes in skills and knowledge that the use of new technologies required were still largely unknown. The EC took on the role of a passive coordinator rather than of a proactive pacemaker in the European response to digital change. Only by the mid-1980s was this approach expanded to include the launch of several mobility initiatives in education, such as COMETT and ERASMUS. These initiatives fostered the exchange of skilled talents and created a common European sphere of education and training that could respond to the new skill demands in the context of digital change.

Keywords: history of education; policy analysis; vocational education and training; continuing education; VET and the labour market

Introduction

In today's debates on digital change, it is often forgotten that in Europe there were already disputes in the late 1970s about how to deal with the emergence of the so-called "new information technologies". This discussion began with the broader application of electronic computing in public administration, private industry, and

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service companies in the post-war decades.[1]It became more intense with the advent of the personal computer in the late 1970s and continued after the 1990s. The implications of technological change for vocational education and training played a major role in these debates.[2] Crucial questions regarding information technologies were how the required skills could be produced and which changes in the established skill formation systems were necessary.[3]

This chapter is concerned with the education and training policies devised by the European Community (EC) in response to perceived challenges posed by technological change between 1970 and 2000. It is based on previous comparative studies of the various action programmes in the EC since the 1970s. In our analysis, we take on a historical perspective that interprets educational change within the framework of technology and economic policy. We demonstrate how the new technology-oriented competitiveness agenda of the EC served as a catalyst to change the overall educational governance. The specific context given the greatest attention here is on the emergence of new information technologies viewed as an economic challenge and an opportunity.

The consequences of the new information technologies for educational governance, especially "datafication", "commercialization", and "digital governance", play an increasing role in policy processes, according to recent scholarship within policy sociology.[4] Methodologically, the text follows this line. In this study, however,

1 Thomas Haigh, "Introducing the Early Digital," in *Exploring the Early Digital*, ed. Thomas Haigh (Cham: Springer International Publishing), 1–18.

2 Guy Neave, *The EEC and Education* (Stoke-on-Trent: Trentham Book, 1984); Paul-Pierre Valli, "The challenge of technology: an approach to the problem," *Vocational Training* 11 (1983): 3–7; UNESCO-UNEVOC, *Vocational Education and Training in Europe on the Threshold of the 21st Century. UNESCO-OEEK Symposium 23–26 September 1998, Island of Crete, Greece in preparation for the Second International Congress on Technical and Vocational Education* (Berlin: UNESCO, 1999).

3 Colin Crouch, David Finegold, and Mari Sako, "The dispiriting search for the learning society," in *Are Skills the Answer? The Political Economy of Skill Creation in Advanced Industrial Countries,* ed. Colin Crouch et al. (Oxford: Oxford University Press, 1999), 1–30; Karl Ulrich Mayer and Heike Solga, "Skill Formation: Interdisciplinary and Cross-National Perspectives," in *Skill Formation: Interdisciplinary and Cross-National Perspective*s, ed. Karl Ulrich Mayer et al. (New York: Cambridge University Press, 2008), 1–18; Guy Michaels, Ashwini Natraj, and John Van Reenen, "Has ICT polarized skill demand? Evidence from eleven countries over 25 years," *Review of Economics and Statistics* 96, no.1 (2019): 60–77.

4 Ben Williamson, "Governing software: networks, databases and algorithmic power in the digital governance of public education," *Learning, Media and Technology* 40, no. 1 (2015): 83–105, https://doi.org/10.1080/17439884.2014.924527; Anna Hogan, Sam Sellar, and Bob Lingard, "Commercialising comparison: Pearson puts the TLC in soft capitalism," *Journal of Education Policy* 31, no. 3 (2016): 243–258, https://doi.org/10.1080/02680939.2015.1112922; Ben Williamson, "Digital policy sociology: Software greater attention is paid to the historical conditions of "policymaking"[5] than is usual in mainstream policy sociology. Policy documents of various actors at the European level serve as source material.

We begin by introducing the analytical concepts that inform the analysis. The so-called "digital society" emerges with the broad implementation of microchip-based technologies. It is characterized by the alternation of innovation and re-stabilization. In this context, the attribute "digital" was used increasingly to describe the specifics of contemporary societies.[6] We use the concept of "technologies" to refer primarily to the so-called "new information technologies", especially the personal or microcomputer, but also on the increasing possibilities of computer use in industrial production and electronic data processing.[7]

In this chapter, we focus on political "initiatives". Initiatives are time-limited packages of measures which political actors frame as a response to a perceived or conjured urgent economic, social, or technological challenge. They usually have a defined target group, use defined instruments, have a budget, and aim to change schooling, education, or training in a specific area of the education system. In contrast to laws, however, they are not aimed at the long-term structuring of the education system. Rather, initiatives are intended either to test new approaches, (i. e., pilot projects) or to prompt certain developments. Finally, the term "skills" refers to know-how, learned behaviour and attitudes in demand by the private economic sector. The understanding of skills is therefore rather broad in the following.[8] This allows us to grasp the broad use of the concept of skills by historical actors. Research has shown how "narrow job-specific skills" have been challenged by the advent of new information technologies, and in this context a trend "toward broader, more analytical general skills, but also a move from hierarchically fixed

and science in data-intensive precision education," *Critical Studies in Education* 62, no. 3 (2021): 354–370, https://doi.org/10.1080/17508487.2019.1691030.

5 Roy Lowe, "Policy-Making in Education," in *Handbook of Historical Studies in Education: Debates, Tensions, and Directions*, ed. Tanya Fitzgerald (Singapore: Springer, 2019), 1–14.

6 David Gugerli and Daniela Zetti, "Computergeschichte als Irritationsquelle," in *Provokationen der Technikgeschichte*, ed. Martin Heßler et al. (Paderborn: Schöningh, 2019), 193–228, https://doi.org/10.30965/9783657792337_007.

7 David Gugerli, *Wie die Welt in den Computer kam. Zur Entstehung digitaler Wirklichkeit* (Frankfurt am Main: S. Fischer, 2018).

8 See also David Ashton and Francis Green, *Education, training and the global economy* (Cheltenham: Elgar, 1997); Linda Clarke and Christopher Winch, "A European Skills Framework? – But What Are Skills? Anglo-Saxon versus German Concepts," *Journal of Education and Work* 19, no. 3 (2006): 255–269, https://doi.org/10.1080/13639080600776870.

activities to autonomous work in processual and cooperative work settings" can be observed.[9]

After a discussion of the methodological approach and overview on previous research, the first step will be to trace the economic situation in Europe after the first oil crisis and to show how education policy reacted to it. Second, we trace the educational programmes established to counter the crisis and examine the intended role for initial and continuing vocational education and training. In the concluding section, we present the central findings with reference to existing literature on the development of education and training in the last decades of the 20th century, and the emergence of the lifelong learning paradigm.

State of Research

Whilst the advent of a European dimension in vocational education and training until 2000 is already well researched,[10] the economic context of many EC programmes has so far been neglected. Nevertheless, these earlier studies offer a framework for the present analysis.

In comparative VET research, the development of political competencies of European institutions has been studied, including its legal aspects. In a literature review, Ertl[11] traced how VET policies in the EC were understood from the beginning as a means of economic integration. In the first decades, the educational policy of the European institutions was purely economically motivated. Sellin[12] has pointed out that, until the mid-1970s, only one EC programme was concerned with vocational education and training. Not until the first oil crisis did European institutions begin to focus more on education policy measures with a whole cascade of initia-

9 Mayer and Solga, "Skill Formation," 2.

10 Solveig Buder and Frank Bünning, "Lisbon, Bruges, Copenhagen: milestones towards a European vocational education and training sector – a critical survey of the current situation," in *The transformation of vocational education and training (VET) in the Baltic states*, ed. Frank Bünning (Berlin: Springer Netherland, 2006), 13–21; Ulf Fredriksson, "Changes of Education Policies within the European Union in the Light of Globalisation," *European Educational Research Journal* 2, no. 4 (2003): 522–546, https://doi.org/10.2304/eerj.2003.2.4.3.

11 Hubert Ertl, *The role of EU programmes and approaches to modularisation in vocational education: fragmentation or integration?* (München: Herbert Utz Verlag, 2002).

12 Burkart Sellin, "EC and EU Education and Vocational Training Programmes from 1974 to 1999: An Attempt at a Critical and Historical Review," *Vocational Training: European Journal* 18 (1999): 17–27.

tives.[13] With the Maastrich Treaty (1992), compulsory education was, for the first time, brought into the European framework.[14] However, Balzer and Rusconi[15] or Trampusch[16] do not recognize a critical juncture in European educational governance until after the Lisbon Summit 2000.

Recent research on the history of the European Communities has addressed the problem that historical contexts in which European actors made decisions have often been neglected.[17] Although education remained the responsibility of the individual countries, the conditions for greater cooperation between the member states were created in the early 1970s.[18] Paoli[19] argues that until the 1980s, vocational training policy at supranational level pursued primarily social objectives. This argument coincides with Guy Neave's[20] view that from the late 1970s, the dominant policy mechanism in Europe was to bring together education, training, and the labor market, a strategy accentuated by the advent of new technologies. However, he claims that although employment and social policy were the immediate setting in which education and training services operated, they were part of the more complex issue of the viability of the Communities in face of the challenges in high technology that foreign competition brought.

13 Patrick Clemenceau, "Die Gemeinschaftsprogramme im Bereich der beruflichen Bildung: Dreißig Jahre Zusammenarbeit, Aktionen, Konzertierung," *Berufsbildung (CEDEFOP),* no. 3 (1994): 15–22.
14 Jacky Brine, "Educational and Vocational Policy and Construction of the European Union," *International Studies in Sociology of Education* 5, no. 2 (1995): 145–163, https://doi.org/10.1080/0962021950050202.
15 Carolin Balzer and Alessandra Rusconi, "From the European Commission to the Member States and Back – A Comparison of the Bologna and the Copenhagen Process," in *New Arenas of Education Governance: The Impact of International Organizations and Markets on Educational Policy Making*, ed. Karin Martens et al. (Basingstoke: Palgrave Macmillan, 2007), 57–75.
16 Christine Trampusch "Europeanization and Institutional Change in Vocational Education and Training in Austria and Germany," *Governance* 22, no. 3 (2009): 369–395, https://doi.org/10.1111/j.1468-0491.2009.01444.x.
17 Kiran Klaus Patel, *Projekt Europa: eine kritische Geschichte* (München: C. H. Beck, 2018).
18 Simone Paoli, "Building a European cultural and educational model: another face of the integration process, 1969–1974", in *Beyond the customs union: the European Community's quest for deepening, widening and completion, 1969–1975,* ed. Jan van der Harst (Brussels: Bruylant, 2007), 251–273.
19 Simone Paoli, "The European Community and the Rise of a New Educational Order (1976–1986)," in *Contesting Deregulation. Debates, Practices and Developments in the West since the 1970s*, ed. Knud Andersen et al. (New York and Oxford: Berghahn, 2017), 138–151.
20 Guy Neave, "Policy and Response: Changing Perceptions and Priorities in the Vocational Training Policy of the EEC Commission," in *Vocationalizing Education,* ed. Jon Lauglo et al. (Oxford: Pergamon Press, 1988), 99–114.

Paoli[21] identifies a shift in the mid-1980s towards economic competitiveness. He distinguishes a social democratic phase from a neoliberal phase and points out how economic representatives played a decisive role in these decisions. Calligaro and Patel,[22] on the other hand, have pointed out in their analysis of European cultural policy, that the Cold War should also be considered as an important context for historical developments. Using audio-visual policies as an example, they trace how, in the 1980s, the question of competitiveness vis-à-vis Japan and the USA also began to play a greater role. This argument is important in the present historical analysis of the political reactions to the advent of new information technologies.

Although challenges posed by technological change are often mentioned in historical research and are directly related to the shift in the 1980s, the role these changes played for vocational education and training policies remains unclear. The same applies to historical studies on the paradigm of lifelong learning, in which the 1980s appear either as a period of "decreasing interest"[23] or as a "formative period for the neo-liberal lifelong learning discourse".[24]

This chapter builds on the aforementioned research but asks more precisely what role technology oriented economic policies have played for European education and vocational training policies. We assume that since the oil crises there has been a significant redefinition of educational governance. The competitiveness agenda of the European states played a central role in this. The advent of microchip-based technologies seemed to pose challenges to European economies that needed to be addressed through education policy. This then opened the door in the 1980s for a broader transformation of European education policy, which henceforth became more interventionist, but had to resort to soft policy approaches such as mobility programmes. It simply lacked the competencies for more far-reaching measures. However, it gradually broadened the understanding of its remit. In the

21 Paoli, "European Community," 99–114.

22 Oriane Calligaro and Kiran Klaus Patel, "The True 'EURESCO'? The Council of Europe, Transnational Networking and the Emergence of European Community Cultural Policies, 1970–90," *European Review of History: Revue Européenne d'histoire* 24, no. 3 (2017): 399–422, https://doi.org/10.1080/13507486.2017.1282430.

23 Alexandra Dehmel, "Making a European Area of Lifelong Learning a Reality? Some Critical Reflections on the European Union's Lifelong Learning Policies," *Comparative Education* 42, no. 1 (2006): 49–62; Vera Centeno, "Lifelong learning: a policy concept with a long past but a short history," *International Journal of Lifelong Education* 30, no. 2 (2011): 133–150.

24 Moosung Lee, Thayer Tryggvi, and Madyun Na'im, "The Evolution of the European Union's Lifelong Learning Policies: An Institutional Learning Perspective," *Comparative Education* 44, no. 4 (2008): 445–463.

1980s, the Lifelong Learning Agenda was already on the horizon, and it was to dominate debates and measures in the 1990s.

Methodology and Sources

This article focuses on European policies and governance regimes in the context of technological change. However, in contrast to sociological policy research, the analysis here is undertaken from a historical perspective to bring developments over time into focus. Lowe[25] has pointed out three aspects that must be considered in order to understand the historical genesis of educational policies. First, the political system in which the policies are created and reformed must be considered. Second, the specific economic and social contexts of the policy reforms must be included in the analysis. The prevailing conditions of a society (e. g., the state of its labor market and economy, or its social order) inform the function of certain educational policies and thus are essential elements that need to be considered. Third, it is important to consider how powerful the policies under study could be in a given context.

The policies and governance regimes examined here are located at a supranational level. According to Lowe, there is a multi-faceted European network of national, supranational, and transnational actors or organizations. As the regulatory competence of the European institutions is limited, the power remains with the nation states.[26]

The sources for this analysis consist mainly of publications and written interventions from the various players in European VET governance. The EUR-Lex database was consulted for the official announcements. Publications relating to individual initiatives and general developments stored in the Archive of European Integration (AEI) and the Publications Office of the European Union were also accessed in order to analyze the shifts in understanding of vocational education and training, and the emergence of the lifelong learning paradigm. Furthermore, different periodicals such as the *European Journal of Vocational Training* from the European Centre for the Development of Vocational Training were evaluated to obtain further contextual information.

25 Lowe "Policy-Making in Education," 1–14.

26 Mark A. Pollack, *The engines of European integration: delegation, agency, and agenda setting in the EU* (Oxford: Oxford University Press, 2003); Liesbet Hooghe and Gary Marks, *Multi-level governance and European integration* (Lanham, MD: Rowman & Littlefield, 2001).

Building the Technological Community

Fear of American or Japanese competitors, and later also of the so-called 'Asian Tiger' states, led to numerous European technology policy initiatives, and resulted in increasing implications for education and training. In the development and application of microchip-based technologies, the USA and Japan seemed much further ahead compared to the highly industrialized countries in Europe. While the UK was the European leader in electronic mainframe computers after the Second World War, British IT companies were increasingly unable to keep pace with their American competitors. Even their own public administration no longer wanted the products of the state-controlled computer firms. The problem of a shortage of skilled workers, which arose partly because the vast number of women in the computer sector was not considered, further exacerbated this issue.[27]

As early as the mid-1960s, the large and efficient American companies were considered a central threat to European economies. In this context, the computer and high-technology industry was one of the sectors believed to be particularly threatened. This initiated a change in Europe towards an active supranational industrial policy. However, between the strong industrialized countries – and within these states – the ideas about the right way of implementation diverged widely. The first attempts at an ambitious European industrial policy failed since the nation states were not prepared to give the European Commission more powers. Although intergovernmental cooperation or programmes for declining industries were established, no future-oriented European industrial policy was developed. What prevailed was the impression that there was an economic threat from strong economies outside Europe.[28]

This changed fundamentally in the wake of the 1970s crises. The end of Bretton Woods and the global oil crisis of 1973 marked an abrupt end to the decades of post-war boom in Europe.[29] In this context, the reference to the threat of international economic competition was deliberately used to call for and legitimize the use of state funds to promote the industry, and later also to support broad-

27 Marie Hicks, *Programmed Inequality. How Britain Discarded Women Technologists and Lost Its Edge in Computing* (Cambridge, MA: The MIT Press, 2017).

28 Laurent Warlouzet, "Towards a European Industrial Policy? The European Economic Community (EEC) Debates, 1957–1975," in *Industrial Policy in Europe after 1945: Wealth, Power and Economic Development in the Cold War,* ed. Christian Grabas et al. (London: Palgrave Macmillan UK, 2014), 213–235.

29 Nicholas Crafts and Gianni Toniolo, "'Les Trente Glorieuses': From the Marshall Plan to the Oil Crisis," in *The Oxford Handbook of Postwar European History,* ed. Dan Stone (Oxford: Oxford University Press, 2012).

based computer education programmes. It was primarily information technology companies themselves who demanded for more direct state investment. Their request was not simply a regulatory framework for free competition. Rather, the large companies demanded direct support for the computer industry in order to be able to keep up with international competitors. While in the 1960s expectations were still clearly directed at the national government, the focus now shifted to a European level. The ideal of a free-market economy was partially abandoned by the companies, at least for microelectronics, in favor of an interventionist industrial policy.[30]

The companies were well-networked on a European level, but the new developments meant that many companies no longer felt represented at the European level by the established industry associations. The European Round Table of Industrialists (ERT), founded in 1983,[31] was central to the development of the European Single Market policy. Since the mid-1980s, this advocacy group turned its attention to problems of higher education, and in 1987 established a Standing Working Group on Education.[32] At the same time, the European Commissioner for Industry, Etienne Davignon, launched an IT business gathering, which became the European Information Technology Industry Round Table (EITIRT) in 1987.

The demands of the IT industry sector made the interventionist policy possible. For the IT sector, private investment in research and development was considered particularly risky and success would only be seen in the long term. National markets and a high degree of fragmentation were regarded as a further obstacle to the emergence of large, competitive players in the private sector. The first step towards a technological community was the European Strategic Programme on Research in Information Technology (ESPRIT), which originated in 1979 and was launched in 1984 after an initial pilot phase.[33]

30 Edgar Grande and Jürgen Häusler, *Industrieforschung und Forschungspolitik: staatliche Steuerungspotenziale in der Informationstechnik* (Frankfurt am Main: Campus, 1994).

31 Inge Maria Burgmer, *Die Zukunft der Wirtschaftsverbände: am Beispiel des Bundesverbandes der Deutschen Industrie e. V.* (Bonn: IfWP, 1999), 95–110; Michael Nollert, “Transnationale Wirtschaftseliten: Das Netzwerk des European Roundtable of Industrialists,” in *Elitenmacht*, ed. Ronald Hitzler et al. (Wiesbaden: VS Verlag für Sozialwissenschaften, 2004), 91–102.

32 Ilkka Kauppinen, “The European Round Table of Industrialists and the restructuring of European higher education,” *Globalisation, Societies and Education* 12, no. 4 (2014): 498–519, https://doi.org/10.1080/14767724.2013.876313.

33 Simon Parker, “Esprit and technology corporatism,” in *State-building in Europe: the revitalization of Western European integration*, ed. Volker Bornschier (Cambridge: Cambridge University Press, 2000), 93–121.

Uncertain Skills Demands

Warlouzet[34] distinguishes three different political responses to the crisis of the 1970s: a "socially oriented" approach, primarily concerned with disadvantaged groups, a "neomercantilism" approach, focused on protecting one's own companies and increasing the productivity of the economy, and "market-oriented" public policies, aimed primarily at releasing physical, financial, and human capital. In the area of educational policies, however, these different approaches were intertwined.

The following section will show how different initiatives were primarily based on an economic agenda aimed at strengthening competitiveness. Even if social, educational, or even cultural aspects played a role in the policy debates that led to several action programmes, the initiatives in the area of vocational training were clearly aimed at strengthening companies in the field of new information technologies. However, this was by no means accompanied by a clear vision of the skills that would be needed to meet the new challenges. The strategy of the Community in the early 1980s was exploratory in terms of skill formation. The priority was to "adapt the whole of society to the new tools", which would be accomplished by analyzing future needs, adapting workers to the new technologies, promoting exchange of experiences among schools, and organizing forums and seminars featuring firms and trade union leaders.[35]

In the 1980s and 1990s, the focus was on fundamentally questioning the conventional understanding of vocational education and training, and the relationship between the different areas of the education system. In practical terms, this meant more flexibility and the removal of boundaries instead of clearly tailored competence profiles.

The question of the effects of technological change on vocational training and the production of the required skills accompanied the new European technology policy agenda throughout the 1980s. In the first report of the European Commission, which was approved in 1979,[36] new information technologies were seen as part of industrial policy, and vocational training as "the key to society's adaptability". In addition to identifying the skills needed, a proposed programme allowed for the exchange of experience in knowledge transfer at all levels and in all aspects of education, including compulsory education.

34 Laurent Warlouzet, *Governing Europe in a globalizing world: neoliberalism and its alternatives following the 1973 oil crisis* (London and New York: Routledge, 2018).

35 COM/79/650 final, 20.

36 Maria Michalis, "Broadband communications in the European Union: myths and realities," in *European economic and political issues,* ed. Frank H. Columbus (New York: Nova Science, 2002), 4.

With an uncertain future, it was difficult to find concrete solutions. As a rule, the European initiatives were not geared to specific skills. Rather, the aim was to provide impulses so that the required training regimes would somehow set themselves up automatically. The flexibilization of established vocational education and training, the promotion of cooperation between public and private actors, and a lifelong learning agenda replaced a more concrete educational policy.

On 19 September 1983, the Council and Ministers of Education meeting within the Council adopted a resolution which entailed a series of measures relating to the introduction of new information technologies in education.[37] This provided the basis for Community action aimed at supporting and supplementing initiatives in education taken by different Member States. The Commission of the EC thus had a mandate to intervene in all three areas of general, vocational, and higher education to complement the actions taken in industrial policy and R&D with measures to address the social implications of technological change. The Council's resolution stated the need to "[…] familiarize young people with new information technology in order to provide better chances for future generations. Teaching in this field must introduce pupils to the practical use of new information technology and provide them with a basic understanding of the operation, the possible applications and the limitations of such technology".[38] With regard to the important role of education in mastering technological, social, and cultural changes and the anticipated significant influence that new information technology would have on all aspects of working and private life, the Council of the EC argued the need that "young people be taught not only the use of information technology as a tool but also to judge its effects on everyday life and its social significance".[39]

These measures related to the introduction of new information technologies in education and vocational training. Alongside the concurrent preparation of the EC's mobility programmes COMETT and ERASMUS, these programmes were situated within the framework of the creation of the European Single Market. The 'European Dimension of Education', a concept coined in a resolution from 1988, aimed at guaranteeing the participation of Europeans in protecting democratic and social justice principles. Additionally, this concept emphasized the participation of learners in the economic and social development of Europe, and in turn, the preparation of a highly skilled workforce to fulfill the demands of the economy. The vocational policy followed in this period was based on the concept of Education-Training-Employment that promoted the development of Europe's human resour-

37 Official Journal of the EC, C 256, 24/09/1983, 1–2.
38 Official Journal of the EC, C 256, 24/09/1983, 1.
39 Official Journal of the EC, C 256, 24/09/1983, 2.

ces,[40] which, as shown above, meant preparing Europeans for a work life involving new information technology.

Pushing Boundaries and Moving People: From Passive to Active Coordination

In November 1979, the Commission of the EC published a position paper titled "European Society faced with the Challenge of New Information Technologies: A Community Response", in which it delineated its strategy for social and education policy in response to technological change in Europe.[41] The paper argued for the need to develop a social policy strategy to prepare the climate for innovation via three combined approaches. First, by undertaking studies on the impact of new technologies on employment, second, by exploring measures together with social partners to ensure that innovation is introduced in an acceptable way, and third, by establishing education and training programmes in schools and industry to reinforce the efforts of Member States. However, in the paper, the Commission also affirmed its standpoint that a community approach to the challenge of new information technology did not require the creation of new financial instruments. Rather, the EC's role would be to "mobilize and coordinate the efforts made by Member States and by specialized international agencies within a wider framework".[42]

On 20 May 1980, the Commission of the EC requested the Economic and Social Committee's (ESC) opinion on said document. The ESC warned that the exploitation of new information technology offered enormous scope for economic progress but could also be accompanied by unforeseeable social repercussions. The ESC voiced concerns over the potential social consequences of the development and application of new information technology in all areas of social and economic life that might even be more far-reaching than the expected economic benefits. The ESC also criticized the Commission's tentative approach and the proposed community response as insufficient, pointing out the lack of plans and funds to counter possible negative effects.[43]

Whereas the ESC had identified the improvement and reorientation of education and vocational training as a priority in the response to technological change, the Commission of the EC decided to wait and first consult the educational author-

40 Brine, "Educational and Vocational Policy".
41 COM/79/650 final.
42 COM/79/650 final, 5.
43 R/CES/720/80, 5.

ities of the Member States before developing its own propositions regarding future activities. The Commission had noted that several Member States had already proposed education reforms at all levels of the education system. They were in the process of developing their own concepts to revise or newly implement curricula in initial vocational education and training, continuing education for qualified technicians, as well as to incorporate the teaching of a basic knowledge about new technologies into mandatory schooling.[44] However, the Commission had no oversight over the scope and details of such activities in the individual Member States. By putting itself in a primarily coordinating role, the Commission was able to draw on individual Member States' experiences. On the downside, this approach meant that Community efforts would depend heavily on the Member States' political will to abolish barriers, as well as to launch, coordinate, and fund their own aid programmes to promote the introduction of new information technology into education. In particular, the ESC highlighted the fact that the actions proposed by the Commission consisted merely in a coordination of efforts and did not entail the deployment of any financial means by the Community, which may not be enough to reach the envisaged effects.[45]

The EC's work programme for 1985–87 regarding the use of new information technology in general schooling consisted primarily in the support of studies and pilot projects undertaken in the Member States, as well as the organization of seminars to exchange and discuss information and experiences.[46] A number of studies had already been conducted in the first half of the 1980s on different approaches to computer education in secondary schools in several Member States[47] and on the use of new information technology to facilitate the education of handicapped children.[48] The Commission of the EC also proposed to support experiments and actions aimed at increasing opportunities for girls to gain access to teaching related to new information technology in cooperation with the Advisory Committee on equality of opportunity.[49] In the field of teacher training, the Commission proposed the organization of exchanges and study visits for teacher trainers and "multipliers" with the aim of establishing common guidelines for the content of teacher training in the field of new information technology. An initial series of such exchanges and study visits to France and the UK already took place in 1984–85.[50]

44 COM/81/578 final.
45 R/CES/720/80, 3.
46 COM/84/722 final.
47 COM/84/722 final, 3–4.
48 COM/84/722 final, 9.
49 COM/84/722 final, 8.
50 COM/84/722 final, 11–13.

With regard to the development and use of appropriate software, courseware and hardware systems for schools, the work programme envisioned a series of roundtables and symposia to stimulate collaboration between education authorities and industry at Community level, as well as the launching of a series of projects on Community level, with the Commission and industry sharing the costs for developing IT-based educational equipment. In the same vein, the EC Council decided in 1988 on an Exploratory Action on DELTA (Developing European Learning through Technology Advance) with an initial budget of 20 million ECU.[51] DELTA was aimed at bringing together academia and industry for research on learning systems and the collaborative development of advanced learning technology. However, DELTA targeted continuing vocational education and higher education, whilst learning in schools was not of direct interest. DELTA had originated in the Directorate General XIII of the European Commission, which was responsible for research and development in the field of IT, telecommunications, and related technologies. Thus, it was essentially a technology focused R&D initiative.[52]

With regard to the introduction of new information technology into European school systems, the EC essentially took on the role of supranational coordinator and provider of platforms for the gathering and exchange of information, experience and best practices based on projects undertaken and funded by the individual Member States. Rather than launching community projects on its own, the EC initiated the creation of a network of designated institutions in all Member States to coordinate research activities. The EURYCLEE network was set up in 1986 with the task to select, store, and exchange information relating to the introduction of new information technology into schools in the Member States. In addition, the EC sought out possibilities for cooperation with international organizations such as OECD (CERI in particular), Council of Europe, UNESCO, and the International Bureau of Informatics (IBI). The EC was interested in the participation in actions launched by these organizations, as well as in regular exchanges of information on the issue of new information technology in education.

By the early 1980s, the wider social consequences and changes in skills and knowledge that the use of new technologies required, as well as the benefits and constraints of using computers in the classroom were still largely unknown. Consequently, it also seemed unclear in what ways the systems of teaching and learning across Europe should be adapted to be able to realize the anticipated benefits from the use of new media in the education sector. The EC largely left it to the

51 88/417/EEC.

52 Peter Goodyear, "Development of Learning Technology at the European Level: The DELTA Programme," *Innovations in Education & Training International* 26, no. 4 (1989): 335–341, https://doi.org/10.1080/1355800890260408.

Member States to take the initiative and develop their own concepts as to how their respective school systems should be responding to the challenges of new information technology, in what ways school curricula need to be adapted and what purpose the use of computers in general education should serve. Rather than launching its own initiatives, the EC's strategy consisted mainly in mobilizing and coordinating the efforts made by Member States, by pooling studies on the impact of the introduction of new information technologies on the labor market and new demands for education and training systems.

In contrast to the earlier self-assigned role of a passive coordinator in the response to technological change with regard to general schooling, during the second half of the 1980s, the EC took on a more active role in promoting new information technology both in higher and vocational education, in particular through the launch of European exchange schemes. On the one hand, this pertained to the smaller-scale exchange and study visits for teacher trainers to broaden their practical and professional experience. On the other hand, it involved the launch of substantial mobility initiatives such as COMETT and ERASMUS with the aim of pooling resources for higher education or advanced training in new information technology across Europe.

A New Understanding of Education and Training Emerges

In an interview held in the early 1980s, the European Commissioner for Industrial Affairs and Energy Etienne Davignon described the issue of vocational training in the context of new information technologies as "a central problem" and announced various surveys to assess new skills required in industry. However, Davignon also announced that it could not just be a matter of defining specific skills that were now needed. Rather, the commissioner held out the prospect that the whole understanding of fixed occupational codes of conduct would have to change radically. As a direct result, he saw an urgent need for radical flexibility in vocational education and training. The new information technologies would be accompanied by an "occupational adaptation on an almost permanent basis".[53]

Within the limits of its legal framework, the European Commission therefore wanted to help manage both the economic and social consequences of technological change and, overall, ensure cultural adaptation to the new situation. "Informa-

53 Davignon, "Telematics in Europe," *Vocational Training (CEDEFOP)*, no. 5 (1981): 2–4.

tion, education, training and retraining" were the means to achieve this.[54] In any case, the ultimate goal of the initiatives was to strengthen the competitiveness of the member states. All measures served this one purpose, following the conviction that social problems of the member states, such as high unemployment, would for the most part simply resolve themselves once this goal was achieved.[55]

With regard to vocational education and training, two policy documents (both adopted in 1983) were central to the next steps.[56] These were the "Council resolution concerning vocational training policies in the EC in the 1980s"[57] and the "Council resolution concerning vocational training measures relating to new information technologies".[58] With regard to the challenges posed by technological change, it became clear how comprehensively they seemed to affect vocational education and training. Unemployed young people, workers with obsolete qualifications and women working in office jobs were identified to be particularly threatened by computer-aided rationalization. Each of these specific stakeholder groups appeared to require special attention. The Community's medium-term programme 1986–1990 to promote equal opportunities for women, for instance, explicitly mentioned the advancement of women's training for occupations connected with new technology as one of its goals.[59] The new information technologies called into question the established system of coordinating the interests of state, capital, and labor.

Over the course of the 1980s, social issues were still meant to play a certain role in the new technology policy. However, the new situation called for a highly qualified workforce, which was now meant to be shaped by various European initiatives. With the advent of new information technologies, a different understanding of education and training prevailed. This culminated in a lifelong learning approach in the 1990s. The individual initiatives in the 1980s and 1990s were catalysts for these shifts towards a fluid, flexible, and institutionally ill-defined concept of vocational education and training.

54 COM/1980/513 final, 3.

55 Alan Clarke, "Competitiveness, technological innovation and the challenge to Europe," in *The Learning Society: Challenges and Trends*, ed. Peter Raggatt et al. (London: Routledge, 1996), 59–67; Marina Cino Pagliarello, "Aligning policy ideas and power: the roots of the competitiveness frame in European education policy," *Comparative Education* 56, no. 4 (2020): 441–458, https://doi.org/10.1080/03050068.2020.1769927.

56 Clarke, "Competitiveness".

57 Council resolution of 11 July 1983 concerning vocational training policies in the European Community in the 1980s (OJ C, C/193, 20.07.1983), 2–5.

58 Council resolution of 2 June 1983 concerning vocational training measures relating to new information technologies (OJ C, C/166, 25.06.1983), 1–3.

59 COM (87) 155 final.

In preparing the initiatives, the Commission was advised by the Standing Committee on Employment and the Advisory Committee for Vocational Training. The need for information was also met by the European Centre for the Development of Vocational Training (CEDEFOP), founded in 1975. CEDEFOP had been installed to provide a better information base for the situation of vocational training in the member states, and now it also contributed to the question of how to deal with technological change. While the first studies, seminars and reports were primarily devoted to the social aspects of education policy,[60] the context of an economy-oriented technology policy now became increasingly important for CEDEFOP. In 1980, a study was carried out in which documents were analysed and interviews were conducted with experts from the Organization for Economic Cooperation and Development (OECD) and the International Labor Organization (ILO), who were also heavily involved with the impact of technological change on the skills required. This was followed by isolated case studies in the member states to validate the results of this preparatory research.[61] The European Foundation for Living and Working Conditions and the European Pool of Studies Analysis also contributed to the formulation of a new technology agenda.[62]

CEDEFOP was now consolidating its previously rather uncoordinated events and surveys on the impact of technological change on VET. In the mid-1980s, it responded to the Commission's requests to set up a proper observatory for vocational training. Vocational education and training created problems here, as access via the education system and via companies differed fundamentally and led to different results.[63] CEDEFOP was able to gauge a fairly accurate picture of what the various initiatives were about. This put education and employment in a new, direct relationship and made the coupling of the two systems more flexible. The focus was on mobility, exchange, and formalization, not on defined skills. This was intended to meet the challenges posed by new information technologies.

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60 CEDEFOP, *Youth unemployment and vocational training in the European community. Contributions and documents. Presented to the 1st consultative conference at Zandvoort/NL 13–15 Dec. 1976* (Berlin: CEDEFOP, 1977); CEDEFOP, *Equal opportunities and vocational training; In-firm training and career prospects for women in the Federal Republic of Germany* (Berlin: CEDEFOP, 1982).

61 CEDEFOP, *Microelectronics and informatics technology and their training implications in firms* (Luxembourg: Office for Official Publications of the European Communities, 1984).

62 Communication from the Commission to the Council on 10 June 1982 on "Vocational training and new information technologies: New Community initiatives during the period 1983–1987" (OJ No C 162, 29.06.1982), 7–12.

63 CEDEFOP, *Promotion of cooperation among research and development organizations in the field of vocational training: Working meeting papers 20/21 May 1985* (Berlin: CEDEFOP, 1986), 104–107.

The first major European initiative to address technological change dealing with training issues was the "Community Programme for Education and Training in Technology" (COMETT).[64] The aim of COMETT was to increase mobility and promote transnational cooperation. It was an initiative designed to facilitate the transfer of knowledge and experience between member countries, but also between the spheres of education, research, and business. As such, COMETT was not only meant to bring together schools and universities, but also to promote cooperation between publicly funded research institutions and private companies. Although it primarily targeted higher education, the initiative was meant to "reinforce training in technology (particularly advanced technology), increase the development of highly skilled human resources and the competitiveness of European industry".[65]

While COMETT was still very close to technology policy initiatives such as ESPRIT, the following programmes gradually moved away from this close connection. However, the central motivation behind their measures was not given up. In terms of financial volume, COMETT remained the largest educational initiative of the 1980s and 1990s. In the longer term, COMETT was only surpassed by the broader and much better-known mobility programme "European Community Action Scheme for the Mobility of University Students" (ERASMUS), which still exists in an adapted form and was launched shortly afterwards. While the programme's name evokes the idea of traveling intellectuals in line with the humanist tradition, ERASMUS served more mundane and pragmatic purposes. On the one hand, the mobility programme was intended to help instill a sense of European citizenship in youth, as a cultural educational contribution in the effort to create a single European market. On the other hand, ERASMUS served to create a common pool of higher education resources among member states for the training of a mobile, highly skilled workforce that the European economy needed to keep with technological change. In 1988, the "Action programme for the vocational training of young people and their preparation for adult and working life" (PETRA) was launched to modernize vocational education and training, and to respond explicitly to technological change. In 1990, the smaller "Action programme to promote innovation in the field of vocational training resulting from technological change in the European Community" (EUROTECNET) was set up, which even had the technology policy thrust into its name. The "Action programme for the development of continuing

64 For a detailed study of the development and implementation of the COMETT initiative as a response to technological change, see: Carmen Flury, Michael Geiss, and Rosalía Guerrero Cantarell, "Building the technological European Community through education: European mobility and training programmes in the 1980s," *European Educational Research Journal* 20 (2021): 348–364. https://doi.org/10.1177/1474904120980973.

65 COM/1994/368, final, 6.

vocational training in the European Community" (FORCE), aimed at the vocational learning of adults, ran in parallel.[66]

The aim of PETRA was to ensure that young people in all member states received at least one year of vocational training after compulsory education. Like the other initiatives, the programme was intended to introduce a European dimension to vocational training. However, even this initiative had a specific function in the context of "rapid economic, technological and social change"[67]: to create skills required in a digital society. FORCE and EUROTECHNET aimed to lead traditional vocational training into the future. This meant promoting innovative formats, placing greater emphasis on continuing vocational education and training, and developing an overall vision for a regime advocating flexible, dynamic, and transnational skill formation. This corresponded to a new meaning of industrial society, which was already understood as "information society", in the report "European society faced with the challenge of new information technologies: a Community response".[68] The two initiatives targeting women's education and training, the IRIS network, launched in 1988, and NOW (New Opportunities for Women), launched in 1991, can be seen as part of these series of efforts to create a pool of human resources geared with skills to face the technological society.[69] However, it should be noted that IRIS did not fund training but functioned as a network of best practices. Out of the 330 projects carried out in 1991, only 6 were part of EUROTECNET, and 5 members of the IRIS directory were also COMETT projects. This shows some overlap between women's projects and the larger EC initiatives, but not at a significant level. In 1991, a preparation meeting between the twelve member states took place to draft their NOW projects. The topic of new technologies was considered a priority. The training of women in new technologies, however, decreased over the years leading to less emphasis on their contribution in a so-called information society. Consequently, this entailed a decline in the participation of women in technical areas.[70]

66 COM/1993/151 final.

67 87/569/EEC: Council Decision of 1 December 1987 concerning an action programme for the vocational training of young people and their preparation for adult and working life (OJ No L 346/31, 10.12.1987), 31–33.

68 COM/1979/650 final.

69 PA Cambridge Economic Consultants limited, *An Evaluation of the IRIS Network (Final Report)* (Brussels: Commission of the European Communities, 1992).

70 See UK example in Jacky Brine, "The European Social Fund and the Vocational Training of Unemployed Women: questions of gendering and re-gendering," *Gender and Education* 4, no. 1–2 (1992), 158.

In Search of Coherence

It was clear to contemporaries that the microchip presented a challenge. However, what remained unclear was the type of skills needed to cope with it. The dynamization and flexibilization of vocational education, the desire for high level of skills and the focus on continuing education and training were all partly framed as an attempt to meet new needs and challenges. These perspectives were then incorporated into a more coherent programme in the 1993 EC White Paper *Growth, competitiveness, employment: The challenges and ways forward into the 21st century.* Although the major argument for launching this report was the high rate of unemployment in Europe,[71] the report built on the various measures and experiences of the 1980s. The programme outlined a tripartite approach to increasing employment: stimulating the market by creating the best legal conditions, investing in structural elements and activating the labor force.[72] Vocational education and training were to play a central role here, as can been seen from the White Paper *Teaching and Learning: Towards the Learning Society.* Large sections of this document only integrated the approaches of the 1980s, yet it provided a conceptual framework for them. On the one hand, it adopted the diagnosis of information society that had already served as the framework for the new technology policy agenda since the late 1970s. On the other hand, the global dimension of the programme had now been adopted. However, the approaches in the 1980s had already been formulated in a transcontinental context, in which the USA and Japan were seen as the biggest competitors. Finally, the creation of scientific and technical skills was seen as a central problem for future-oriented vocational training. Mobility programmes and an extension of the meaning of vocational training and vocational skills remained central features of this accelerated programme "towards a learning society".[73] In parallel, all initiatives that were explicitly aimed at vocational training were brought together in the Leonardo da Vinci programme, which aimed at further consolidating the new European vocational training policy.[74]

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71 Jeff Kenner, *EU employment law: from Rome to Amsterdam and beyond* (Oxford: Hart, 2003), 296.
72 Peter Muntigl, Gilbert Weiss, and Ruth Wodak, *European union discourses on Un/employment: an interdisciplinary approach to employment policy-making and organizational change* (Amsterdam: John Benjamins Publishing, 2000), 59.
73 COM/1995/590 final.
74 Gisella Gori, *Towards an EU Right to Education* (The Hague: Kluwer Law International, 2001), 105.

Conclusion

The greater the claim, the more unspecific the package of measures. The only thing that European policymakers took for granted was that things could not stay the way they were. In the aftermath of the two oil crises of the 1970s, European states and supranational institutions were deeply unsettled by their IT industry's warning that they risked falling behind in the face of accelerating structural change. They developed new economic and educational approaches to meet changing demands and requirements. With the arrival of the personal computer in private households in the 1980s, it became clear to everyone that a new era had begun.[75]

However, since it was not clear which skills were actually needed in a dawning digital era, European education policy became both more ambitious and more unspecific. The European Year of Lifelong Learning (1996) celebrated this supposedly new approach.[76] Although the idea of lifelong learning had already emerged under completely different economic and social conditions in the context of the post-war boom,[77] it underwent a redefinition that took hold in the 1990s. The new information technologies seemed to make the necessity of this new policy immediately evident.

In 2010 the European Commission proposed a "Digital Agenda for Europe" as part of the "Europe 2020" programme, which can be interpreted as a direct continuation of the efforts of the 1980s. Once again, the aim was to strengthen the competitiveness and productivity of European companies.[78] There was also a section of this agenda that explicitly focused on the lack of digital skills in Europe. The "New Skills Agenda for Europe" aimed for closer integration of education and private business, more student mobility, recognition, and validation of acquired competences and modernization of vocational and higher education.[79]

The relation between education and technology is a site of ongoing struggle, negotiation, and conflict.[80] As the history of the European debates and initiatives regarding the introduction of new information technology into education indicates, there is certainly no easy way to deduct skill demands from technological

75 Gugerli and Zetti, "Computergeschichte," 193–228.

76 Decision No 2493/95/EC of the European Parliament and of the Council of 23 October 1995 establishing 1996 as the 'European year of learning' (OJ L, L/256, 26.10.1995), 45–48.

77 John Field, "Lifelong education," *International Journal of Lifelong Education* 20, no. 1–2 (2001): 3–15, https://doi.org/10.1080/09638280010008291.

78 COM/2010/245.

79 COM/2016/381 final.

80 Neil Selwyn, *Education and Technology. Key Issues and Debates* (London: Bloomsbury Academic, 2021), 188.

development alone, as the education for a digital society is necessarily intertwined with contested and value-laden ideas of what such a society entails and how it is organized. Moreover, the fast pace of technological change necessitates a constant re-evaluation of temporary conclusions. As such, it seems impossible to pin down a persistent set of skills that a future European workforce or citizenry requires. Instead, the European history of educational policymaking in face of technological change points to the efforts through which challenges were repeatedly reframed and educational policy responses sought and re-evaluated. The complex negotiation processes involved a wide range of stakeholders and target groups – from at-risk groups such as women and low-skilled workers, to a pool of highly qualified, mobile, and versatile workers that the EC's mobility programmes hoped to create. Therefore, it cannot be expected that educational systems ever find a definitive answer to the question of how to respond to technological change. Instead, it is worthwhile to attend to the ongoing struggle between differing views about what challenges new information technology poses for education systems and how they should be appropriately addressed. With regards to Europe, this historical and current struggle relates to the shifting focus between economic concerns of global competitiveness on the one hand, and social policy and social justice issues on the other, including people who are displaced from the labor market, excluded from participation in educational opportunities, or otherwise disadvantaged by the rise of digital technologies.

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Barbara Hof

Defuturization Machines: The OECD's Early Efforts to Plan the Computerized Future of Education

Abstract: In the late 1960s, the mass use of computers still seemed a thing of the future. However, even though the number of computers actually available was quite small, the pursuit of a technology-based society nourished visions of the coming high relevance of computers. This chapter argues that such visions are not only expressions of the desired future, but also entail defuturization. Defuturization is proposed here as an analytical concept to describe how visions inform governing strategies in the present, namely through a deliberate reduction in the openness of the future. Therefore, the concept of defuturization is helpful for understanding actors that attempt to define policies and support their implementation, such as the OECD. Drawing on archival documents, books, and journal reports this chapter not only outlines the early history of computer education in OECD member countries, but also analyzes how this intergovernmental organization shaped the discourse on technological innovation and social change at a time when computers had not yet entered classrooms on a large scale.

Keywords: technological optimism; future; systems analysis; computer-assisted instruction (CAI); history of educational technology; international; OECD

Introduction

Large segments of the population in Western European countries had limited physical access to computers in the late 1960s, but developments at that time were important in the formation of visions for the mass use of computers in public schools. To support this assumption, this chapter shows that the gap between the actual number of computers and the belief in their increasing relevance, underpinned by projections of current trends into the future, fed expectations for the coming computer age that were collectively shared. Such expectations mobilized and guid-

Note: I am grateful to Carmen Flury and Michael Geiss for the editorial work and to Romina Bertschinger for the help in pre-selecting sources from the myriad of digitized records of the OECD. I particularly would like to thank Vassilis Galanos, Bernard Keenan, Felicitas Macgilchrist, Karin Priem, and Sebastian Randerath for their comments, which helped improve this chapter considerably.

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ed the activities of researchers, innovators, corporations, politicians, and other stakeholders.[1] Particularly powerful and widely accepted actors translated expectations into policymaking, which is notably true for the Organization for Economic Co-operation and Development (OECD).

This intergovernmental organization was founded in 1961 (as the successor to the OEEC) to represent and maintain the interest of its member countries, but was also given the legitimacy to make its own decisions. The OECD works to stimulate economic growth and raise living standards, and, to this end, provides expertise in support of policy development and implementation. By advocating the idea of the knowledge economy, the OECD gained significant influence in the field of education.[2] As outlined in an earlier article, research on the potential of computers in education was conducted under the auspices of the OECD from the late 1960s onwards, coordinated by its Centre for Educational Research and Innovation (CERI).[3] This division sought to develop recommendations for best practices in computer education, as well as to provide access to computers to a larger part of the school population, and thus collected and communicated findings from experiments, evaluations, and descriptive reports. The following analysis seeks to discuss the centrality of visions to OECD's governmentality by examining the impact of expectations on this organization's protocols. Archival materials of the OECD chronicle numerous meetings from 1968 to 1973 that testify to grandiose claims about emerging technologies and the optimism that computers will profoundly change education within the next few years. This techno-optimistic imagination of the near future, formulated as a prediction, is of interest here. Therefore, before moving to the results of the source study, a few remarks on the chapter's theoretical contribution.

Media scholars reveal that we not only live with materially existing technologies, but also engage with fantasies of how speculative media will affect us in the

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1 For the mechanism of expectations, see Kornelia Konrad et al., "Performing and Governing the Future in Science and Technology," in *The Handbook of Science and Technology Studies*, ed. Ulrike Felt et al. (Cambridge, MA: MIT Press, 2016), 465–493.

2 Tony Porter and Michael Webb, "The Role of the OECD in the Orchestration of Global Knowledge Networks," in *The OECD and Transnational Governance*, ed. Rianne Mahon and Stephan McBride (Vancouver, BC: UBC Press, 2009), 43–59; Maren Elfert, "The OECD, American Power and the Rise of the 'Economics of Education' in the 1960s," in *The OECD's Historical Rise in Education. The Formation of a Global Governing Complex*, ed. Christian Ydesen (Cham: Palgrave Macmillan, 2019), 39–62; Tore Bernt Sorensen, Christian Ydesen, and Susan Lee Robertson, "Re-Reading the OECD and Education: The Emergence of a Global Governing Complex – an Introduction," *Globalisation, Societies and Education* 19, no. 2 (2021): 99–107.

3 Barbara Hof and Regula Bürgi, "The OECD as an Arena for Debate on the Future Uses of Computers in Schools," *Globalisation, Societies and Education* 19, no. 2 (2021): 154–166.

future.[4] Accordingly, this chapter aims to show that in the late 1960s, the anticipated growing importance of computing formed the basis for proposals to introduce computers in education. By describing a past vision, the chapter addresses the early phase of the computerization of schools and answers how initial ideas for computer education have taken shape.

Visions have the power to shape policymaking; this chapter illustrates this process by combining two heuristics: historical research shows that debates on classroom technologies are often debates on a desired future, and technology use is believed to be instrumental in building future worlds.[5] In addition to the impact of such imaginaries, solutionism represents a second well-studied topic. Science and technology studies suggest that new technologies are not value-free but promise improvements, and these promises foster the acceptance of technologies in innovation-driven societies. Moreover, the computer industry often touts its products as tools for solving complex social problems and praises them for increasing economic productivity through more streamlined processes.[6] I claim no originality in using "imaginaries" and "solutionism" as heuristics. My argument is rather that progress-oriented visions that revolve around technologies, combined with solutionism, impact decisions in the "now". Normative projections of better tomorrows create collective fictions that powerful actors use to intervene in debates and policymaking *in the present.* In addition to tracing the origins of computer education, this chapter therefore explores broader questions of "defuturization"; or the "making present" of a desired future.

Defuturization forms a complementary figure to imaginaries. It can be understood as a form of (wishful) thinking to tame the openness and uncontrollability of

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4 Simone Natale and Gabriele Balbi, "Media and the Imaginary in History. The Role of the Fantastic in Different Stages of Media Change," *Media History* 20, no. 2 (2014): 203–218; Nelson Ribeiro, "The Discourse on New Media: Between Utopia and Disruption," in *Theorien des Medienwandels*, ed. Susanne Kinnebrock, Christian Schwarzenegger, and Thomas Birkner (Köln: Herbert von Halem, 2015), 211–230.

5 Lina Rahm, "Educational Imaginaries: Governance at the Intersection of Technology and Education," *Journal of Educational Governance*, 2021, 1–23. Imaginaries are best described as historically rooted, collective, normative dreams of something "better"; they are sets of connotations, fantasies, and beliefs that shape politics and impact social ordering. Imaginaries can therefore be understood as a cultural technique for the production and maintenance of reality. The concept was refined by Sheila Jasanoff, "Future Imperfect: Science, Technology, and the Imaginations of Modernity," in *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power*, ed. Sheila Jasanoff and Sang-Hyung Kim (Chicago, IL: University of Chicago Press, 2015), 1–33.

6 Evgeny Morozov, *To Save Everything, Click Here: The Folly of Technological Solutionism* (New York: Public Affairs, 2013); Sean Johnston, *Techno-Fixers. Origins and Implications of Technological Faith* (Montreal, QC, and Kingston, ON: McGill-Queen's University Press, 2020).

the future by imagining the desired future as the coming present; hence, defuturization reduces complexity by deliberately excluding alternative future scenarios. It projects the future as manageable, enacts options to achieve defined goals, helps to coordinate actions, resources, and attention, and thereby supports planning as a future-oriented practice. To this end, defuturization builds on the understanding of temporality as linear and determinable by social actors, rather than temporality as cyclical and unchangeable.

I claim that defuturization gained significant prominence in the planning euphoria phase that characterized the 1960s, when planning was seen as a method to achieve the best of all options. Historically, this period witnessed the optimism that societies can shape their own future with the help of rational decisions and scientific reasoning.[7] The future was believed to be a predictable parameter and direct consequence of informed decisions taken in the present – and this notion of anticipatory governance became important to the OECD.[8] However, decisions to achieve future goals can only be made in the present or be postponed. This is where defuturization comes into play. Systems theorist Niklas Luhmann introduced this term in 1976, thereby making a distinction between two modes of defuturization: the utopian scheme serves as a guiding horizon and is thus to be understood as a *present future*, while technologies are oriented on *future presents.*[9]

Technologies are tailored to expectations for (positive) change, which illustrates the dual dynamics between technology and the idea of progress. These dual dynamics are mirrored in the way the advent of computers was seen in the late 1960s, namely as an irreversible path leading to the future. The computer developed into a key symbol of technology-based society and economic growth, which are also two central rationalities embodied in the anticipatory governance strategies of the OECD. Hence, I borrow Luhmann's term "defuturization" to speak about the vision of the computerized classroom as it was driven by the OECD from 1968 to 1973. Defuturized visions turn into present expectations. Consequently, "defuturization machines" are a touchstone here to illustrate how expectations for the coming high relevance of computers informed debates of selected experts invited

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7 In the late 1960s, control and rational choice theories, which can be associated with cybernetics, operations research, and game theory, morphed into systems analysis as a method for planning: Jenny Andersson, *The Future of the World. Futurology, Futurists, and the Struggle for the Post Cold War Imagination* (Oxford: Oxford University Press, 2018); Julia Obertreis, "Planning," in *Critical Terms in Futures Studies*, ed. Heike Paul (Cham: Palgrave Macmillan, 2019), 215–219.

8 Susan Lee Robertson, "Guardians of the Future: International Organisations, Anticipatory Governance and Education," *Global Society* 36, no. 2 (2022): 188–205.

9 Niklas Luhmann, "The Future Cannot Begin: Temporal Structures in Modern Society," *Social Research* 43, no. 1 (1976).

to meetings by the OECD's CERI. The following four sections use archival documents (meeting and speech protocols, minutes, evaluations, descriptive statistics), journal reports, and books to illustrate how attempts were made to plan for a future that was believed to be highly computerized.

When "Command and Control" Entered the First Classrooms

Visions usually imply statements of a preferable scenario. In the late 1960s, the vision of the OECD was that computers would become indispensable for future societies to thrive, which would require a better understanding of computers and more programming skills in the broader population. This idea reflected promising developments: the cost of leasing a computer for commercial use was falling, minicomputers began to replace huge mainframes, and more and more companies were able to purchase computers. Terminal systems now linked them via cables to several teletypes for information exchange, and time-sharing was developed, allowing easier access for parallel users. At that time, US American manufacturers such as IBM had a virtual monopoly in the Western European computer market, although several countries were revitalizing their domestic industries through government investment, notably France through its "Plan Calcul" launched in 1966.[10] In education, the context was similar: at the end of 1966, there were 2300 computers in educational institutions in the United States and 700 in Europe. Two years later, this gap had widened from 45,000 compared to 12,000. This development concerned the OECD, a concern that not only stemmed from its history as a vehicle for economic reconstruction in Europe, but was also to shape its strategies in computer education in the years to come.[11]

Journal reports indicate that computer education was first promoted by professional associations to meet the shortage of programmers and data analysts in the private industry. It then expanded to include study programs at universities and was only later considered an important subject matter in secondary education. Entrepreneurs believed that the demand for computer skills would increase along with the number of new commercial applications. By the late 1960s, general edu-

10 Editors, "California Computer Teaches Arithmetic to Schoolchildren in Kentucky," *Computers and Automation* (1967), 52; Ted Schoeters, "Schoeters from Great Britain," *Computers and Automation*, March (1968), 33; OECD, *Gaps in Technology* (Paris: OECD, 1969).

11 OECD Library & Archives, Paris (hereafter OECD-A), Reel 1969-OCDE_0442, CERI/CT/69.02, Computers in Education: Present Situation and Development Trends, March 13, 1969.

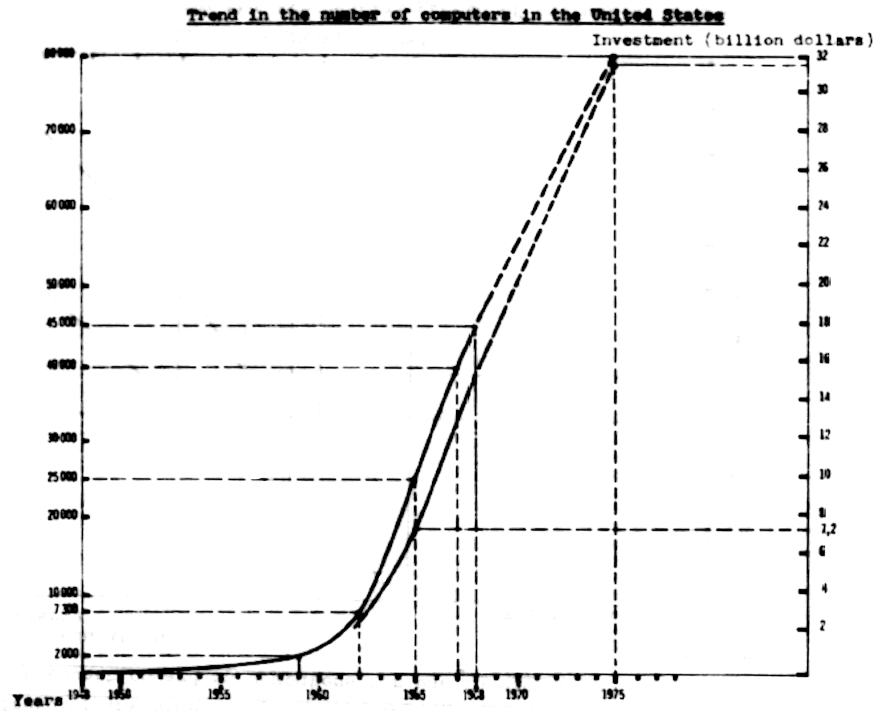

Fig. 1: Trend in the number of computers in the United States since 1948 and forecast for 1975. The graph depicts the tremendous growth of the number of computers and investments made in the 1960s (source OECD-A, Reel 1969-OCDE_0442, CERI/CT/69.02)

cation was seen as instrumental in the successful development of more skills, whereas in the previous two decades only research institutes, the military, government agencies, and a few businesses had required their employees to be trained in computing. Economic planning underpinned the argument that it was necessary to impart knowledge about computers to the young generation.[12] The historical data that exist are hard to interpret, but examples help to comprehend some important changes. Statistics from the United States suggest that in 1970, thirty percent of secondary schools had access to computers for administrative work and thirteen per-

12 Swen Larsen, "Computer Training in Private Schools," *Computers and Automation*, March (1968), 22–25; Joan Fine, "Computers in High Schools – A 'Hands On' Approach," *Computers and Automation*, March (1968), 26–29; Editors, "Computers and Education: Forecast," *Computers and Automation*, March (1969), 6; Leon Davidson, "Access to a Computer for Every Person – a Prediction," *Computers and Automation*, March (1969), 13.

cent reported having already used computers in teaching. Five years later, the number had risen to nearly sixty percent. Although computers were still more likely to be used in administration than in the classroom, and computers were hardly part of everyday school life, their availability was increasing substantially. This increase fueled optimism about the future of educational technology in the United States, and this optimism spilled over into Europe, in part with the support of the OECD.[13]

The understanding of computer education as it was incorporated into policy development of the OECD encompassed two ideas that connected the present and the future: learning to use a computer should prepare students for the anticipated changes that would impact their future professional lives. Moreover, the computer itself was thought to be the perfect medium for developing instructional techniques, as well as for better learning in mathematics, languages, and science in the now.

The normative notion of the computer as a better learning tool benefited the further development of computer-assisted instruction (CAI), which had grown out of the work of the Electric Typewriter Division at the IBM Research Center in collaboration with Harvard behaviorist psychologist B.F. Skinner. Programmed instruction, as it had been popularized in the years before, was integrated into a younger medium when, in 1959, researchers recognized that the computer offered advantages over analog teaching machines and programmed books because they believed computers processed information more quickly and were thus better able to adapt to individual proficiency levels.[14] This continuity in the conception of educational technologies illustrates that computers did not bring any disruptive innovation. They required a clear line of "command and control" rather than being a user-friendly communication medium. In other words, when the first initiatives for computer education in secondary schools were taken, advanced programming skills were still essential in order to make full use of the computer.

Terminal computers served as prototypes for computer-assisted instruction because they could provide distributed access to a single computer that collected data from students and set them individualized learning tasks. In the 1960s, several research projects were undertaken in parallel: Control Data Corporation supported the installation of a tutorial system called PLATO (programmed logic for au-

13 William J. Bukoski and Arthur L. Korotkin, "Computing Activities in Secondary Education," *Educational Technology* 16, no. 1 (1976): 9–23; Robert V. Price, "An Historical Perspective on the Design of Computer-Assisted Instruction: Lessons from the Past," *Computers in the Schools* 6, no. 1–2 (1989): 145–158.

14 Gustave J. Rath, Nancy S. Anderson, and R.C. Brainerd, "The IBM Research Center Teaching Machine Project," in *Automatic Teaching. The State of the Art*, ed. Eugene Galanter (New York: John Wiley & Sons, 1959).

tomatic teaching operations) at the University of Illinois. TICCIT (time-shared, interactive, computer-controlled information television) was a tutorial system created at the University of Texas with the support of the federally funded Mitre Corporation. A third important development took place at Stanford, where researchers designed the IBM 1500 computer and the programming language COURSEWRITER, made specifically for computer-assisted instruction in mathematics and reading.[15] Comparable to the American tutorial systems was SOCRATES (System for Organizing Content to Review and Teach Educational Subjects), designed by the British cybernetician Gordon Pask.[16] While the experts who met at OECD's CERI to discuss further steps to promote computer education frequently referred to the North American innovations, the British SOCRATES had no impact on their strategies. Those who relied on the projects in the United States exemplified this nation's hegemonic position in the transnational dissemination of ideas catalyzed by the OECD.

Western Europe was found to be lagging in pedagogical use of mass media, echoing both the competitive rhetoric in OECD protocols and the power asymmetry between CAI developers from different OECD member countries, which at the time included several European countries, Japan, Canada, and the United States. In 1969, the "working party on the use of computers in higher education" of CERI proposed the establishment of a network of individuals to collect and disseminate information and to coordinate the exchange of researchers, with the United States seen as the most advanced nation in computer education. The perception of a "digital gap" between different OECD member countries, both in terms of the number of computers and in terms of adequate instruction, persisted for several years, even if development projects in computer-assisted instruction were carried out at several places.[17] In Belgium, for instance, two projects had been launched. One of them linked the computer to a keyboard, projector, and slides. The addition of sound was considered. One of the three projects in France involved an IBM computer

15 Klaus Fischer and Ulrich Kling, "Schulbezogene Forschungs- und Entwicklungsaspekte des CUU in Amerika," in *Computerunterstützter Unterricht*, ed. Hans Freibichler (Hannover: Schroedel, 1974), 74–103; More detailed in: Robert A. Reiser, "A History of Instructional Design and Technology," *Educational Technology Research and Development* 49, no. 1 (2001): 53–64.
16 Lawrence M. Stolurow and Daniel Davis, "Teaching Machines and Computer-Based Systems," in *Teaching Machines and Programmed Learning, II. Data and Directions*, ed. Robert Glaser (United States: Department of Audiovisual Instruction, 1965), 162–212. For Pask, see Barbara Hof, "The Turtle and the Mouse. How Constructivist Learning Theory Shaped Artificial Intelligence and Educational Technology in the 1960s," *History of Education* 50, no. 1 (2021): 93–111.
17 OECD-A, Reel 1969-OCDE_0442, CERI/CT/69.07, Minutes of the Meeting of the Working Party on Joint Project CERI-XI, November 4, 1969; Henri Janne, *For a Community Policy on Education* (European Communities Report, 1973), 46.

with twenty terminals, operational from 1965. In Japan, a study of the effects of different programming techniques on creativity was conducted in 1969, linking a HITAC 10 minicomputer to two audiovisual terminals, each equipped with a typewriter and a cathode ray screen or a slide projector. In the Federal Republic of Germany, research was funded to create computer-assisted instruction using a Telefunken computer linked to four terminals consisting of typewriters and a cathode ray screen. In the Netherlands, a group of projects was carried out in two cities, and in the United Kingdom, four pioneering projects were launched that combined minicomputers, additional memory, and controllers; respectively, one system connected the computer to teletypes and a television screen – an indication that a lot of tinkering and trial runs were involved.[18] The governing board of CERI, composed of a small panel of selected experts rather than country representatives,[19] decided to take action because these developments were seen as a prevailing trend with long-term consequences.[20]

The decision to make educational technology a priority in CERI's program not only reflected national impulses but must also be seen as a response to social changes at a time when the postwar "baby boomer" generation was enrolling in secondary and higher education en masse; while the ideal of individual learning was highly valued. Moreover, this decision came at a time when there were calls for educational reform to maintain the West's leadership position in technoscience and the space race. Within four years, the number of pioneering projects in computer education and the number of committees set up to study their outcome had increased to the extent that by 1969 there was no OECD member country left that was not looking for ways to make better use of computers in the classroom. Although the number of pilot classes was still easy to oversee, and most citizens of OECD member countries still knew computers only from science fiction and the news, CERI's governing board argued that general education would soon be inseparable from the use of computers.[21]

Based on the anticipation that computers would become increasingly important to the economy, resulting in the need for more technical and programming

18 OECD-A, Reel 1969-OCDE_0442, CERI/CT/69.05, Joint Project CERI-XI on the Use of Computers in Education, August 20, 1969.

19 Bürgi, Regula. "Engineering the Free World. the Emergence of the OECD as an Actor in Education Policy, 1957–1972," in *The OECD and the Global Political Economy since 1948*, ed. Matthias Schmelzer and Mathieu Leimgruber (Cham: Palgrave Macmillan, 2017), 299–301.

20 OECD-A, Reel 1968–1971-OCDE_0262, CERI/GB(69)23, Proposal for a Common Project on Educational Technology, October 22, 1969.

21 OECD-A, Reel 1968–1971-OCDE_0262, CERI/GB(69)1, Projects for the Use of Computers in Education, February 20, 1969.

skills in the future, CERI began to gather information on the best use of computers to plan their mass introduction in schools. However, the motives behind this performativity of the vision of the coming computerized society must also be seen in the context of several problems that were coming into focus. In 1969, OECD representatives undertook a critical reassessment of the rapid technological progress and high economic growth rates, as student and worker protests pointed to the severe social tensions underlying the postwar growth paradigm, the belief in an unstoppable push for innovation, and the financing of (military) technologies. Solutions were discussed that promised qualitative rather than quantitative improvements in the social sphere,[22] which is why the OECD gave high priority to educational reform.

Systems Analysis to Integrate Education and Technology

Information was collected from current test classes whereby research was future-oriented. The first years in computer-assisted instruction were characterized by optimistic assumptions about the potential of computers for educational reform and the likely speed of their proliferation in schools, as well as the belief in their smooth acceptance by teachers and students. Researchers assumed that there were no technical and social obstacles, and they raised ample funds to develop learning content. In 1968, shortly before CERI's governing board decided to coordinate the exchange of knowledge, the view was that in five to ten years, computer-assisted instruction would form an instrumental role in American education.[23] Patrick Suppes, head of the research group at Stanford and an influential figure in the development of computer education wrote that it would only take a few years before students had access to well-informed tutoring systems that equipped them with personalized learning. Suppes also claimed that in the 1970s, many US American children were using individualized drill-and-practice systems in elementary school. By the time they reached high school, computer-led tutorials would be widely available.[24] Such promising predictions not only helped in-

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22 Schmelzer, Matthias. "The Crisis Before the Crisis: The 'Problems of Modern Society' and the OECD, 1968–74," *European Review of History* 19, no. 6 (2012): 999–1020.

23 OECD-A, Reel 1968–1971-OCDE_0262, CERI/GB(68)17, Survey on the Use of Computers in Education, December 11, 1968.

24 Patrick Suppes, "The Uses of Computers in Education," *Scientific American* 215, no. 3 (1966): 206–220; Patrick Suppes, "Computer Technology and the Future of Education (Reprint from 1968)," in dividuals to obtain grants, contracts, and prestige, but were also widely disseminated by the OECD.

Defuturization meant that prospective developments were taken for granted, and that existing difficulties with the applications were seen as temporary. Computer enthusiasts blanked out the "now" and instead aligned their activities with expectations placed on the future present. Like earlier discussions of programmed instruction, computer-assisted instruction was intended to individualize learning content while accommodating a growing number of students. The lack of equipment and high costs for running a computer were seen as problems that would soon be solved.[25] However, as seen in the previous section, new visions and old realities overlapped. Computers were supposed to provide tutorial support, enable games, simulations, and problem-solving. In practice, however, computer-assisted instruction simulated the teaching machines of the 1950s. The learning programs did not work properly or were too slow, and students were bored with their learning tasks.[26]

Consequently, the minutes of CERI meetings were dominated less by enthusiastic expressions than cautious reflections on the benefits of computers and by assessments of the challenges associated with current use; an approach that reveals the technocratic form of defuturization. The computer's secure place in the future classroom was considered a given, underscoring the attribution to the computer as a defuturization machine. The orientation of policy development toward the anticipated computerized world of tomorrow remained consistent in the discussions or-

Computer-Assisted Instruction: A Book of Readings, ed. Richard Atkinson and H. A. Wilson (New York: Academic Press, 1969), 44.

25 William F. Atchison and John W. Hamblen, "Status of Computer Sciences Curricula in Colleges and Universities," *Communications of the ACM* 7, no. 4 (1964); Richard Atkinson, "Computer-Assisted Learning in Action," *Proceedings of the National Academy of Sciences in the United States of America* 63, no. 3 (15, 1969): 588–594; Patrick Suppes and Mona Morningstar, "Computer-Assisted Instruction," *Science, New Series* 166, no. 3903 (1969): 343–350; Keith A. Hall, "Computer-Assisted Instruction: Problems and Performance," *Phi Delta Kappan* 52, no. 10 (1971): 628–631; Patrick Suppes, *Computer-Assisted Instruction at Stanford, 1966–68: Data, Models, and Evaluation of the Arithmetic Programs* (New York: Academic Press, 1972); David Ciborek, "Computer-Assisted Instruction? Some Said the Airplane Would Never Fly," *American Secondary Education* 2, no. 3 (1972): 36–39.

26 John Feldhusen and Michael Szabo, "A Review of Developments in Computer Assisted Instruction," *Educational Technology Publications* 9, no. 4 (1969): 32–39; Stolurow and Davis, "Teaching Machines and Computer-Based Systems"; Kurt Eyferth, "Möglichkeiten und Perspektiven des Computers im Bildungswesen," in *Computer und Gesellschaft: Nutzen und Gefahren einer modernen Technologie*, ed. F. Krückeberg, W. Walcher, und B. A. Brandt (Stuttgart: Wissenschaftliche Verlagsgesellschaft, 1974), 65–72; Kurt Eyferth, *Computer im Unterricht: Formen, Erfolge und Grenzen einer Lerntechnologie in der Schule*, *Computer im Unterricht Formen, Erfolge und Grenzen einer Lerntechnologie in der Schule* (Stuttgart: Klett, 1974).

ganized by CERI; what followed from the critique of computer-assisted instruction was not a rejection of the idea of computer use as a good educational technology, but a reinterpretation of strategies. In short, the one-dimensional flowchart of the learning system as it was popular since the heyday of programed instruction in the 1950s (see figure 2) was modified by adding more elements to better account for perceived social complexity.

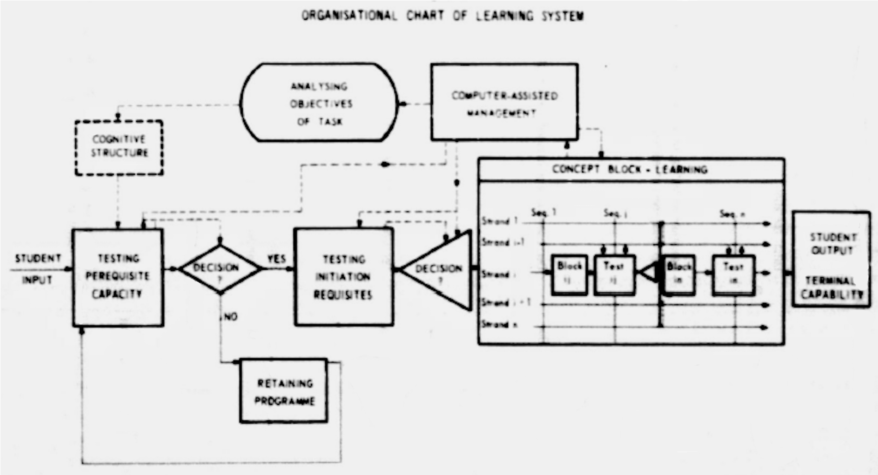

Fig. 2: Organizational chart of a learning system. The triangle represents the decision-making process, the dashed line the transfer of information, and the line the student's itinerary (source: OECD-A, Reel 1972-OCDE_0469, CERI/CT/72.01)

The many experts from school boards and research institutions invited to CERI working sessions to discuss the role of the computer in secondary and higher education moved away from defining the computer as a single medium able to do the same as the teacher. They now sought a change in perspective through "systems analysis". The analogy of the computer as a replacement for teachers and of an electronic brain performing faster and more accurate thinking had been prevalent in popular culture since the postwar period. Systems analysis allowed a different view, namely, to see the computer as an element interacting with other elements. Computer-assisted instruction was expected to advance only in conjunction with innovation regarding instructional methods and curricula. CERI meetings were aimed at developing an effective implementation of new learning systems, which necessitated moving away from the previous "gadget approach" that had allegedly placed too much emphasis on hardware.[27] Computers were believed to provide an evolutionary step toward better learning, with older media such as audio-visual media, television, correspondence, and games believed to soon find their place in computer programs. All of this was seen as a matter of progress that would occur with the advancement of terminal systems, decreasing costs per machine, and expanded public access. The computer was seen as part of a larger system that had to be adjusted, with the computer assigned as the central agent of change to foster a broad sociotechnical transformation.[28]

Education "systems" ought to be prepared for the increasing relevance of computing to accommodate the time needed for a complete change in mental attitudes.[29] Such claims testify to techno-determinism, as computers were seen as defuturization machines that provided a shortcut to important social changes. Put another way, computers were touted as a means to "update education to the needs of modern society".[30] The consensus at CERI meetings was that the successful and lasting implementation of educational technologies demanded a "total" change in education. The introduction of computers into the classroom had to result from a set of negotiations involving questions of change in media, instruction, and infrastructure. CERI thus advocated systems analysis to reform both the procedural and the content aspects of education.[31]

Representatives of CERI and meeting participants did not deny the potential of computers to improve learning arrangements in mathematics, languages, and science, but they believed that the computer required a comprehensive reform through system re-design and modification. Future goals were put into perspective by solutionism and an over-confident assessment of existing possibilities. In 1969, CERI secretary André Kirchberger argued that systems analysis weighed the many possible functions of computers in testing, administration, and teaching. Secretary

27 OECD-A, Reel 1970–72-OCDE_0394, CERI/CT/70.40, Educational Technology: A Systematic Approach to the Teaching/Learning Process, February 17, 1970; CERI/CT/70.41, Educational Technology: Practices for Implementation, February 20, 1970.

28 OECD-A, Reel 1969-OCDE_0442, CERI/CT/69.02, Computers in Education: Present Situation and Development Trends, March 13, 1969; CERI/CT/70.46, Educational Technology Strategies, March 6, 1970.

29 OECD-A, Reel 1970–72-OCDE_0394, CERI/CT/70.11, Seminar on Computer Sciences in Secondary Education: The Methods, Techniques and Means of Teaching Computer Sciences in Secondary Education, February 17, 1970.

30 OECD-A, Reel 1970–72-OCDE_0394, CERI/CT/70.40, Educational Technology: A Systematic Approach to the Teaching/Learning Process, February 17, 1970.

31 OECD-A, Reel 1970–72-OCDE_0394, CERI/CT/70.42, Planning of Teaching/Learning System: An Outline of Factors that Influence Design, February 19, 1970; CERI, *Educational Technology. The Design and Implementation of Learning Systems* (Paris: OECD, 1971).

Kirchberger also stressed that computer-assisted instruction was not yet operational, despite the considerable financial and material resources allocated to it. The CERI governing board concluded from this that the research center would do better to devote itself to developing policies than supporting the genesis of further knowledge in the practical use. In 1969, nearly 800'000 Francs (about 160,000 US Dollars at the time) were budgeted for meetings, seminars, publications, and salaries for the next two years. The policy guidelines resulting from this effort were to make a significant contribution to reform in education, especially in Europe. Experimental work was nevertheless considered a solid starting point. Belgium, France, Japan, Britain, and the United States agreed to cooperate with CERI in "field experiments" to establish computer-based learning systems in universities. Another initiative was to create a network of experimental schools, with computers as their essential part, to advance strategies for reform in secondary education. The goal was to transfer best practices from these test classes to every school.[32]

Planning toward the Computerized Future

Educational experts and members of the CERI secretary agreed that a "concerted international action" was needed to keep pace with the surge of innovation. These experts felt that it was too premature to define strategies and make pedagogical and technical recommendations, thereby legitimating their own further research.[33] Activities in educational technology research culminated in two international conferences in 1970. A workshop in the Dutch city of Leiden was held to come up with strategies for promoting educational technology more broadly, and a seminar hosted by the French authorities in Sèvres was set to discuss the introduction of computer science in secondary education. Participants noted that the use of computers in education was not a question of why, but of *how*.[34]

32 OECD-A, Reel 1968–1971-OCDE_0262, CERI/GB(69)1, Annex, February 25, 1969; CERI/GB/M(68)3, Third Session of the Governing Board, Summary Records, January 23, 1969; Reel 1969-OCDE_0442, CERI/CT/69.04, Joint Project CERI-XI on the Use of Computers in Higher Education, August 20, 1969; OECD, "Curriculum Development and Educational Technology (Activity 4 in 1970 CERI Programme of Work)," in *Centre for Educational Research and Innovation, Purposes, Programmes, Progress. Programme Objectives* (Paris: OECD, 1971), 14–15; CERI, *The Use of the Computer in Teaching Secondary School Subjects* (Paris: OECD, 1976).
33 OECD-A, Reel 1969-OCDE_0442, CERI/CT/69.07, Minutes of the Meeting of the Working Party on Joint Project CERI-XI, November 4, 1969.
34 OECD-A, Reel 1970–72-OCDE_0394, CERI/CT/70.07, Seminar on Computer Sciences in Secondary Education, February 6, 1970.

The seminar in Sèvres concluded with the view that the advent of the computer had serious consequences as the growing gross national product of several OECD member countries was already dependent on computer use. The technology-driven changes in the economy required curriculum development, a reform of teacher training, and more computer science in education. These three topics became the most frequently discussed issues in the numerous protocols following the decision to make educational technology one of CERI's central activity.[35] Following the seminar in Sèvres, two working groups were formed to bring together a multinational group of experts from school administrations and research institutes every three months to determine further steps. One group focused on the design of computer science syllabi; the other group evaluated implications of computer use for teacher training. In parallel, the "working party on computer use in higher education" was developing recommendations for target groups at universities. CERI planned to draw conclusions from these groups at an international workshop in Edinburgh in 1973, which would be organized with the aim to propose further steps.[36]

In 1971, the CERI governing board argued that computer science education should not be treated separately from other study subjects. Rather, its integration into general pedagogical concepts was to have a positive effect on all subjects and would open up new prospects for curriculum development.[37] In line with the system analytical approach, computers were seen as the solution to overcome the conventional division of curricula. Therefore, the scope of recommendations was expanded from mathematics, science and languages to all learning contents; and it also included the training of teachers.[38] A change in education could only be achieved through overall reform, with "[p]erhaps the teacher of the future in an urban school system […] have a support team consisting of research specialists, media specialists, and systems analysts with the teacher's primary responsibility to deter-

35 OECD-A, Reel 1970–72-OCDE_0394, CERI/CT/70.20, Seminar on Computer Sciences in Secondary Education: Final Recommendations, March 27, 1970; OECD-A, Reel 1971-OCDE_0424, CERI/CT/71.07, Report of the Third Meeting of the Working Group, March 3, 1971.

36 OECD-A, Reel 1970–72-OCDE_0394, CERI/CT/70.57, First Meeting of the Working Group, September 16, 1970; George Papadopoulos, *Education 1960–1990. The OECD Perspective* (Paris: OECD, 1994), 87; Le Monde, "Un séminaire de l'O.C.D.E. sur l'enseignement de l'informatique est réuni à Sèvres," *Le Monde*, March 12, 1970, https://www.lemonde.fr/archives/article/1970/03/12/un-seminaire-de-l-o-c-d-e-sur-l-enseignement-de-l-informatique-est-reuni-a-sevres_2663822_1819218.html.

37 OECD-A, Reel 1968–1971-OCDE_0262, CERI/CD/M(71)1, First Session of the Governing Board, Summary Records, August 17, 1971.

38 OECD-A, Reel 1970–72-OCDE_0394, CERI/CT/70.43, Educational Technology: Problems of Implementation in Relation to Production, February 25, 1970; CERI/CT/70.04, Seminar on Computer Sciences in Secondary Education, 28 January 1970.

mine what the students are to learn",[39] a view that illustrates that the experts were less concerned about practicality on the ground (and costs) than they were about possible meaningful task assignments. Teacher training was deemed most important for the successful implementation of new curricula. Experts gathered at CERI agreed that ever more teachers would soon be working with computers in both administration and teaching.[40]

Although the computer promised improvements, a time lag was perceived between the introduction of technologies in the outside world and their counterpart in teacher training.[41] An initiative of CERI was therefore to join forces with other stakeholders to develop learning materials for teachers, particularly with the International Federation of Information Processing (IFIP).[42] This step was motivated by the concern about an incompatibility between the present children growing up with audiovisual electronics and their teachers who had grown up in an environment of magazines and books. The teachers were seen as relics from the past who needed to be convinced of the benefits of new technologies and who had to learn more about the capabilities of the computer.[43] However, children did not only have advantages. Experts argued that today's children had prospects in a society that offered them fewer opportunities for employment in routine occupations. At a CERI seminar, participants estimated that within a decade, every university and college student would need to have basic knowledge in programming to take on a job.[44] R. Lewis, a lecturer in mathematics education invited to a CERI meeting, stated that the world was moving toward the computer age, which was visible in the higher number of computers and accelerating dependency on their use. Children should be adequately prepared for the next social and industrial revolution in which

39 OECD-A, Reel 1970–72-OCDE_0394, CERI/CT/70.12, Computer Sciences in Secondary Education in Scotland, February 10, 1970.

40 OECD-A, Reel 1971-OCDE_0424, CERI/CT/71.08, Report of the Third Meeting of the Working Group, Annexes, March 8, 1971.

41 OECD-A, Reel 1971-OCDE_0424, CERI/CT/71.10, Fourth Meeting of the Working Group, Working Group II: Teacher Training, The Computer in Educational Technology, May 6, 1971.

42 CERI also held a meeting with IFIP to discuss general aspects of introductory courses in computer science education at the secondary level: OECD-A, Reel 1971-OCDE_0424, CERI/CT/71.20, Fifth Meeting of the Working Group, Guidelines for an Appreciation Course, July 5, 1971; William F. Atchison, "The Impact of Computer Science Education on the Curriculum," *The Mathematics Teacher* 66, no. 1 (1973): 81–83; William F. Atchison, "Computer Education, Past, Present, and Future," *ACM SIGCSE Bulletin*, December 1981.

43 OECD-A, Reel 1970–72-OCDE_0394, CERI/CT/70.13, Training of Teachers to Use Computers in Instruction, February 16, 1970.

44 OECD-A, Reel 1970–72-OCDE_0394, CERI/CT/70.13, Seminar on Computer Sciences in Secondary Education: Training of Teachers to Use Computers in Instruction, February 16, 1970.

human mental efforts were replaced by computer power.[45] Such futuristic claims supported the position that all children needed a general understanding of computers in the present. They also had to acquire knowledge in computer science to dispel the "aura of mystery surrounding the so-called 'electronic brain'".[46] The defuturization machine was thought to prepare teachers and students for their respective future work as well as to improve learning in the present.

Learning *about* computers should be linked to learning *how* to use them. This rationale was behind the initiative for a program called "computer education for all", designed by the British National Computing Centre in 1969, which aimed at providing introductory courses in computer science in public schools. CERI began to follow the "education for all" scheme closely, which underscores the impact of this program.[47] Speaking at a CERI meeting, representative M. Bloxham, a teacher at Oundle School in the Midlands of England, argued that computer education should no longer be a study subject for a small elite. "Computer education for all" was instead to provide all pupils in secondary education with a conceptual insight into computing, meaning an introduction to information processing, and an overview of how computers organize and present information. The course included history, an overview of the structure and organization of digital computers, an introduction to the use and social impact of computers, and a presentation of the work of computer scientists. Only the "supplementary courses" covered programming, problem-solving, the construction of algorithms, and an overview of analog computers and their difference to the digital ones.[48] According to J. Perriault, researcher at the Maison des Sciences de l'Hommes in Paris, public schools were generally not yet well-equipped with computers, these topics were to be illustrated using flowcharts. It was nevertheless believed that the computer would revolutionize the possibilities of conveying information only comparable to the invention of printing, which depicts the dichotomy between digital imaginary and school reality.[49] The human-controlled present was juxtaposed with the expected computer-

45 OECD-A, Reel 1971-OCDE_0424, CERI/CT/71.11, Fourth Meeting of the Working Group, Working Group II: Teacher Training, General Computer Education, May 5, 1971; CERI/CT/71.17, Fourth Meeting of the Working Group, Annex 1–5, June 4, 1971.

46 OECD-A, Reel 1970–72-OCDE_0394, CERI/CT/70.02, Seminar on Computer Sciences in Secondary Education, February 4, 1970.

47 Tinsley, J. D. "The General Introduction of Education about Computers for Primary and Secondary Schools." *Educational Media International* 10, no. 1 (1973): 2–12.

48 OECD-A, Reel 1970–72-OCDE_0394, CERI/CT/70.02, Seminar on Computer Sciences in Secondary Education, February 4, 1970.

49 OECD-A, Reel 1970–72-OCDE_0394, CERI/CT/70.40, Educational Technology: A Systematic Approach to the Teaching/Learning Process, February 17, 1970.

ized future, and individuals had to adapt to this transformation. Defuturization made such visions accessible.

Hype Cycle After Hype Cycle

Computers heralded visions of a technology-based society, and this normative mindset shaped CERI's research program. The countless experts invited to countless meetings did not object the view of the CERI secretariat that computers were soon to have such an enormous impact that the entire school population would need to be computer literate.[50] Such assumptions of a tremendous technology-infused change legitimated the development of proposals for educational reform. Thus, although computer-assisted instruction had exposed old problems, the belief in the transformative power of machines persisted. Optimistic visions of the proliferation of computers were thereby compared to the spread of earlier mass media, such as television and radio. Moreover, participants in CERI sessions believed that computers would be as important in ten or twenty years as the car or telephone was in the present,[51] illustrating the strong orientation on implementation processes that had already occurred and were considered repeatable.

Despite such past/future orientations, the mass use of computers in public schools remained a subject of speculation for several more years. Although the early 1970s was a relevant period of transition in digital technology in terms of minicomputers, time-sharing, terminal systems, and, not least, the spread of the programming language BASIC,[52] the ideas expressed and collected at CERI had few practical consequences. Wild expectations had attracted the attention of experts from all corners of the OECD member countries, but these expectations were soon followed by less optimistic outlooks. As stated elsewhere,[53] CERI's working groups concluded in 1973 that a recommendation of widespread adoption of computer education was not necessary. CERI discontinued its support of "curriculum development and educational technology" and placed its priority instead on learning theories, health education, creativity in school, equality, and early child-

50 OECD-A, Reel 1970–72-OCDE_0394, CERI/CT/70.03, Common Project CERI VII, Seminar on Computer Sciences in Sec. Education held from 9th to 14th March 1970, February 2, 1970.

51 OECD-A, Reel 1970–72-OCDE_0394, CERI/CT/70.11, Seminar on Computer Sciences in Secondary Education: the Methods, Techniques and Means of Teaching Computer Sciences in Secondary Education, February 17, 1970.

52 Joy Lisi Rankin, *A People's History of Computing in the United States* (Cambridge, MA: Harvard University Press, 2018).

53 Hof and Bürgi, *The OECD.*

hood education, areas that now promised more positive change. Although CERI had organized activities to channel information and gather knowledge on computer education for about six years, no synthesis on better curricula had been achieved, nor had a policy proposal for reforming teacher education been developed. Furthermore, the question of how to integrate learning with and about computers in public schools remained open. CERI's working groups saw the potential of computers to be used more often in school in the "advanced" countries, but also assumed that widespread adoption would not be achieved for another five to ten years.[54] The goal was shifted to a time horizon that seemed to be close enough to allow planning. However, this goal was not met due to the inflation and economic crisis following the 1973 oil shock. In addition, concern about the possible future irrelevance of human labor focused attention more on the problematic present.[55]

But the hype cycle did not stand still.[56] In the 1980s, more and more public schools were equipped with computers. This surge occurred after a change in the computer market due to the expansion of microchip production, which made smaller, cheaper desktop computers a reality, and when computers became more user-friendly with learning software available on cassette tapes or floppy disks.[57] In this context, the OECD returned to its former mission and established a "committee for information, computer, and communications policy" in the belief that computers were an important growth area for the economy and a tool for transforming society and policy.[58] Computer education was also regaining importance. Again, the portrayal of a society unprepared for the next industrial revolu-

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54 OECD-A, Reel Série CERI, Microfiche 3121.7286, 2/2, 1973, Série CERI 2/2, CERI Report for June 1973.

55 Tilly Blyth, "Computing for the Masses? Constructing a British Culture of Computing in the Home," in *Reflections on the History of Computing*, ed. Arthur Tatnall (Berlin and Heidelberg: Springer, 2012), 231–42.

56 For hype cycles, see: Christo Sims, *Disruptive Fixation. School Reform and the Pitfalls of Techno-Idealism* (Princeton, NJ: Princeton University Press, 2017), 165.

57 David Walker, "The Evaluation of Computer-Assisted Learning," in *World Yearbook of Education 1982/83*, ed. Jacquetta Megarry, David Walker, and Stanley Nisbet (New York: Kogan Page, 1983), 42–49; Richard Capel, "Social Histories of Computer Education: Missed Opportunities?", in *Technological Literacy and the Curriculum*, ed. Hughie Mackay and John Beynon (London: The Falmer Press, 1991), 38–65; Janet Abbate, "Getting Small: A Short History of the Personal Computer," *Proceedings of the IEEE* 87, no. 9 (1999): 1695–1698; Neil Selwyn, "Learning to Love the Micro: The Discursive Construction of 'Educational' Computing in the UK, 1979–1989," *British Journal of the Sociology of Education* 23, no. 3 (2002): 427–443; Mizuko Ito, *Engineering Play. A Cultural History of Children's Software* (Cambridge, MA: MIT Press, 2009); Gleb Albert, "Der vergessene ‚Brotkasten'. Neue Forschungen zur Sozial- und Kulturgeschichte des Heimcomputers," *Archiv für Zeitgeschichte* 59 (2019): 495–530.

58 Resolution of the Council No. 48, Establishing a Committee for Information, Computer and Communications Policy, in *Acts of the Organisation Volume 22* (Paris: OECD 1983), 87–91.

tion prompted calls for more computer awareness via education. In the United Kingdom, the understanding of information technology was promoted by the BBC's "computer literacy project".[59] In France, the "plan informatique pour tous" was set up to support learning about and with computers, with a particular focus on reforming teacher training.[60] Consequently, a 1989 CERI publication depicts that the major steps toward bringing computers into the classroom were taken only after its governing board had decided sixteen years earlier to discontinue activities in this area.[61] CERI observed and followed rather than initiated the new trend, suggesting that it was driven by other actors and independently of the research center.

Concluding reflections

In the late 1960s, the vision of a computerized future became evident in expectations, which in turn prepared the ground for attempts to shape policy to support the introduction of computers into the classroom. To analyze this catalytic effect, this chapter has incorporated "defuturization" as an analytical concept into the broader debate about temporalities. It has shown how speculative technological futures recruited and organized actions, resources, and attention at OECD's CERI. An ensemble of social actors (school administrators, teachers, researchers, industrialists, the CERI governing board and secretary) shared a belief in the computer as a "better" educational technology that would soon to be increasingly used, and they sought to translate their belief into an anticipatory government strategy. The desired future informed discourses conducted in the historical present – a mechanism that created and fueled a "defuturization machine".

By describing the influence of visions on debates and decisions, this chapter brings to light two central themes. The first theme concerns the failure of technocratic planning strategies, as expectations for the rapid mass use of computers in schools were hardly met in social reality. Initial ideas for computer education took shape via criticism of the method of computer-assisted instruction, and a much broader reform of education was envisioned. However, this reform was soon abandoned. The OECD provided a platform for sharing knowledge about best practices

59 Thomas Lean, "Mediating the Microcomputer: The Educational Character of the 1980s British Popular Computing Boom," *Public Understanding of Science* 22, no. 5 (2012): 546–558.

60 See Cardon-Quint, *Informatique pour tous, France 1985: Pedagogy, Industry and Politics* in this book.

61 CERI, *Information Technologies in Education. The Quest for Quality Software* (Paris: OECD, 1989), 11.

in computer education, but this intergovernmental organization did not guide the entry of computers into the classrooms. Rather, this process must be understood as the result of complex logics of market demand that, for reasons beyond the scope of this chapter, did not manifest themselves until the 1980s. The historical case study, however, offers another theme, namely, to show that the discourse of progress tends to replicate and to transcend temporal gulfs. The anticipation of the dawn of the computer age created a collective fiction that implied a teleological narrative. As previously mentioned, belief in technology-induced progress and the vision of reform through mass adoption of computers persisted, and resurfaced with renewed hype, including attempts to pave the way to a more digitized future. The notion that technologies would benefit society and prepare the current generation for its future was powerful in the 1960s and remains so today.

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