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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.

https://doi.org/10.1515/9783110780147-010

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

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.

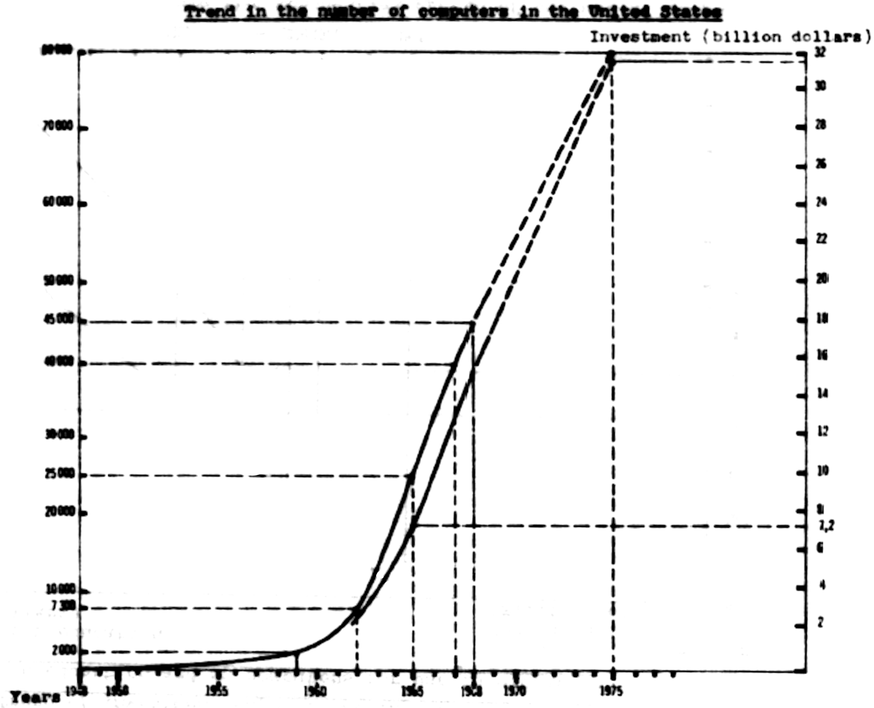

Fig. 1: Trend in the number of computers in the United States since 1948 and forecast for 1975. The graph depicts the tremendous growth of the number of computers and investments made in the 1960s (source OECD-A, Reel 1969-OCDE_0442, CERI/CT/69.02)

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-

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.

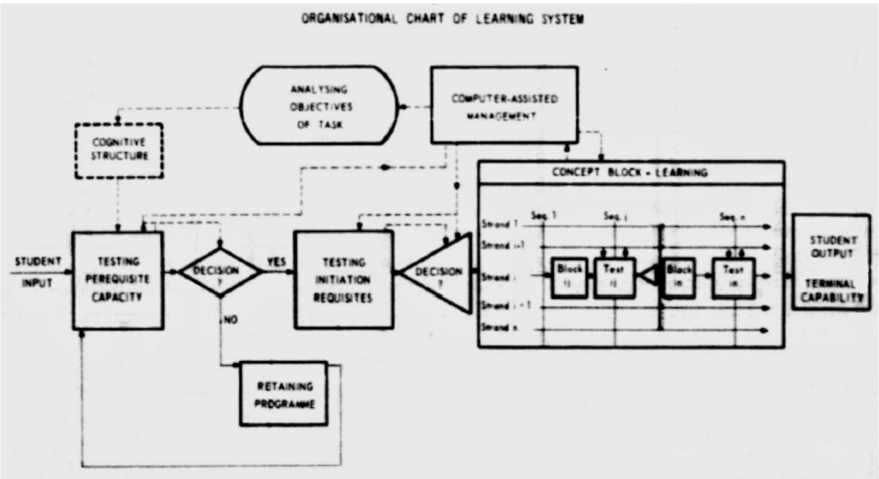

Fig. 2: Organizational chart of a learning system. The triangle represents the decision-making process, the dashed line the transfer of information, and the line the student's itinerary (source: OECD-A, Reel 1972-OCDE_0469, CERI/CT/72.01)

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

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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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