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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.

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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-OEUwN0Vne lYzQ1ZQdi90MU1iY0NiQT09

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).

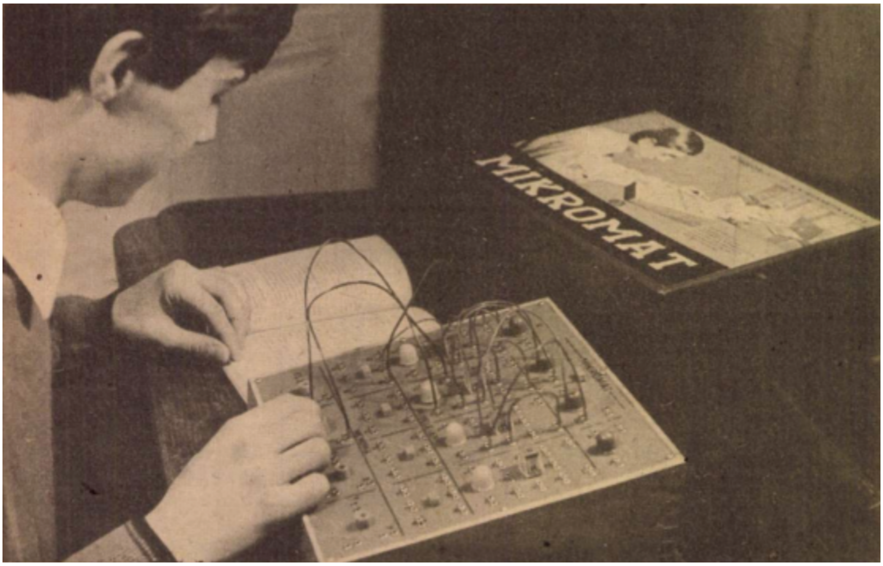

Fig. 2: Mikromat, the cybernetic building set. Photographer: unknown Mihály Kovács, "Számítógép-ismeretek [Computer know-how]," Köznevelés, 19 February 1971, 4.

> 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.

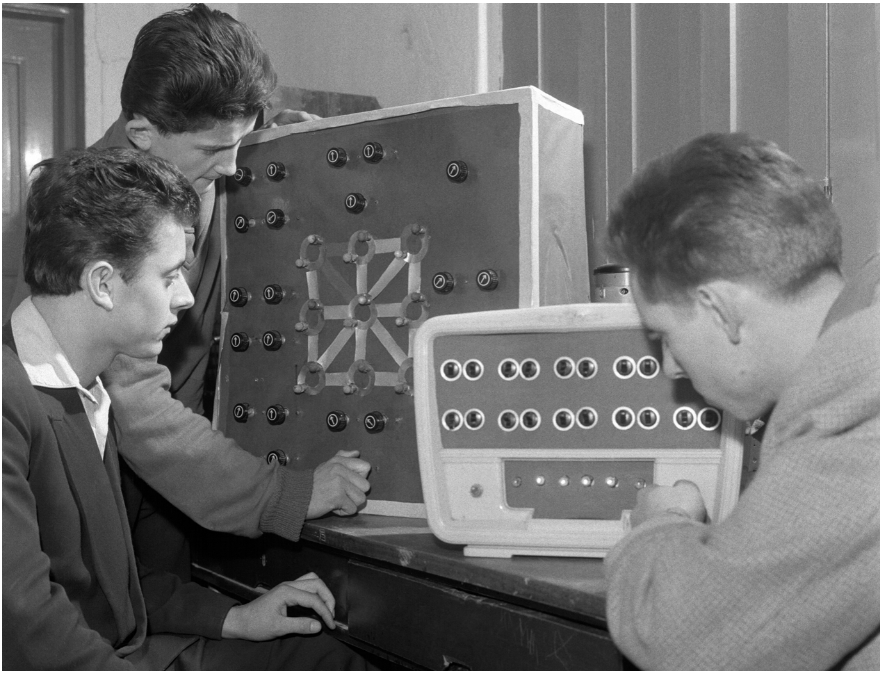

Fig. 3: Cybernetics Club in Kisújszállás. Archive: MTVA Sajtó- és Fotóarchívum. Record number: MTI-FOTO-830738. Photographer: József Bajkor. https://archivum.mtva.hu/photobank/item/MTI-FOTO-b0hRaTZLYzU2Q2FIWUF6OXpTQTA1UT09

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 re-wiring, 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]

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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

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.

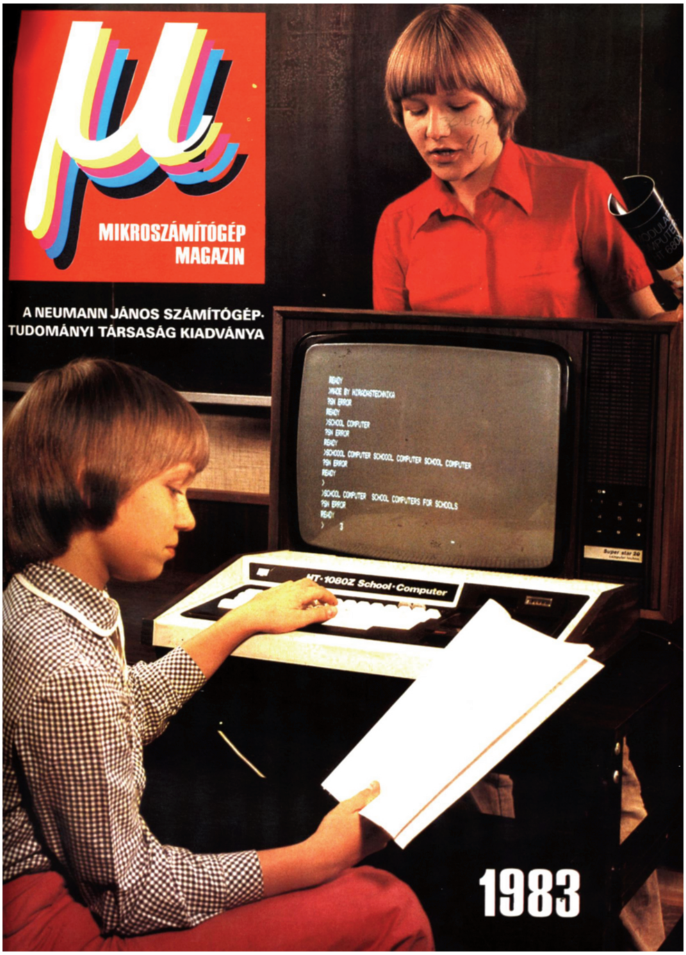

Fig. 6: The cover of the first issue of Mikroszámítógép Magazin with the HT-1080Z, 1983. Archive: NJSZT and Pál Faklen

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 [Micrompters 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:

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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