From Non-Existent to Mandatory in Five Years – The Journey of Digital Education in the Austrian School System

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Abstract

The concept of life-long learning has become progressively important over the last few decades. As part of this development the European Digital Competence Framework for the Digital Competence of Educators (DigCompEdu), a scientifically sound framework, responds to the need that every European citizen should gain necessary competences for enhancing and using digital technologies in a critical, innovative, and creative way. As long ago as 1985, Austria introduced the subject "Computer Science" in grade 9. Quite a long time there was solely this one year of mandatory IT-education during school career. When Austria implemented the mandatory curriculum "Digital Education" (Digitale Grundbildung) in September 2018 for all students in lower secondary education, 21st century skills finally found their formal way into additional grades. School administration could determine if they offer "Digital Education" as a stand-alone subject or if they implement the curriculum in an integrative way in several other subjects. Finally, in the school year 2022/23, "Digital Education" will be installed as compulsory subject in regular Austrian timetables. This paper reports on the journey of digital education in the Austrian school system – from the beginning with solely computer science topics to a stand-alone subject covering digital competences, media competences, as well as civic education.

Keywords

Digital Education, Digital Literacy, STEM, Computer Science

1. Introduction

Digitization is changing our working world drastically. New professions are emerging and adults will need new skills and qualifications in the future. Therefore, there is an urgent demand to react in the educational world in order to optimally prepare today's children for the challenges of the digital future. In addition to the requirements of the forthcoming professional life, the COVID-19 pandemic has also shown the importance of being equipped with digital skills and the need to intensively promote them. The rapid global development of the pandemic has presented educators with major challenges in continuing to teach regularly. With no preparation time,

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schools had to switch to Emergency Remote Teaching (ERT), meaning that lessons are taught online instead of face-to-face [1]. Besides technical challenges educators and students were faced with, ERT also carries the stigma that it is less valuable for academic success [1].

However, the elimination of fixed structures in everyday school life due to the pandemic has not only brought disadvantages, but also led to an enormous boost in innovation and digitization and confirmed the importance of digital education.

After the subject of computer science was introduced for the 9th grade in 1985, the next big change only came in 2018 with the introduction of "Digital Education" as an independent subject or integrated into other subjects of the lower secondary school. In the school year 2022/23, the subject "Digital Education" should finally be anchored in 5th - 7th grade as a compulsory subject in the timetable and teachers should receive intensive further training. Grade 8 will follow in the consecutive year.

This paper presents an overview of the journey of digital education in the Austrian school system and provides an insight into the most important topics covered in this subject. The remainder of the paper is structured as follows: Section 2 provides an overview of the subject computer science in the Austrian school system, whereas sections 3.1 and 3.2 give an insight into the background and first integration of the subject "Digital Education" in lower secondary schools from 2018-2022. Finally, section 3.3 presents an outlook for the implementation of "Digital Education" as a compulsory subject starting in autumn 2022.

2. Computer Science in Austrian Schools

In 1985, computer science was introduced as a separate subject in the Austrian school system. Up to now, the Austrian curriculum only implements two hours computer science lessons a week in the 9th school level of Academic Secondary Schools. Even though Austria can look back on 37 years of computer science education in school, it has merely changed over the centuries. As a "newly" introduced subject, it had to compete with long-established subjects and justify the considerable costs for the necessary infrastructure and additional space requirements. The continuing rapid progress of information and communication technologies repeatedly tempted teachers to focus on technologies and products rather than on the underlying educational content and concepts [2]. In addition, computer science has neither a long tradition nor a lobby in the form of a long-established professional association [2, 3].

Another aspect that still is part of a heated debate is about the content of the subject. Although there is a curriculum, the content is described vaguely and leaves space for individual interpretation. Accordingly, Academic Secondary Schools, focusing on general education, had to decide what constitutes as general education content. Focusing on a device, the computer, typing skills or operating a computer are rather skills than education. Nevertheless, compulsory computer science classes at Academic Secondary Schools are largely reduced to the basics of computer-use as described in the European Computer Driving Licence (ECDL) curriculum, for example. However, they present young people with a distorted picture of the subject of computer science and can hardly convey higher educational values for an information society. Computer science as a school subject should do both – convey fascination of the subject, but also show that general educational content can be taught in this subject that has nothing to do

with a later career perspective as a computer scientist, but rather prepares for life in a modern society in which information plays a dominant role [4].

3. Digital Education in Austria

As long ago as 1985, Austria introduced the subject "Computer Science" in grade 9. Quite a long time there was solely this one year of mandatory IT-education during school career. When Austria implemented the mandatory curriculum "Digital Education" (Digitale Grundbildung) in September 2018 for all students in lower secondary education, 21st century skills finally found their formal way into additional grades. Over the past two decades the idea of life-long learning has become increasingly important. Back in 2006 "digi.komp", a model for digital competences, was introduced in Austria. It is divided into four groups depending on the school grade. *Digi.komp4* describes the model until grade four, *digi.komp8* states examples from grade five until grade eight, *digi.komp12* puts forward competences for grades nine to twelve, and further *digi.kompP* characterizes the model for teachers [5]. The Austrian "digi.kompP" competence model strongly relates to the European DigCompEdu framework.

The Joint Research Centre of the European Union defines "Digital Competence" as the following [6]:

> Digital Competence is the set of knowledge, skills, attitudes (thus including abilities, strategies, values, and awareness) that are required when using ICT and digital media to perform tasks; solve problems; communicate; manage information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, socialising, consuming, and empowerment.

The European Framework for the Digital Competence of Educators (DigCompEdu) responds to the – due to the COVID-19 pandemic especially required – need that every European citizen should gain these necessary competences (as defined in [6]) to use digital technologies in a critical, innovative, and creative way. DigCompEdu provides a structure to understand what it means to be digitally competent in particular for an European educator. The scientific framework provides a sound background that can guide policies in different countries [7].

3.1. Masterplan for Digitalization

In 2018 the Austrian government published a *master-plan for digitalization* in which three sub-projects were presented. The first partial project "teaching and learning content" concentrates on revision of existing curricula, whereas digital content must be integrated. Moreover, it introduces the new subject "Digital Education" and furthermore demands the development and purchase of digital teaching and learning tools and materials for classrooms. Sub-project two defines "teacher training and teacher education". "Infrastructure and modern school administration" forms the third part of the Austrian master-plan and focuses on the expansion of technical infrastructure, installation of digital devices (technical & administrative), and simplifying school administration throughout the deployment of practice-oriented programs and tools [8].

3.2. 8-Point-Concept

The master-plan also presented an 8-point-concept to foster digital education. With its thematic setting, the concept includes all central areas of the education system that are inevitable for high-quality, future-oriented school operations.

Firstly, the objective of *"Portal Digital School" (PoDS)* was installed to bundle existing applications in order to provide consolidated and clear information that is easy to use, and additionally, support everyday school life in different ways. PoDS offers a uniformed online platform with essential applications for pedagogy and administration, for the technical support of the digitized learning process of students, and for support by educators. The portal has been available for federal schools since September 2020 and one year later for compulsory schools [9].

To support the implementation of the recommendations for standardization of the platforms, instructions and assistance are provided on the distance learning service portal of the BMBWF (Bundesministerium für Bildung, Wissenschaft und Forschung – Federal Ministry of Education, Science, and Research). School administration is supported in initiating and accompanying the process of standardizing the platforms at the school location [10].

Next, as part of a *"Massive Open Online Course" (MOOC)*, educators are well prepared for teaching in blended- and distance learning settings by implementing information and communication technologies. As a virtual format, MOOC is a supplement and extension of the offerings at teacher training colleges, where educators acquire basic knowledge for teaching in digital classrooms using mobile devices. The BMBWF recommended participation in preparation for the roll-out of digital devices at secondary level I. More than 11,000 Austrian teachers took part in the first accompanied round starting in August 2020 [11].

As a digital platform, the *"Eduthek"* provides in-depth materials for all types of schools and subjects from elementary up to secondary education. In the still ongoing expansion of the Eduthek, all digital teaching and learning resources are linked with the respective Austrian curricula [12].

Next, the installation of standardized *qualification marks* in the evaluation and certification of learning applications for mobile, blended, and distance learning is planned. The qualification mark is intended to provide orientation and assistance in the selection of innovative learning tools that are already available in Austria. The "Education Agency OeAD" developed and piloted the certification procedure, which started in September 2021 [13].

In order to be able to fully exhaust all possibilities of digitization in education and to promote the use of IT in schools, basic IT infrastructure (e.g. fiber optic broadband connection, powerful and sufficient WIFI coverage) is an absolute prerequisite. As part of the 8-point-concept the framework conditions for digitally supported teaching at federal schools will be significantly improved by 2023. All federal schools should provide a high-performance broadband connection in individual classrooms [14].

For the purpose of ensuring that each Austrian secondary school student and teacher has access to their own learning and teaching device, it was planned to fund digital devices in the 5^{th} and 6^{th} grades in the school year 2021/22. However, the COVID-19 pandemic caused considerable shipping problems, accordingly not all Austrian 5^{th} and 6^{th} graders have received a device yet [15]. Currently there are no devices for teachers available, so educators still have to (partially) finance their digital devices and other tools (e.g. learning applications and e-books)

on their own [16].

3.3. Introduction of the Subject "Digital Education"

The subject "Digital Education" was launched in September 2018 in lower secondary education (grades five to eight), implemented by two to four weekly lessons. There was a high level of flexibility and autonomy in the operational implementation – the content could be taught both in specially designed hours or in an integrated manner in existing subjects, whereas the organization and content distribution over the four school years of secondary level I could be determined autonomously at each school location [17]. In a survey conducted in Upper-Austria, 26% of the participating schools claimed that they introduced a stand-alone subject, 21% said they integrate the curriculum in other subjects, 45% picked "mixed", and 9 (8%) chose "other" [18]. Furthermore, from 2018 to 2022 students were solely graded with "successfully completed" or "not successfully completed".

"Digital Education" covers digital competences, media competences, as well as civic education. According to the curriculum, those three topics should not be taught separately but must be connected to other subject-specific fields. The *BGBL (Bundesgesetzblatt für die Republik Österreich — federal law gazette of Austria)* states that the main aim is to raise students who deal with media and technology responsibly and well-briefed [19].

The eight subject-specific topics are described as the following [19]:

1. Social aspects of digitalization: reflecting the usage of digital devices in everyday life as well as benefits and ethical boundaries
2. Information, data, and media: queries, evaluating sources, sharing information
3. Operating systems & standard software: basic knowledge of operating systems, text processing, presentation software, calculations
4. Media design: adopting, producing, and adapting media
5. Communication & social media: different communication platforms, creating digital identities, cloud-sharing
6. Data security & privacy: securing devices as well as private data
7. Technical problem solving: solving basic IT problems
8. Computational thinking: working with algorithms, creative usage of programming languages

The first topic *social aspects of digitalization* addresses digital devices and processes of daily life, as well as the possible impacts on the ongoing digitalization. Furthermore, students should discuss the merit, standards, and different interests in respect of the usage of digital media concerning ecological, religious, political, and cultural aspects [20].

Information, data, and media lists topics like searching, finding, comparing, and evaluating data. Therefore, it is of high importance that students learn how to identify reliable and valuable sources and how to cite those. Furthermore, students should know how to organize data and work with different file formats. Of course, they should also know how to cope with cloud-based file systems and how to share information with others [20].

The third section of the curriculum deals with *operating systems and standard software*, where students should learn how different operating systems work and how they vary from area to

area. Text processing, presentation, and spreadsheets are defined as the three main applications of *standard software* [20].

Media design covers the creation of various digital media formats, as well as learning to deal with information in a conscious way. Henceforth, it is crucial to differ between mass media and individual media, as well as the discussion of media manipulation, influence of media, and covert advertising [20].

In the fifth topic of the curriculum students get to know the terms *communication & social media*. They get acquainted with different digital communication tools and learn how to behave when using those ("netiquette"). Moreover, students cope with problematical messages or situations like "cyber-mobbing", hate speech on the net, "sexting", or "cyber-grooming", and get to know strategies how to evade and report those. Of course, it is also very important to create online identities carefully and to be aware of risks or misuse of personal information [20].

Data security and privacy describe the risks and dangers of digital environments, as well as the protection of digital devices against computer viruses and malware. Furthermore, it is essential that students learn how to set strong passwords and understand the basics of data encryption. Concerning *privacy*, students should be able to draw a distinction between direct, indirect, and non-personal data, as well as sensitive and non-sensitive data [20].

The seventh chapter of the curriculum of "Digital Education" in Austria covers *technical problem solving*. Hence, it is important that students know the basic components of a computer and a network. They should also be able to define and describe everyday bugs concerning digital devices, select appropriate solutions, or know how to apply help systems. Furthermore, students should be competent in the usage of data protection and backup systems [20].

The last section covers the world-wide popular competence of *Computational Thinking*. Jeanette Wing [21] defines the term as a fundamental 21st century skill for everyone. It is best described as a problem-solving process with distinctive problem-solving techniques and general intellectual practices [21]. Students should learn how to describe their everyday procedures, as well as postulate and understand well-defined, finite sequences (algorithms). Moreover, the curriculum states that students should develop simple programs and identify basic programming structures, like conditional statements, loops, or methods [20].

Concerning Oppl et al. (2021) the eight sub-areas depicted in the curriculum are perceived as having different levels of importance by both school administrations and teachers. In terms of budgeting with the available time resources, it can be assumed that the different sub-areas will also be given different amounts of attention by teachers. It is striking that the topics, which from the point of view of the learning outcomes can be assigned to the computer science perspective ("Computational Thinking" and "Technical Problem Solving"), are considered less important by the majority of teachers and school management than those areas that deal with media education and application competences [17].

3.4. Compulsory Subject Digital Education in Austria

In November 2021 the Austrian Minister of Education Heinz Faßmann presented the implementation of the compulsory subject "Digital Education" in the school year 2022/23. Surprisingly, one week after that Martin Polaschek took his seat – still he went on with the plan of his predecessor [22].

Besides, the major difference is that from 2018 to 2021 students were solely graded with "successfully completed" or "not successfully completed", whereas now they will receive traditional grades in five stages from "very good" to "inadequate" when completing the subject "Digital Education".

The revised model for the subject "Digital Education" plans to implement one annual hour peer week from grades 5 to 7 starting in the school year 2022/23. The new competence-oriented curriculum will be installed with the beginning of the school year 2023/24 in both primary level and secondary level I and to that end, "Digital Education" will be compulsory for all students. In addition, the new curriculum introduces the overarching topics "IT education" and "media education" starting with the 1st grade and their mandatory implementation in other lessons [23].

A group of experts from universities and teacher training colleges was entrusted with the creation of a draft for the new curriculum for "Digital Education". This draft was created with the help of national and international competency models [23]. In March 2022 the concepts of the new curriculum were presented by the Ministry of Education by implementing the 4C's of the 21st century: Critical Thinking, Creativity, Collaboration, and Communication [24]. Educators should help students to gain these skills to prepare for successful careers when entering the workforce [25].

A well established, two dimensional competence model forms the basis of the presented curriculum of "Digital Education" (see figure 1) [24]:

		orientation	information	communication	production	interaction
(T)	structures and functions of digital, IT, and media systems					
(G)	social interactions through the use of digital technologies					
(I)	interaction in the form of usage, action, and subjectification					

Figure 1: Competence Model of Austrian Curriculum "Digital Education" (adapted by the authors) [24]

The different areas of competences form the horizontal line: (1) orientation – analyzing and reflecting about social aspects of media change and digitization, (2) information – responsible handling of data, information, and information systems, (3) communication – communicating and cooperating using media systems, (4) production – creating and publishing digital content, designing algorithms, and creating software programs, (5) interaction – responsible use of offers and options of a digital world [24].

The vertical classification describes the subject-specific topics that are represented in the "Frankfurt Dreieck" (see figure 2) [24]. This theory can be seen as an extension of the famous "Dagstuhl-Dreieck" but concentrates on the aspects of digital education.

The three central concepts are based on the following perspectives: (T) technical-media – structures and features of digital, IT, and media systems, (G) social-cultural – social interactions

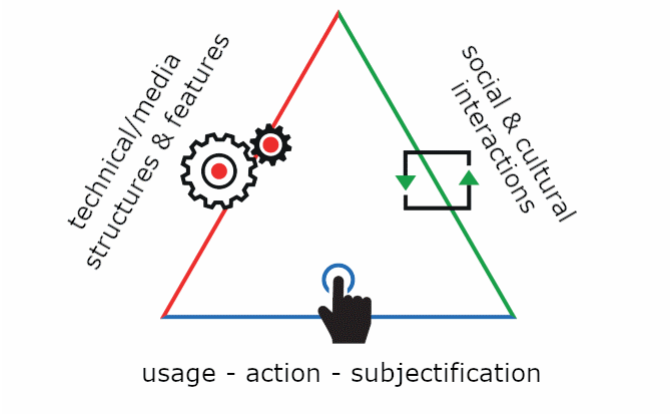

Figure 2: Frankfurt Dreieck (adapted by the authors) [26]

through the use of digital technologies, and (I) interaction-related – interaction in the form of usage, action, and subjectification [27].

The general plan of the curriculum of 2022 is very similar to the old one. Still, some differences in the exact formulation of competences exist that should be analyzed in further studies.

4. Conclusion and Outlook

The present paper displayed an overview of the journey of digital education in the Austrian school system and wanted to grant insight into the most important topics covered in this subject. When Austria implemented the mandatory curriculum "Digital Education" in September 2018 for all students in lower secondary education and with the compulsory subject starting in 2022, digital literacy finally found its official way into additional grades.

With the introduction of the compulsory subject another problem appeared, as currently no entire "Digital Education" studies in Austrian teacher education exist, as there is for other traditional subjects. In autumn 2022 postgraduate training for teachers is planned to tackle the lack of fully trained staff in "Digital Education". Besides, there still is no schoolbook that covers the current curriculum available yet.

To help educators dealing with the unfamiliar curriculum of "Digital Education", it is necessary to create a large collection of material for the specific topics, especially for the technical oriented ones. Henceforth, there is still a lot of effort that has to be put into the implementation of the curriculum to gain further motivation of the teachers.

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