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Education for technologies and ICT in compulsory education in Romania. Comparative analyses, the need for reconsiderations and equal opportunities

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Abstract: The research analyses the situation of education in Romania regarding the presence in the official documents of the school subjects that form competences for the technological field and for ICT. The framework plans for compulsory education at the primary, secondary and lower cycle of high school were analysed. The conclusions show the fact that many of the official school documents are older than 10 years and they were developed and approved by the Ministry of Education without considering continuity and a unitary vision. If in secondary education the situation is somewhat better, in all the analysed profiles, in primary education the curricular area "Technologies" is underrepresented, although equal opportunities are offered to students from all majors. The high school operates framework plans approved in 2009, which means that there is no continuity in the study of some subjects, ICT/Computer science being present only in certain specializations. The situation is analysed in the classes belonging to mass education, the one intended for national minorities and from specializations such as: mathematics, computer science, technological, arts, music, theology, pedagogy, social sciences, sports, military, public security. A series of research directions and priorities are proposed for a better presence of technology and ICT education in the training of students for the society of the future.

Key words: technologies; ICT; compulsory education; equal opportunities; curriculum.

1. Introduction

The analyses from the educational field are unanimous in considering the vision of the graduate profile as the main determinant in the articulation of the curriculum for the formation of key skills in the 21st century (Escribano et al., 2023; EC, 2020). In this context, technology education is considered a key field by current educational factors (EU, 2018), at all levels (Gómez-Trigueros et al. 2024), with an important role in the formation of transformative skills, able to lead to increasing motivation and sustainable development (Robles-Moral, 2021; Heine et al., 2023), creating values, assuming an increased set of responsibilities, solving ethical problems on a social and personal level (Othman et al., 2024; OECD, 2020a). The concern of national decision-makers in the field of curriculum to support ICT/digital literacy is thus fully justified (OECD, 2020b). In this sense, the Eurydice report published in 2023 shows that in approximately one third of European countries students start studying Computer Science from the first year of primary education, usually as part of another school subject. Another third of the students start studying Computer Science in the 3rd - 5th grades, generally as a separate, compulsory subject or integrated into a compulsory subject (CE, 2023, p. 9; CE, 2019). In addition, recent research shows that teaching Computer Science from primary education is not only possible, but also beneficial for learning and increasing self-esteem and motivation (Webb et al., 2017; CE, 2023, p. 21).

The trends on the labour market currently show a growing need for highly qualified personnel, with a series of enhanced skills acquired through education, including through new didactic strategies (Perry & Edwards, 2019), especially among those that consider new technologies and implicitly the high-level use of computers and ICT resources (Mishra & Koehler, 2006; OECD, 2023). However, the

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context is not without questions, including for teacher training (EU, 2015; Eurostat, 2016), all the more so since technological development already brings a series of challenges to the labour market. The production automation and the use of artificial intelligence in more and more fields (Zhu et al., 2023), with all its limitations, can lead to the disappearance of an average of 14% of existing jobs, with significant differences including among European countries, going up to 35% in the case of Slovakia (Georgieff & Milanez, 2021).

The data of recent research shows that the lack of high skills in the field of the use of cutting-edge technologies are risk factors on a personal level, by decreasing the chances of employment on the labour market, but also at the level of national economies (Wall et al., 2023), for which the lack of highly qualified workforce leads to a decrease in the level of productivity and competitiveness (Eurostat, 2016). These employed people will need many more continuous training courses, starting from the first stage of work activity, in relation to employees who have benefited from a very good initial training, since compulsory education (Abedi, 2023; OECD, 2021a). A good design and implementation of the digital curriculum can significantly support the reduction of gaps regarding access to education (Mirzajani et al., 2016), represents an increasingly important support in situations of pandemic restrictions, emergency situations. It can also contribute to pragmatic training (Opriş, 2020) and to a better motivation of students at risk of dropping out (OECD, 2021b; Opriş, 2014). A high level of education in the field of the use of new technologies, provided primarily in compulsory education (Bingimlas, 2009), constitutes an important support for the adaptation of the current generations of students to the increasingly rapid changes on the labour market, which also involve more increased skills in an interdisciplinary plan (Escribano et al., 2023; OECD, 2019). Also, a good initial preparation (Hein et al., 2023) in the field of using modern technologies offers increased chances for those who want to follow specialization courses for different subfields, in the situation where the compulsory education has provided an appropriate preparation (OECD, 2023).

2. Purpose and research methodology

Starting from the constant existence of a time gap in the curriculum, generated by the lagging of school behind in relation to the latest trends and achievements in the technological space and felt by the graduates in their professional activity, the research aims to provide an image of the place of technology education in the framework plans in force in Romania. The analysis resumes and develops research (Opriş, 2017) that shows a growing need for training on new aspects, including security threats or issues related to the security of personal data, alongside the already classic ones in the field, in order to programmatically promote digital transformation in the curriculum in compliance with the current accountability systems in education and training (OECD, 2020a). Also, the research aims to identify new research directions to propose research data in a position to support the revision of the curricular documents of education for technologies and ICT in Romania, in relation to the situation in developed countries.

The framework plans, the main curricular documents in force, were analysed in order to identify the weight that the subjects from the "Technologies" curricular area have in the time budget of each class in compulsory education (primary, secondary and lower cycle of high school), in order to observe the situation of the presence of these subjects in the school. The descriptive analyses made on the basis of the obtained frequencies (number and percentages), central tendency indicators (mean) and elementary scattering indicators (amplitude) were used to formulate the conclusions.

3. Curricular area "Technologies" in the Framework Plans for primary education

The framework plan for primary education (MEN, 2013a) entered into force starting from the 2013-2014 school year provides for the school subject "Visual arts and practical skills" within the curricular area "Technologies", but which partially also covers the curricular area "Arts", the time budget being two hours per week for the first four grades and one hour per week for the fourth grade. The analysis of the data from the framework plan and of the curriculum shows that this curricular area is actually underrepresented in primary education in Romania.

For all five grades in the primary cycle, the framework plan foresees the possibility of granting an extra hour, within the Curriculum upon school decision (CSD), without specifying the curricular area. In Table 1, we presented the percentage of hours of the discipline "Visual arts and practical skills" in the situation where no elective course is chosen (in which the students only complete the hours allocated to Common Core - CC), respectively in the situation where an allocated CSD was chosen of the curricular area "Technologies" (with an extra hour).

Table 1. *The frequency (number and %) of hours allocated to the curricular area "Technologies" in the Framework Plan for primary education*

TECHNOLOGIES	**Preparatory Grade**		**Grades I-III**		**Grade IV**	
	No. hours	**%**	**No. hours**	**%**	**No. hours**	**%**
CC (Visual arts and practical skills)	2	**11**	2	**10**	1	**5**
No. minimum hours	19		20		21	
CC + CSD	3	**15**	3	**14**	2	**9**
No. minimum + CSD (1 hour)	20		21		22	

The data in Table 1 show the halving of the number of hours and their percentages for the discipline "Visual Arts and Practical Skills" from the preparatory class to the IVth class. We mention the fact that this decrease was achieved against the background of the introduction of two new subjects: "History" and "Geography" within the curricular area "Man and Society".

The same time budget is provided for the curricular area "Technologies" and in particular cases: in the Education Framework Plan for primary education in the languages of national minorities (MEN, 2013b), in the Framework Plan for primary education for schools or classes with students belonging national minorities who study in the Romanian language (MEN, 2013c), where the CSD can be assigned to any of the curricular areas.

If we analyse the Framework Plan for primary education with integrated and additional art-music program (MEN, 2013d), the Framework Plan for primary education with integrated and additional choreography program (MEN, 2013e), respectively the Framework Plan for primary education with integrated sports program (MEN, 2013f), we observe the same number of hours in the Common Core and the same time budget for CSD. The specification made regarding the CSD for all three Framework Plans: "The hourly allocations for the CSD will be used in other curricular areas than the main specialization" shows the fact that students following these specializations have equal chances in choosing a CSD in the "Technologies" curricular area, with their colleagues.

4. Curricular area "Technologies" in the Framework Plans for secondary education

In the Framework Plan that entered into force starting from the 2017-2018 school year, in the "Technologies" curriculum area, two subjects of education were introduced as part of the Common Core: "Technological education and practical applications", respectively "Computer science and ICT", with as many one hour a week each. Also, there is the possibility of proposing an elective course, with a time budget of 1-2 hours per week. Thus, the number of hours that can be allocated to this curricular area can vary between 2 and 4. Depending on the minimum and maximum number of hours established at the level of the educational unit, there may be differences in the percentage values for a certain school subject or for a curricular area (MENCS, 2016a).

In Table 2 shows the percentage of the number of hours dedicated to studying subjects from the "Technologies" curriculum area, compared to the total number of hours per week, depending on the number of elective courses that can be chosen.

Table 2. *The frequency (number and %) of hours allocated to the "Technologies" curriculum area in the Framework Plan for secondary education*

TECHNOLOGIES	Grade V		Grade VI		Grade VII		Grade VIII	
	No. hours Techno-logies	**%**	**No. hours** Techno-logies	**%**	**No. hours** Techno-logies	**%**	**No. hours** Techno-logies	**%**
T (Technological education and practical applications + Computer science and ICT)	**2**	**7.7**	**2**	**7.1**	**2**	**6.5**	**2**	**6.5**
No. minimum: TC + 1 CSD other curricular area	25 + 1 = 26		27 + 1 = 28		30 + 1 = 31		30 + 1 = 31	
T + 1 CSD Technologies	2+1 = 3	**11.5**	2+1 = 3	**10.7**	2+1 = 3	**9.7**	2+1 = 3	**9.7**
No. minimum: TC+ 1 CSD Technologies	25 + 1 = 26		27 + 1 = 28		30 + 1 = 31		30 + 1 = 31	
T + 1 CSD Technologies	2+1 = 3	**11.1**	2+1 = 3	**10.3**	2+1 = 3	**9.4**	2+1 = 3	**9.4**
No. minimum: TC + 1 CSD Technologies + 1 CSD other area	25 + 1 + 1 = 27		27 + 1 = 29		31 + 1 = 32		31 + 1 = 32	
T + 1 CSD Technologies	-	**-**	-	**-**	2+1 = 3	**9.1**	2+1 = 3	**9.1**
No. minimum: TC + 1 CSD Technologies + 2 CSD other area	-		-		30 + 1 + 2 = 33		30 + 1 + 2 = 33	
T + 2 CSD Technologies	2+2 = 4	**14.3**	2+2 = 4	**13.3**	2+2 = 4	**12.1**	2+2 = 4	**12.1**
No. minimum: TC + 2 CSD Technologies + 1 CSD other area	25 + 2 + 1 = 28		27 + 2 + 1 = 30		30 + 2 + 1 = 33		30 + 2 + 1 = 33	
T + 2 CSD Technologies	-	**-**	-	**-**	-	**-**	2+2 = 4	**11.8**
No. minimum: TC + 2 CSD Technologies + 2 CSD other area	-		-		-		30 + 2 + 2 = 34	
Amplitude		**7.65**		**6.2**		**5,6**		**5,6**
Average		**11.1**		**10.3**		**9.4**		**9.8**

The research data show a decrease in the amplitude, along with the increase in the total number of hours per week, from the 5th grade to the 8th grade. The percentage average decreases linearly from the 5th grade to the 7th grade by 0.8 and 0.9 points respectively, with a minimum in the 7th grade, and in the 8th grade, it rises by 0.4%. The highest percentage values of the weight of the number of hours intended for the curricular area "Technologies" are obtained in the situation where we have two elective courses from the curricular area "Technologies".

In the case of secondary education with teaching in the languages of national minorities and secondary education for schools or classes with students belonging to national minorities who study in Romanian, even if the number of hours allocated to the curricular area is the same, the weight allocated to the curricular area changes and, implicitly, each discipline, given the greater number of hours per week provided by the framework plans.

In the case of secondary education with an integrated and additional art program: music, choreography, visual arts, respectively with an integrated sports program, there are differences both in terms of the number of hours allocated to the elective course at the level of the "Technologies" curricular area, which decreases from 0-2, to 0-1, as well as regarding the total number of hours per week, which increases in favour of the specialized curricular area, which has a time budget between 5-10 hours, differentiated by grades and specialties (MENCS, 2016b; MENCS, 2016c; MENCS, 2016e).

For example, in the 5th grade, if we graphically represent the amplitude and the average of the percentages, we obtain distributions that show the differences in terms of the weight of studying these subjects in secondary education in Romania, depending on different factors (Figure 1).

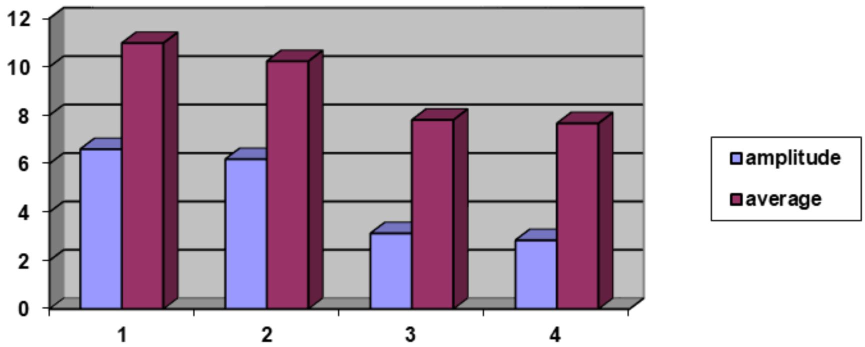

Figure 1. *Comparison charts for the amplitude (A) and average (a) of the percentages in which subjects are studied in the Technologies curriculum area in the 5th grade, in:*

1. Mainstream secondary education

2. Secondary education for minorities

3. Secondary education with integrated and additional arts program – choreography and visual arts and integrated sports program

4. Secondary education with integrated and additional program of arts - music

The data show us a decrease in the share of subjects that form competences related to "Technologies" in secondary education with an integrated and additional arts program and in the integrated sports program, together with the increase in the total number of hours per week and the decrease in the number of hours allocated to the elective courses from this curricular area.

5. The curriculum area "Technologies" in the framework plans for the lower cycle of high school

The graduates of the 8th grade, from 2020-2021, who benefited from a curriculum based on new conceptual foundations (entered into force in 2012), starting with the preparatory grade, should have benefited from new framework plans and new school programs at all disciplines, which ensure a continuum in the high school cycle as well. This did not happen, so all our analyses were carried out on the basis of the framework plans in force, most of which were approved in 2009. This explains the presence of Computer science subject only in certain branches and specializations.

As a common note, in the framework plans for the lower cycle of the high school we find in the curricular area "Technologies", in the case of all branches, the disciplines "Information and Communication Technology", respectively "Entrepreneurial Education". Additional disciplines appear as follows: "Computer science", in the case of the theoretical branch, real profile, Mathematics-Computer Science and Natural Sciences specializations and within the vocational branch (High Schools of the Ministry of National Defence), Mathematics-Computer Science specialization, "Practical training of specialty", in the case of the pedagogical profile vocational branch, the specializations teacher-educator, educator-childcare worker, school mediator, extracurricular education instructor, "Specialist culture", respectively "Weekly practical training", in the case of the technological branch, all specializations. The analysis of the framework plans shows not only changes in the time budget plan allocated to this curricular area, but also regarding the names of the respective disciplines.

An analysis of the framework plans on aspects related to the number of hours allocated to technological disciplines reveals differences depending on branches, profiles and specializations. We present them further in the ascending order of the percentage (in the 9th grade) regarding the time allocated to studying all subjects in the "Technologies” curricular area, depending on the total number of hours per week, keeping the headings and abbreviations from the framework plans (CC – common core, DC – differentiated curriculum). In calculating the percentages, we did not take into account the possibility of distributing CSD to the curricular area "Technologies".

Vocational branch, artistic profile, choreography specialization (MATCH, 2009b)

The weekly time allocated to studying subjects from the "Technologies" curriculum area in the lower cycle of high school, the vocational branch, artistic profile, choreography specialization is equal in both grades, in a percentage of 6.06% - see Table 3.

Table 3. *The weekly time allocated to studying the subjects from the "Technologies" curriculum area in the lower cycle of high school, vocational branch, artistic profile, choreography specialization*

TECHNOLOGIES	**Grade IX**					**Grade X**			
	CC	**DC**	**CC + DC**	**% N=33**		**CC**	**DC**	**CC + DC**	**% N=33**
Information and communication technology	2	-	2	6.06		1	-	1	3.03
Entrepreneurial education	-	-	-	-		1	-	1	3.03
No. hours / %	**2**	**-**	**2**	**6.06**		**2**	**-**	**2**	**6.06**

Vocational branch, sports profile, all specializations (MATCH, 2009b)

In all specializations, the weekly time allocated to studying the subjects from the "Technologies" curriculum area in the lower cycle of high school, vocational branch, sports profile, is equal in both grades, in a percentage of 6.25% - see Table 4.

Table 4. *The weekly time allocated to studying the subjects from the "Technologies" curriculum area in the lower cycle of high school, vocational branch, sports profile, all specializations*

TECHNOLOGIES	**Grade IX**					**Grade X**			
	CC	**DC**	**CC + DC**	**% N=32**		**CC**	**DC**	**CC + DC**	**% N=32**
Information and communication technology	2	-	2	6.25		1	-	1	3.125
Entrepreneurial education	-	-	-	-		1	-	1	3.125
No. hours / %	2	-	2	**6.25**		2	-	2	**6.25**

Vocational branch, artistic profile, music specialization (MATCH, 2009b) and theological profile (Roman-Catholic cult and Greek-Catholic cult), religious tourism guide specialization (MEN, 2014; MECS, 2015)

The weekly time allocated to studying subjects from the "Technologies" curriculum area in the lower cycle of high school, the vocational branch, artistic profile, the music specialization and the vocational branch, theological profile (Roman-Catholic cult and Greek-Catholic cult), the religious tourism guide specialization has equal value with 6.45% in the 9th grade and in the 10th grade – see Table 5.

Table 5. *The weekly time allocated to studying subjects from the "Technologies" curriculum area in the lower cycle of high school, vocational branch, artistic profile, music specialization and vocational branch, theological profile (Roman-Catholic cult and Greek-Catholic cult), religious tourism guide specialization*

TECHNOLOGIES	Grade IX					Grade X			
	CC	DC	CC + DC	% N=31		CC	DC	CC + DC	% N=31
Information and communication technology	2	-	2	6.45		1	-	1	3,225
Entrepreneurial education	-	-	-	-		1	-	1	3,225
No. hours / %	**2**	**-**	**2**	**6.45**		**2**	**-**	**2**	**6.45**

Vocational branch, artistic profile, acting majors, architecture, ambient arts, design, plastic arts, decorative arts, conservation-restoration of cultural assets (MATCH, 2009a) and theological profile, specializations in Orthodox theology, church music, cultural heritage, Catholic theology, Unitarian theology, Reformed theology, Baptist theology, Pentecostal theology, Adventist theology, Muslim theology (for all cults and religions see MECI. (2009b), religious tourism guide (Orthodox cult) (MECTS, 2011a)

The weekly time allocated to study the subjects from the "Technologies" curriculum area in the lower cycle of high school, vocational branch, artistic profile, all specializations (except music) and vocational branch, theological profile, all theological specializations and religious tourism guide (Orthodox cult) is 6.67% in both grades – see Table 6.

Table 6. *The weekly time allocated to studying subjects from the "Technologies" curriculum area in the lower cycle of high school, vocational branch, artistic profile, all specializations (except music), respectively vocational branch, theological profile, all theological specializations and religious tourism guide (Orthodox worship)*

TECHNOLOGIES	Grade IX					Grade X			
	CC	DC	CC + DC	% N=30		CC	DC	CC + DC	% N=30
Information and communication technology	2	-	2	6.67		1	-	1	3,335
Entrepreneurial education	-	-	-	-		1	-	1	3,335
No. hours / %	**2**	**-**	**2**	**6.67**		**2**	**-**	**2**	**6.67**

Theoretical branch, humanistic profile, specializations in philology, social sciences (MATCH, 2009b) and vocational branch, public order and security profile (High schools of the Ministry of Administration and the Interior), majoring in social sciences (MECI, 2009b)

The weekly time allocated to studying the subjects from the "Technologies" curriculum area in the lower cycle of high school, the theoretical branch, humanities profile, the philology, social sciences and the vocational branch, order and public security profile (High Schools of the Ministry of Administration and the Interior), the social sciences specialization is of 6.9%, in both grades – see Table 7.

Table 7. *The weekly time allocated to studying subjects from the "Technologies" curriculum area in the lower cycle of high school, the theoretical branch, humanities profile, philology, social sciences and vocational branch, order and public security profile (High Schools of the Ministry of Administration and Interior), social sciences specialization*

TECHNOLOGIES	Grade IX					Grade X			
	CC	DC	CC + DC	% N=29		CC	DC	CC + DC	% N=29
Information and communication technology	2	-	2	6.9		1	-	1	3.45
Entrepreneurial education	-	-	-	-		1	-	1	3.45
No. hours / %	**2**	**-**	**2**	**6.9**		**2**	**-**	**2**	**6.9**

Vocational branch, military profile (High schools of the Ministry of National Defence), Mathematics-Computer Science specialization (MECI, 2009b)

The weekly time allocated to studying the subjects from the "Technologies" curriculum area in the lower cycle of high school, vocational branch, military profile (High Schools of the Ministry of National Defence), Mathematics-Computer Science specialization increases from 6.9% to the 9th grade, at which no hours can be allocated for DC in this curricular area, to 12.8% in the 10th grade, where hours were allocated within DC – see Table 8.

Table 8. *The weekly time allocated to studying subjects from the "Technologies" curriculum area in the lower cycle of high school, vocational branch, military profile (high schools of the Ministry of National Defence), Mathematics-Computer Science specialization*

TECHNOLOGIES	Grade IX					Grade X			
	CC	DC	CC + DC	% N=29		CC	DC	CC + DC	% N=29
Information and communication technology	1		1	3.45		1	1	2	6.9
Computer science	1	-	1	3.45		-	1	1	3.45
Entrepreneurial education	-	-	-	-		1	-	1	3.45
No. hours / %	**2**	**-**	**2**	**6.9**		**2**	**2**	**4**	**12.8**

Theoretical branch, real profile, Mathematics-Computer Science specializations, natural sciences (MATCH, 2009b)

The weekly time allocated to studying the subjects from the "Technologies" curriculum area in the lower cycle of high school, the theoretical branch, real profile, Mathematics- Computer Science specializations and Natural Sciences is equal in the two grades, the percentage being 10.35% - see Table 9.

Table 9. *The weekly time allocated to studying subjects from the "Technologies" curriculum area in the lower cycle of high school, the theoretical branch, real profile, Mathematics-Computer Science and Natural Sciences specializations*

TECHNOLOGIES	Grade IX					Grade X			
	CC	DC	CC + DC	% N=29		CC	DC	CC + DC	% N=29
Information and communication technology	2	-	2	6.9		1	-	1	3.45
Computer science		1	1	3.45			1	1	3.45
Entrepreneurial education	-	-	-	-		1	-	1	3.45
No. hours / %	**2**	**1**	**3**	**10.35**		**2**	**1**	**3**	**10.35**

Vocational branch, pedagogical profile, kindergarten teacher - primary school teacher specialization (MECTS, 2011b)

The introduction of the discipline "Practical specialized training" means that the weekly time allocated to studying the subjects from the "Technologies" curriculum area in the lower cycle of high school, vocational branch, pedagogical profile, kindergarten teacher - primary school teacher specialization reaches 16.67% in the 9th grade, respectively to 19.34% in the 10th grade – see Table 10. As far as we are concerned, we believe that the reason why the respective discipline was included in the "Technologies" curricular area is that the name of the discipline contains the word "practical". In reality, in the pedagogical profile, in the three hours allocated for "Practical specialized training", assistance is provided in lessons and didactic activities assisted by the full-time teachers in the classroom.

Table 10. *The weekly time allocated to studying subjects from the "Technologies" curriculum area in the lower cycle of high school, vocational branch, pedagogical profile, kindergarten teacher - primary school teacher specialization*

TECHNOLOGIES	Grade IX					Grade X			
	CC	DC	CC + DC	% N=30		CC	DC	CC + DC	% N=31
Information and communication technology	2	-	2	6.67		2	-	2	6.45
Specialized practical training	-	3	3	10		-	3	3	9.67
Entrepreneurial education	-	-	-	-		1	-	1	3.22
No. hours / %	**2**	**3**	**5**	**16.67**		**3**	**3**	**6**	**19.34**

Vocational branch, pedagogical profile, specializations kindergarten teacher-childcare worker, school mediator, extracurricular education instructor (MECTS, 2011c)

The weekly time allocated to studying the subjects from the "Technologies" curriculum area in the lower cycle of high school, the vocational branch, pedagogical profile, the specializations kindergarten teacher-childcare worker, school mediator, extracurricular education instructor is equal in the two grades, 17.23% - Table 11. For this specialization in the pedagogical field, in the three hours allocated for "Specialist practical training", assistance is provided in lessons and didactic activities by the full-time teachers in the classroom.

Table 11. *The weekly time allocated to studying the subjects from the "Technologies" curriculum area in the lower cycle of high school, the vocational branch, pedagogical profile, the specializations kindergarten teacher-childcare worker, school mediator, extracurricular education instructor*

TECHNOLOGIES	Grade IX					Grade X			
	CC	DC	CC + DC	% N=29		CC	DC	CC + DC	% N=29
Information and communication technology	2	-	2	6.89		1	-	1	3,445
Specialized practical training	-	3	3	10.34		-	3	3	10.34
Entrepreneurial education	-	-	-	-		1	-	1	3,445
No. hours / %	**2**	**3**	**5**	**17.23**		**2**	**3**	**5**	**17.23**

Technological branch, learning day, all specializations (MECI, 2009c; MECTS, 2010)

The weekly time allocated to studying subjects from the "Technologies" curriculum area in the lower cycle of high school, the technological branch, learning day, all specializations is one third of the total hours (33.33%) in the 9th grade, respectively 40% in the 10th grade – see Table 12. In this case, the presence of the discipline "Weekly practical training" in the curricular area "Technologies" is justified, as the allocated time interval is intended for the realization of practical applications by capitalizing on the notions from the technical field studied in class.

Table 12. *The weekly time allocated to studying the subjects from the "Technologies" curriculum area in the lower cycle of high school, the technological branch, full-time education, all specializations*

TECHNOLOGIES	Grade IX (MATCH, 2009c)					Grade X (MECTS, 2010)			
	CC	DC	CC + DC	% N=30		CC	DC	CC + DC	% N=30
Information and communication technology	1	-	1	3.33		1	-	1	3.33
Entrepreneurial education	-	-	-	-		1	-	1	3.33
Specialty culture		6	6	20			5	5	16.67
Weekly practical training	-	3	3	10		-	5	5	16.67
No. hours / %	**1**	**9**	**10**	**33.33**		**2**	**10**	**12**	**40**

The analysis of the data in tables 3-12 reflects differences of more than 30 percentage points among the time allocated to the subjects in the "Technologies" curricular area in different branches. Also, in the comparison diagrams in Figure 2, we presented an average for each interval, for each class in the lower cycle of high school.

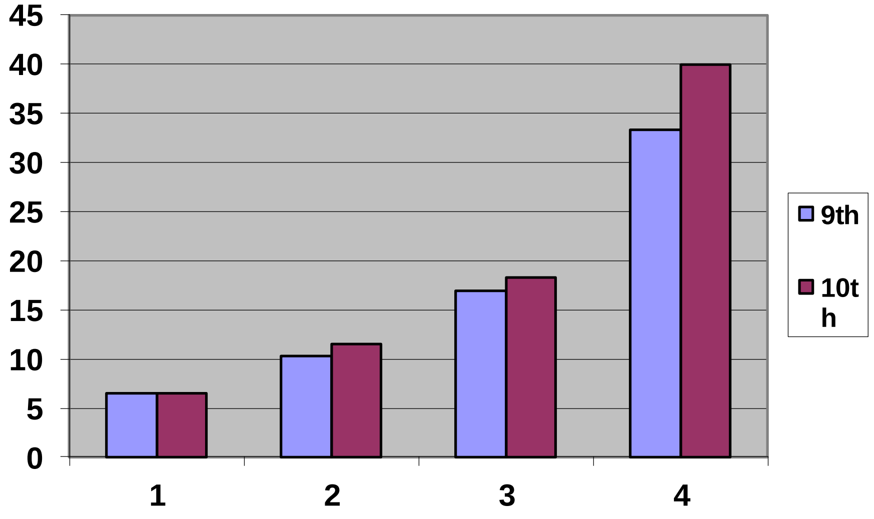

Figure 2. *Comparison diagrams for the percentage allocated to the weekly number of hours in the 9th and 10th grades in the subjects from the "Technologies" curriculum area, in the lower cycle of high school, for:*

1. Vocational branch, arts, sports, theological, military profiles - 9th grade, public order and security and theoretical branch, human profile

2. Theoretical branch, real profile, respectively vocational branch, military profile - 10th class

3. Vocational branch, pedagogical profile

4. Technological branch

3. Conclusion

The changes that have occurred in the last decades in the curricular plan in Romanian education, also highlighted by the framework plans analysed in this research, reveal the importance that the Romanian school gives to the role of the subjects from the "Technologies" curricular area in the training of future specialists in IT and/or different technical fields. Supported by the paradigm promoted by the key competences provided at the European level and by the need for development in directions that are proving increasingly important for the labour market, the preparation of new generations of students for further high-level specialization in IT or technical fields also shows the need for change and update, for real continuity in Romanian education.

The trend registered in developed countries is only partially present in Romania, a country which, at the secondary school level, over the past decade, it has been working to get closer to the approach in EU countries and the OECD area. If at the level of primary (elementary) education, training in the field of technologies and ICT is ensured in particular through the compulsory subject "Visual arts and practical skills" and can be additionally supported by choosing an elective course, at the lower cycle of high school, lagging behind is obvious, and the differences between specializations are very large. There is no continuity in the training of students in compulsory education, including because there is no continuity in the development and introduction of new framework plans at the high school, which would support the continuation of training from the secondary school.

Some percentages with which training in the field of technologies and ICT is present in the framework plans are higher due to the presence of practical activities in the curricular area "Technologies". In the case of the pedagogical profile, this presence is only due to a certain association regarding the name of the subject, not its specific content.

The low percentage with which the targeted field appears in the framework plans from the humanities fields, at the lower cycle of the high school (9th - 10th grades), shows a place far below the average in the OECD space.

We believe in the context that the individualization of learning under the conditions of a reduced number of hours dedicated to training in the field of technologies and ICT can only be achieved through additional training outside the regular school program of the students, the attention that can be given during school activities to the students with a special potential in the field of technological education or computer science is reduced, if we are talking about schools other than specialized high schools.

Because in Romania the branch or profile followed at high school is of very little importance for admission to college, we believe that the framework plans need to be revised as urgently as possible, at all levels, to ensure equal opportunities for graduates of compulsory education and high school in the subsequent course of professional and university training in the field of technologies and ICT, but also for the educational offer in Romania to be in line with the trends in economically developed countries.

A possible remedy for the situation is the observation of some recent models of good practice from countries with a better concern in the fields targeted by the current research. An example is the situation in Lithuania (Eurydice, 2024), where official education documents associate the term "technological/technologies" with different educational contexts or educational subjects, such as: "Computer music technology", "Integrated course of arts and technology", "Applied technologies", etc., even if some of them are intended only for certain specializations.

Limits of research

The research analyses only the framework plans, the official documents by which in Romania the number of hours allocated to a curricular area, a compulsory subject or elective courses is determined. The school programs were not analysed, in order to identify the presence of some skills that involve training in the field of technologies or ICT in disciplines that do not have as their main purpose training on these aspects, but which can contribute to them as a secondary aspect. An analysis of the presence of subjects aimed at training in the field of technologies and ICT has not been carried out in relation to education funding and the endowment with computers and modern equipment of schools in European and OECD countries. All these remain future research directions and priorities.

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