ISBN: 978-989-8704-39-9 © 2022

TEACHERS' DIGITAL COMPETENCES BEFORE AND DURING THE COVID-19 PANDEMIC FOR THE IMPROVEMENT OF SECURITY AND DEFENCE HIGHER EDUCATION

Marina Marchisio[1], Fabio Roman[1], Matteo Sacchet[1], Enrico Spinello[2], Linko Nikolov[3], Malgorzata Grzelak[4], Magdalena Rykala[4] and Cristian-Emil Moldoveanu[5]
[1]*Department of Molecular Biotechnology and Health Sciences, University of Turin, Via Nizza 52, 10126 Torino, Italy*
[2]*Education and Training Command and School of Applied Military Studies, Via Arsenale 22, 10121 Torino, Italy*
[3]*Department of Communication Networks, National Military University, Karel Shkorpil 1 str., 9700 Shumen, Bulgaria*
[4]*Faculty of Safety, Logistics and Management, Military University of Technology, Poland*
[5]*Military Technical Academy "Ferdinand I", 39-49 George Cosbuc, Sector 5, Bucharest, Romania*

ABSTRACT

COVID-19 hastened a trend that was already ongoing before the pandemic outbreak: the progressively increasing use of distance and online teaching and learning, alongside with lectures and classes. The potentialities of online teaching allowed a didactic continuity that would have been impossible otherwise, and this approach is likely to be maintained even after COVID-19 related restrictions end. From these remarks, it immediately follows that it is of great importance that teachers, students and other personnel, such as technicians and program managers, possess digital skills devoted to education. In the context of security and defence, areas with a strong international vocation, these skills are even more valuable. This research investigates the impact of COVID-19 on education in these contexts: the changes caused by the pandemic, the teachers' perception about some aspects of their job, such as the way they relate with students, and their ability to perform the same commitments in a different scenario. The research has been conducted based on the analysis of an online anonymous questionnaire with more than 500 responses. Results suggested the importance of the development of a training devoted to improving teachers' digital skills, since they live frontline in education, and they have been directly impacted by disruptive changes. This study is part of the European project Digital Competences for Improving Security and Defence Education - DIGICODE. Pursuing to the Digital Education Action Plan, the project aims at improving education quality in security and defence, by means of digital tools in didactics, and the development of teachers' professional competences.

KEYWORDS

Digital Education, Distance Learning, Future Skills, Online Education, Online Teaching, Security and Defence, Teacher Training.

1. INTRODUCTION

Security and defence play a prominent role in the 21st century: new challenges such as cybersecurity and drone defence have come out, requiring nations to cooperate to cope with them. In the past most military affairs pursued the scope of national interest and prosperity. Nowadays a global perspective is necessary: the operations against terrorism constitute a well-known example characterizing international military action from the beginning of the century. As for several forms of collaboration, it is important to start in advance, to guarantee plausible proficiency and long-term duration. Internationalization in Higher Education can be strengthened using traditional and virtual modalities, experiences and training programs dedicated to young officers (Marchisio and Spinello, 2021). Such international initiatives can be enhanced with digital education. In fact, the importance of e-learning has emerged with the COVID-19 pandemic requiring an extensive rethinking of teaching and learning. Shortly after its outbreak, actions were devised in emergence (Hodges et al., 2020), but then more structured modifications were planned (Galluzzi et al., 2021). Many authors considered the potential of e-learning, becoming a support regardless of the modalities of the courses, and

being a strategic tool for internationalization (Mihalova, 2006). It is possible to take full advantage of this potential only if all the stakeholders (teachers, students, technicians…) are properly competent under the digital point of view, especially in relation to education. A potentially critical issue is the overestimation of one's own and others' digital skills: the belief to be sufficiently skilled for most jobs that uses digital technologies. The belief in colleagues' digital skills can erroneously suggest that it is not particularly important to develop digital competences, since there is always someone that can compensate for others' gaps. Since both students (Buffardi and Taddeo, 2017) and educators (Tomczyk, 2021) show such tendencies, some effort could be devoted to train them about this misbelief that conditioned their perception of digital skills' importance. This applies to teachers, who in our case are university professors, module leaders in several study programs regarding the context of security and defence, for example Strategic Sciences. In 2020, the European Union published the DEAP, Digital Education Action Plan (European Education Area, 2020), which outlined the strategic value of educators' digital competences. This fostered, in 2021, the inception of Digital Competences for Improving Security and Defence Education - DIGICODE, a project within Erasmus+ Key Action 2 Strategic Partnership, aiming at the improvement of education in the security and defence context, thanks to the use of digital tools. It aims also at favoring teachers who develop the needed digital competences. The project involves several members of the European Union: Bulgaria, Italy, Poland, and Romania. Since the disciplines required to train people in security and defence cover several areas (STEM, languages, law studies…), the relative education is necessarily multidisciplinary, with teachers from divergent backgrounds taking part in courses and programs. Furthermore, in some Member States, like Italy, the agreements between armies and universities imply that some teachers are civilians while others are military, with part-time commission to academic work and teaching or research is only a part of their duty. Thus, they could take advantage from a specific kind of training.

In this paper the authors debate over these diverse topics, starting from the analysis of a questionnaire presented to university teachers involved in security and defence education, in which several aspects were rated. Many aspects, investigated before and during the pandemic, concern their approach with students, the time they took to carry out various tasks related to preparation and check, the use of PCs and electronic devices, and some open-ended questions. More than 500 instructors belonging to 15 countries responded. Data collection was part of the DIGICODE activities, thus involving specific countries, but also other teachers from countries not directly involved in the project who responded to the questionnaire. Most teachers work in security and defence, but some of them also teach elsewhere. The analysis resulted in students being exposed to more difficulties during the pandemic than before, and in more time needed to perform tasks. Both differences are significant from the statistical point of view. Therefore, a proper training could be proposed to avoid these differences and impact on teaching and learning. The paper is structured as follows: Section 2 presents the theoretical framework, while Section 3 is devoted to the research question and the methodology. Section 4 focuses on a short description of the DIGICODE project, and Section 5 reports all the results related to the discussion. Finally, some concluding remarks constitute Section 6.

2. THEORETICAL FRAMEWORK

The need for digital skills in the current world encourages their development. In (Van Laar et al., 2017), the authors examined the relation between 21st century skills and digital skills and they found that the list of skills is far more extensive than the list of digital skills. Moreover, they identified seven core skills: technical, information management, communication, collaboration, creativity, critical thinking, and problem solving. The development of problem solving is particularly important for officers, and there are many experiences on how to make military students develop this approach (Fissore et al., 2021). Digital skills fit into the broader concept of *future skills*, which are needed for societies to be sustainable and organizations to fit in changing environments (Ehlers, 2020, and references therein). Moreover, it is important to provide a proper balance between technical and practical aspects, since in this setting technology is a tool to pursue educational scopes (Goldin and Katz, 2009). According to 2017 data collected by the working group for the DEAP (European Education Area, 2020), while on one hand 90% of future jobs will require digital skills, on the other hand 44% of Europeans lack even the basic digital skills. Furthermore, there is still a strong gender gap, where only less than 20% of ICT professionals are women, and a digital divide, with more than 48000 schools lacking broadband connection. This brought the European Commission to the DEAP, to provide guidelines

for Europeans, educational institutions, and education systems to live and work better in the digitalized world of today. The DEAP proposes three main priorities: to make greater use of digital technology for teaching and learning, to develop relevant digital skills and competences for digital transformation, to improve education systems through preferable data analysis and forecast. In fact, the gap between the use of digital technology in everyday life and in education needs to be filled, with a wide mix of digital competences being the relevant factor. Moreover, a better cooperation in data collection, data analysis and exchange of best practices could help in the formation of a collective awareness relative to the importance of such approaches.

3. RESEARCH QUESTION AND THE METHODOLOGY

The authors' research aims at giving an answer to the question: *How did the teachers of different countries modify their perception of higher education under the disruptive changes caused by COVID-19 pandemic?* The authors tackled the investigation mainly quantitatively, with qualitative data supporting the analysis (mixed method approach). A more qualitative study, concerning strengths, weaknesses, opportunities and threats in the evolution of digital education, as well as the most effective teachers' practices and actions to enhance education, again in relation with the area of security and defence, has been performed in (Marchisio et al., 2022). In the present work, having targeted the population of instructors in security and defence, with a prevalence of scientific professors, the authors collected data from 513 teachers. Table 1 shows the sample population divided by age and gender.

Table 1. Distribution of the teachers by age and gender

Age range	Females	Males	Did not specify
Less than 35 years old	23	37	2
35-45 years old	63	90	1
46-55 years old	60	94	1
56-65 years old	31	79	2
More than 65 years old	6	23	1

Most respondents teach in the scientific area (50%), distributed among Pure Sciences, Information Technology, Engineering and Health, but several representatives of other disciplines, military and not, are present (e.g. Economics, Humanities, Languages, Law, Military Subjects, Social Sciences). Teachers' positions are almost equally distributed between full or associate professors (40%) and assistants that can be either actual professors, post-doctoral researchers, or PhD holders (40%). Instructors having only a master's or a bachelor's degree, along with some personnel with a non-academic role such as military or technical, constitute the remaining 20%. The median of experience in teaching is 15 years, with a substantial uniformity throughout time. In the questionnaire, teachers were invited to discuss how they relate with digital tools: if they are self-confident, which tools they use and own, how they rate their relationship with students, and how much time it takes them to perform specific tasks. The authors considered the reasonably expectable fact that the pandemic brought changes especially in rating and time spent, because digital tools before COVID-19 were used when teachers actually wanted to utilize them (only less than 10% of our sample did not use them at all), while during the pandemic their use often became an obligation. Comparisons were made by means of Likert scales, in which 1 stands for the lowest score and 5 for the highest one, and categorizations, where the reasonable range of time committed for a task was grouped in some intervals (e.g. "from 4 to 10 hours"), from which the respondent had to choose one. Open questions allowed the authors to deal with the qualitative part of the investigation. The use of hypothesis testing such as paired t-test and Wilcoxon signed-rank test (both normally approximate, given the large sample size), and the sign test, allowed the authors to inferentially confirm how differences brought out by descriptive means were statistically significant.

4. THE DIGICODE PROJECT

The project falls within the European strategic actions aimed at improving quality of education in security and defence through digital means, and it pursues the following objectives:

- the conduction of a survey, in order to collect detailed information in a group of students and lecturers from international universities, and to conduct a comparative analysis aimed at comparing processes, strategies, and methods used by the respondents, allowing to identify the best practices and competences ensuring safe and effective online teaching in security and defence;
- a handbook of best practices and solutions adopted by universities during COVID-19;
- the development of a teacher toolkit, including one for digital competences in security and defence, and open online training courses to support teachers and trainers in using specific digital learning environments for education, diverse kinds of digital tools, and in adopting innovative and adaptive methodologies like problem solving, problem-based teaching, learning by doing, formative and data-driven automatic assessment with interactive and immediate feedback, collaborative learning;
- the design and development of a curriculum for a summer school, which will help teachers have an integrated vision of the security and defence education system;
- the application of the teacher toolkit prepared especially for the digital education in order to explain the systems functionality, going beyond the classic laboratory activities;
- the improvement of digital competences and communication skills in online environment of a certain number of teachers and students from security and defence education institutions;
- the promotion of digital education among military academics, by building knowledge and resources in partner institutions.

The main activities of the project are: 4 transnational meetings, 5 intellectual outputs, 2 multiplier events, 2 staff training editions for improving the technical competences and communication skills for digital education, and 2 summer schools in digital education for learners. As a result of the activities implemented, it is expected to obtain solid results for all the participants and the organizations as part of the project, which are meant to be transferred into a better capacity for teachers to face the challenges of digitalization and of digital learning in the context of security and defence. The handbook of best practices, the methodology for the cybersecurity requirements, the teacher toolkit, the teacher digital workbook, and all the other outputs created within the project will support the context for the future organization of the staff training activities and summer schools for students. This would allow the improvement of digital competences and communication skills of teachers and students in online environments, applied to the security and defence.

5. RESULTS AND DISCUSSION

The authors compared pairs of questions consisting of a first question relative to the situation *before* the pandemic, and a second one where the situation *during* the pandemic is considered. As said in the Methodology, Likert scales were used for Pairs 1-4, categorical levels for Pairs 5-7.

Pair 1: how do you rate the engagement of students (in classroom before, in remote classes during)?

Table 2. Rating of students' engagement

Engagement	Before	During	Difference
Very low (1)	2	19	+17
Low (2)	17	99	+82
Average (3)	121	186	+65
Good (4)	281	176	-105
Very good (5)	92	33	-59

Table 2 shows that teachers seem to perceive engagement as reduced with respect to the pre-pandemic setting: indeed, they responded by giving lower scores, averaging a score of 3.20 (standard deviation: 0.95) to the question relative to remote classes, while concerning classrooms the average was 3.87 (standard deviation: 0.75). This is confirmed by the pairing of data and analysing differences: they are significantly below zero, averaging -0.66 (standard deviation: 1.04), and having 262 of them negative, while only 49 of them are positive (202 are null). Classical tests from the inferential statistics give further confirmatory insights on the significance of declines: the z-scores of a paired Wilcoxon signed-rank test and a paired t-test are respectively 11.65 and 14.38. Note that values higher than 3 are usually sufficient to refuse the null hypothesis of insignificance. As evidence, the teachers find it difficult to adopt proper didactic strategies with technologies, being one of the aims to keep the same engagement both in classroom and remotely.

Pair 2: how do you rate communication between teacher and students?

Table 3. Rating of communication with students

Communication	Before	During	Difference
Very low (1)	0	15	+15
Low (2)	3	52	+49
Average (3)	57	153	+96
Good (4)	282	235	-47
Very good (5)	171	58	-113

Table 3 shows the results. Responses resulted again in lower scores, averaging a score of 3.52 (standard deviation: 0.92) for the question relative to the communication during the pandemic, while concerning the communication before the pandemic the average was 4.21 (standard deviation: 0.65). Paired differences have average -0.69 and standard deviation 1.08, being 256 negative, 210 null, and 47 positive. Z-scores are 11.85 for Wilcoxon, and 14.37 for the t-test, thus the decline is significant. This highlights a (perceived) limitation of the communication channels when education is involved: if on the one hand our society allows us to communicate in real-time regardless of physical distances, on the other hand it seems that teachers have difficulties in feeling equally at ease if they are forced to confer with students at a distance.

Pair 3: how do you rate the degree of efficiency for the development of students' competences?

Table 4. Rating of development of students' competences

Competences	Before	During	Difference
Very low (1)	1	17	+16
Low (2)	2	51	+49
Average (3)	90	190	+100
Good (4)	303	208	-95
Very good (5)	117	47	-70

Table 4 shows the results. Responses resulted one more time in lower scores, averaging a score of 3.42 (standard deviation: 0.91) for the question relative to the development during the pandemic, while concerning the development before the pandemic the average was 4.04 (standard deviation: 0.66). Paired differences have average -0.62 and standard deviation 0.93, being 249 negative, 231 null, and 33 positive. Z-scores are 12.02 for Wilcoxon, and 14.96 for the t-test, thus the decline is significant. As a matter of fact, teachers recognized that the difficulties caused by the forced changes, which forced them to look for new methodologies, made it more difficult to have the students develop their competences.

Pair 4: how do you rate the degree of implementation of the learning outcomes?

Table 5. Rating of implementation of learning outcomes

Outcomes	Before	During	Difference
Very low (1)	2	12	+10
Low (2)	3	57	+54
Average (3)	103	192	+89
Good (4)	308	215	-93
Very good (5)	97	37	-60

Table 5 shows lower scores, averaging a score of 3.41 (standard deviation: 0.87) for the question relative to the outcomes during the pandemic, while concerning the outcomes before the pandemic the average was 3.96 (standard deviation: 0.67). Paired differences have average -0.56 and standard deviation 0.89, being 251 negative, 221 null, and 41 positive. Z-scores are 11.45 for Wilcoxon, and 14.29 for the t-test, thus the decline is significant. This means a greater difficulty in achieving the learning outcomes, which are usually determined before the beginning of the course, after didactics underwent the well-known changes.

Pair 5: how many hours per day do you spend at the PC for teaching/preparing teaching purposes?

Table 6. Daily time spent in front of a PC

Daily time	Before	During	Difference
Less than 1 hour (1)	93	17	-76
About 2 hours (2)	130	83	-47
About 3 hours (3)	108	75	-33
About 4 hours (4)	63	87	+24
About 5 hours (5)	37	71	+34
6 hours or more (6)	38	136	+98

Table 6 shows the results. Responses, with a slightly reduced sample (469 teachers instead of 513, since a few of them said that "it was hard to say"), resulted here in higher scores, averaging a final score of 4.11 (standard deviation: 1.58), compared to an initial score of 2.86 (standard deviation: 1.49). Paired differences have average 1.25 and standard deviation 1.54, being 289 positive, 140 null, and 40 negative. Z-scores are 13.54 for Wilcoxon, and 17.58 for the t-test, thus the increase is significant. From a numerical perspective, the situation is reversed here, with increases instead of decreases. Most teachers needed more time in front of the computer during the pandemic than before, while some of them required the same amount as before, and only a few managed to perform their tasks with less time spent at the PC. The statistical significance of such increases is even stronger than for the previous pairs, and the considerably high standard deviation strengthens the opportunity to balance individual differences.

Pair 6: how much time do you spend per week preparing for classes?

Table 7. Weekly time spent preparing for classes

Weekly time - prepare	Before	During	Difference
Less than 1 hour (1)	12	7	-5
From 1 to 4 hours (2)	237	161	-76
From 4 to 10 hours (3)	181	194	+13
From 10 to 20 hours (4)	68	103	+35
More than 20 hours (5)	15	48	+33

Table 7 shows higher scores, averaging a final score of 3.05 (standard deviation: 0.97), compared to an initial score of 2.68 (standard deviation: 0.84). Paired differences have average 0.36 and standard deviation 0.83, being 186 positive, 280 null, and 47 negative. Z-scores are 8.64 for Wilcoxon, and 9.89 for the t-test, thus the increase is significant.

Pair 7: how much time per week do you spend checking students' work (reports, drafts, tests, etc.)?

Table 8. Weekly time spent checking students' work

Weekly time - prepare	Before	During	Difference
Less than 1 hour (1)	102	67	-35
From 1 to 4 hours (2)	278	240	-38
From 4 to 10 hours (3)	112	140	+28
From 10 to 20 hours (4)	16	55	+39
More than 20 hours (5)	5	11	+6

Responses resulted again in higher scores, averaging a final score of 2.42 (standard deviation: 0.92), compared to an initial score of 2.11 (standard deviation: 0.79). Paired differences have average 0.31 and standard deviation 0.76, being 172 positive, 293 null, and 48 negative. Z-scores are 7.93 for Wilcoxon, and 9.27 for the t-test, thus the increase is significant. Only a few teachers were able to complete their commitments more rapidly during the pandemic than before, while a relevant higher number needed more time. Most of them required substantially the same amount of time, although the subdivision of the scale (for which for example 2 hours and 3 hours, or 6 hours and 9 hours, or also 12 hours and 18 hours, referred to the same answer) could have had some impact on this. Figure 1 shows seven trends graphically: every pair of bars correspond to the averages of the scores relative to *Before* (lighter) and *During* (darker), with the standard deviations represented with the lines over them (centered on the average and 1.4 times the mean quadratic deviation wide). Figure 2 depicts the paired trends, that are the same indices, but relative to differences: their standard deviations represent how the teachers perceived the extent of the changes differently from each other.

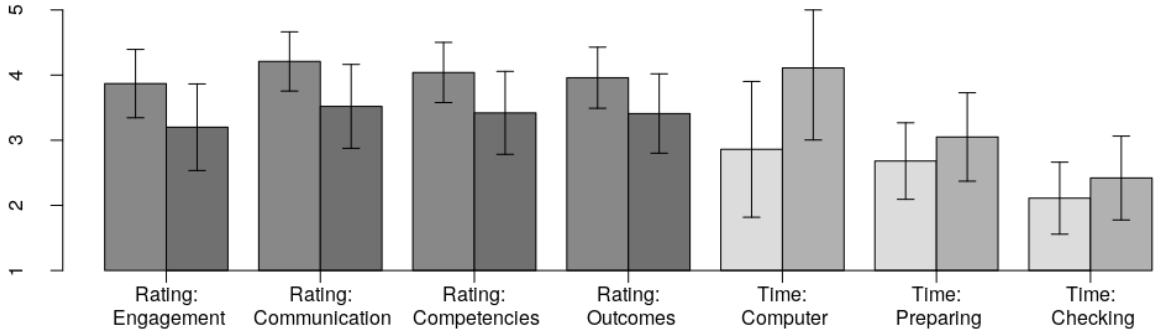

Figure 1. Comparison of ratings (Tables 1-4) and time spent (Tables 5-7) before and during the pandemic

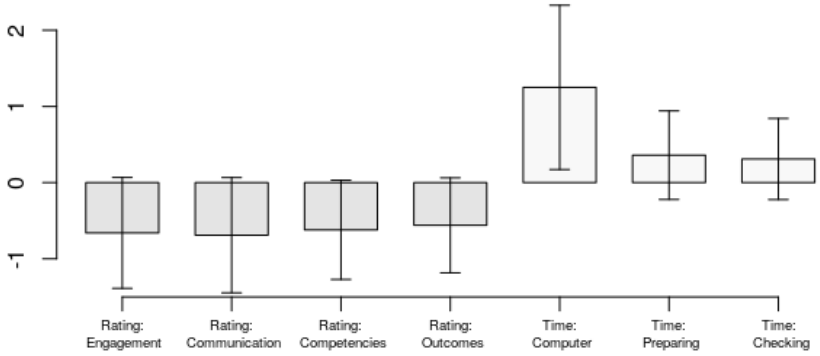

Figure 2. Comparison of ratings and time spent, in terms of differences

By relating these results with the theoretical framework and the research question, the significant decrease in the averages seen in Pairs 1-4, concerning how teachers and students do relate, can depend on various factors. A specific training in digital education can be an appropriate measure to reduce these drops. In fact, training would reasonably bring to a reduced number of teachers having difficulties in perceive comfort, which is one of the causes worsening relations with students. To strengthen this suggestion, we detected a positive difference between the standard deviation within the four pairs of questions, meaning that teachers have different reactions when asked to deal with the changes COVID-19 required. The importance of a training stands also in allowing teachers to put aside a consistent part of their personal differences, and to constitute a common basis of educational practices. Analogously, the significant increase in the averages seen in Pairs 5-7, relative to the time needed to commit various tasks, came with generally positive difference of standard deviations, addressing again differences in the teachers' reactions. Besides, most teachers would take advantage from technical support, and more in general support in things beyond didactics: less time consumption for non-didactic tasks would result in not having to reduce significantly the time dedicated to performing teaching tasks, or teachers' spare time, not affecting the quality of both teaching and life.

Qualitatively, teachers were asked some questions, such as any issues they experienced (and, if any, which ones) while integrating the practical and theoretical aspects of teaching, their sharable good practices implemented during the pandemic, and the direction in which they thought remote education should be developed. Generally, the responses infer that it is not the technology in itself to be critical, but the approach adopted by teachers and institutions. Indeed, the determinant factor is recognized to be the way technology is used by people. It is necessary to reconsider the relationship between technology and education in a wide sense. In fact, teachers perceived technology, in the simple sense of toolsets, as suitable. They were able to distinguish between the organizational difficulties and the technical issues, with a strong prominence of the former ones. This fits with one of the theoretical features depicted in Section 2, namely the balance between technical and practical aspects: it would be not so useful to concentrate only on technology itself, if our purposes are educational and the limitations detected stand for their majority outside the technical facets. Furthermore, respondents acknowledge that a proper training, considering both techniques and applications, could help in dealing with methodological and temporal issues. Specifically, on the one side limits in methodology were recognized as being an effect of lacking proper skills rather than intrinsic, thus being

possible to deal with them, while on the other side time can be seen as an investment, since the training would allow to reduce (or even nullify) the impact of problems requiring a time-consuming handling. With an appropriate consideration of the relational and the methodological components, the training can be developed for aiming at the didactical scope of our study: to provide education effectively as possible.

6. CONCLUSION

This research allowed the authors to obtain an answer to the question regarding how, in different countries, COVID-19 pandemic forced to implement changes in higher education, and the teachers' perception of the new scenario. Various facets of teaching and learning have been affected by these pandemic-related modifications, with a particular focus on how teachers had to relate with students and work harder to complete specific tasks. It emerged that it has been almost impossible to keep the same rate of interaction with students, and to conduct the tasks without needing additional time. It is likely that the disparities in digital skills teachers possessed played a significant role in these results: those lacking experience in handling tools devoted to teaching and learning were reasonably the ones to face the most prominent effects. A proposal to tackle this issue consists in training teachers on digital competences, to make post-pandemic experiences comparable to the pre-pandemic ones. While this action can be broadly proposed, it is even more noteworthy if it concerns sectors in which the cooperation at an international level is pivotal, and this is the case of security and defence education, where the importance of digital skills is particularly marked. Once this training is proposed, it will be possible to enhance this research to detect teachers' improvements.

REFERENCES

Buffardi, A. and Taddeo, G., 2017. The Web 2.0 Skills of Italian Students: An Empirical Study in Southern Italy. *Italian Journal of Sociology of Education*, Vol. 9, No. 1, pp. 45-76.

Ehlers, U.D., 2020. *Future Skills – Future Learning, Future Higher Education.* Springer, Karlsruhe, Germany,

European Education Area, 2020. Digital Education Action Plan. https://education.ec.europa.eu/document/digital-education-action-plan

Fissore C., et al., 2021. Development of Problem Solving Skills with Maple in Higher Education. In: Corless R.M., Gerhard J., Kotsireas I.S. (eds) Maple in Mathematics Education and Research. MC 2020. Communications in Computer and Information Science, vol 1414. Springer, Cham.

Galluzzi, F. et al., 2021. Mathematics in higher education: a transition from blended to online learning in pandemic times. *Proceedings of IEEE 45th COMPSAC Conference*, pp. 84-92.

Goldin, C.D. and Katz, L.F., 2009. *The Race between Education and Technology*. Harvard University Press, Cambridge, UK.

Hodges, C. et al., 2020. The Difference Between Emergency Remote Teaching and Online Learning. https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning

Marchisio, M. and Spinello, E., 2021. Internationalization for enhancing the European Security and Defence Higher Education. *15th International Conference on e-Learning (EL2021) – Held at the 15th Multi-Conference on Computer Science and Information Systems (MCCSIS2021)*, pp. 99-106.

Marchisio, M. et al, 2022. Advantages and disadvantages of digital remote education in the security and defence contexts. *18th International Scientific Conference eLearning and Software for Education (eLSE2022)*, in press.

Mihalova, G., 2006. E-learning as internationalization strategy in higher education. *Baltic Journal of Management*, Vol.1, No. 3, pp. 270-284.

Tomczyk, L, 2021. Declared and Real Level of Digital Skills of Future Teaching Staff. *Education Sciences*, Vol. 11, paper 619.

Van Laar, E., et al, 2017. The relation between 21st-century skills and digital skills: A systematic literature review, Computers in Human Behavior, Vol. 72, pp. 577-588.