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DIGITAL TRANSFORMATION IN HIGHER EDUCATION: PERCEPTIONS AND CHALLENGES OF EU SECURITY AND DEFENCE STUDENTS

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ABSTRACT

The utilization of digital tools in teaching and learning has experienced a remarkable surge in recent years. Even prior to the year 2020, their integration was steadily on the rise, but the outbreak of the COVID-19 pandemic in the early years of this decade significantly accelerated their widespread adoption. Importantly, this shift has endured beyond the pandemic's acute phase, signaling that certain changes have a lasting impact. The incorporation of digital tools into the educational landscape presents advantages and challenges. Moving from the conventional use of computers and similar devices for everyday tasks to their seamless integration into educational contexts is a process fraught with complexities. The scope of this research is understanding how students perceive higher education amidst the ongoing transition catalyzed by the pandemic. A comprehensive survey was administered to both military and civilian students enrolled in Security and Defence studies, with a specific focus on their experiences and perspectives as they navigate profound alterations in their educational routines. The analysis of the questionnaire highlights challenges faced by students in various dimensions. Among these hurdles, establishing meaningful connections with instructors and replicating a level of engagement comparable to face-to-face lectures emerged as significant challenges. Notably, there was a discernible uptick in students' self-assessment of their digital competencies. This research is a constituent part of the overarching initiatives undertaken within the European project DIGICODE. This project aims at enhancing the quality of education in Security and Defence by not only advocating for the judicious utilization of digital tools but also fostering the robust development of digital competencies among both students and educators.

KEYWORDS

Digital Education, Distance Learning, Online Education, Security and Defence, Student Training

1. INTRODUCTION

Security and Defence education requires appropriate tools that facilitate learning in different ways, such as blended learning (Marchisio et al., 2022c), hybrid learning (Marchisio et al., 2022d) and other modalities that allow for strategic internationalisation of educational environments without mandating purely online courses (Mihalova, 2006). To promote effective and long-term cooperation, it is beneficial for military officers and civilians involved in Security and Defence to cooperate early in their educational careers, such as during their student or training years (Marchisio & Spinello, 2021), including through digital media: indeed, the widespread adoption of e-learning worldwide took a significant leap forward during the COVID-19 pandemic (Hodges et al., 2020). Providing targeted training to teachers, students, and stakeholders is crucial to enhance their comprehension of digital tool utilization in education (Marchisio et al, 2022a). The DIGICODE project, which is an Erasmus+ Key Action 2 Strategic Partnership initiative of the European Union, is tackling these challenges on a continental scale. It spans across several countries, including Bulgaria, Italy, Poland, and Romania. The project, DIGItal COmpetencies for Improving Security and Defence Education, aims to promote effective use of digital tools in military teaching. This paper examines students' digital competencies pre and post COVID-19 pandemic. To accomplish our goal, we administered a survey to students evaluating engagement, communication, digital competency development, and learning outcome achievement. Additionally, we compared the time management of students when using computers and electronic devices. Lastly, we utilized open-ended questions to gain additional insights. The study focuses on European students enrolled in Security and Defence programs, which involve interdisciplinary courses with a significant focus on international cooperation. We have already conducted and analyzed a comparable study among teachers (Marchisio et al., 2022a), which allows for comparisons to be made between student and faculty perspectives. The paper, which is an extension of (Marchisio et al., 2023), is structured as follows: Section 2 establishes the theoretical framework, whereas Section 3 outlines the research question and methodology. Section 4 details the findings, and Section 5 presents a thorough analysis. Lastly, conclusive remarks are provided in Section 6.

2. THEORETICAL FRAMEWORK

Numerous recent studies have explored the importance of acquiring digital competencies in the context of Security and Defence. It is clear that digital tools are the building blocks of e-learning, thus demanding that all stakeholders, especially those involved in education, possess digital competencies. The attitudes, motivation, self-efficacy, and utilization of technology play a significant role in the cognitive engagement and academic performance of students as per Patricia Aguilera-Hermida (2020). However, an important concern arises when individuals overestimate their abilities, causing them to assume that existing knowledge is adequate and that they can depend on those with superior tool proficiency for help. This misunderstanding is widespread among students (Buffardi & Taddeo, 2017) as well as educators (Tomczyk, 2021),

which ultimately minimizes the significance of obtaining proper digital skills. Pinchuk and Prokopenko (2021) analyzed the experiences of several countries, including the United States, Australia, China, Britain, Israel, Korea, and Singapore, concerning modern educational approaches to STEM subjects. They recognized the possibility of transdisciplinary integration in advanced training for the Armed Forces of Ukraine, their homeland, and the necessity for efficient control of project planning and organization tools. Barron and Rowles (2021) highlighted the importance of digital literacy in the Air Force and other military branches. Using technology for educational purposes necessitates technical tools that act as means rather than ends (Goldin & Katz, 2009), and involves a range of skills (Van Laar et al., 2017). Despite the alignment between digital competencies and future skills (Ehlers, 2020, and references therein), roughly half of Europeans lack fundamental digital skills. Furthermore, 2017 data from the European Education Area indicate that this situation is worsened by a gender gap and digital divide. The European Union's release of the Digital Education Action Plan (DEAP) in 2020 highlights the critical significance of digital competencies in education, motivating the inception of the DIGICODE initiative. In general, these competencies are essential in overcoming the obstacles of sustainable education (Mentsiev et al., 2022) and are in line with the Sustainable Development Goals of the United Nations (United Nations, 2015).

3. RESEARCH QUESTION AND METHODOLOGY

Fixing the context of higher education in Security and Defence during a transitional scenario caused by the COVID-19 pandemic, our study aimed to address the following research questions: (RQ1) What are the perceptions of military and civilian students, and (RQ2) What are their views on digital competencies? We analyzed a survey that examined quantitative and qualitative aspects to assess these factors. The paper's research examines six pairs of questions, a subset of the questionnaire. The quantitative aspects facilitate a comparison of situations before and during the COVID-19 pandemic. Pairs 1-4 are measured by Likert scales, while Pairs 5-6 are assessed through categorical levels. The ratings utilize a five-level Likert scale, with one denoting the lowest score and five representing the highest. Regarding time spent, we categorized it based on the actual daily number of hours in one case, while in the other case, we utilized reasonable ranges of weekly hours (for example, "4 to 10 hours"). We conducted descriptive and inferential analyses on the resulting numerical data, including the paired Wilcoxon signed-rank test and paired t-test, to effectively demonstrate any differences and establish their statistical significance. Similar questions provided to students and educators enabled us to compare their perceptions, highlighting similarities and differences in how both groups experienced the remote learning scenario. The qualitative data provided perspectives on the challenges and concerns that students perceived as resulting from remote education during and after the COVID-19 pandemic, as well as effective practices to address them. The dataset comprises information gathered from 1047 European students studying Security and Defence, who were categorized based on their age and gender as follows:

Table 1. Distribution of the students by age and gender

Age range	Females	Males	Did not specify
18-22 years old	138	315	4
23-25 years old	129	352	7
Over 25 years old	30	68	4

Around 79% of the participants are students in the military, while the remaining 21% are civilians. They are almost evenly split between undergraduate and graduate students, with slightly more of the former. The survey was given to students who have undergone Security and Defence education during the transitional phase, starting from their final year of undergraduate studies (nearly 95% of the sample). We also evaluated other responses, but their representation within the sample was limited. Additionally, some of the students had prior experience with Security and Defence education from attending military secondary schools before university. Due to the COVID-19 pandemic, the use of digital tools has become mandatory, which may have led to significant changes in rating and time usage. Thus, it is reasonable to expect that these indicators have been affected.

4. RESULTS

In the subsequent tables, the term "before" refers to the period "before the pandemic, in a face-to-face context," while "during" refers to the period "during the pandemic, in an emergency or online context."

Pair 1: how do you perceive your personal engagement?

Table 2. Rating of students' personal engagement

Engagement	Before	During	Difference
Very low (1)	11	19	+8
Low (2)	27	113	+86
Average (3)	210	302	+92
Good (4)	493	451	-42
Very good (5)	306	162	-144

Table 2 shows a decline in students' engagement perception amid the pandemic. Of the total scores, 436 decreased, 162 increased, and 449 remained unchanged. This drop is also reflected in the average score, which decreased from 4.01 (SD: 0.83) to 3.60 (SD: 0.94). The analysis of paired data indicates a mean difference of -0.41 (SD: 1.12). The Wilcoxon signed-rank test and the paired t-test, both approximated normally, demonstrate the significant deterioration with respective z-scores of 11.01 and 11.97. Any value higher than 3 is generally deemed significant, which this case surpasses. The practical implication is that students encountered difficulties in retaining the same level of engagement while participating remotely compared to the participation achieved in the classroom.

Pair 2: how do you rate the/your communication with teachers?

Table 3. Rating of communication with teachers

Communication	Before	During	Difference
Very low (1)	6	22	+16
Low (2)	28	89	+61
Average (3)	214	317	+103
Good (4)	530	440	-90
Very good (5)	269	179	-90

Table 3 shows a decline in communication quality between students and teachers. Of all scores, 374 decreased, 153 increased, and 520 remained unchanged. This is evident in the average score, which decreased from 3.98 (SD: 0.79) to 3.64 (SD: 0.93), with a mean difference of -0.35 (SD: 1.06). The Wilcoxon signed-rank test and the t-test both yield z-scores of 9.57 and 10.55, respectively, thereby indicating statistical significance. This implies that remote communication between students and teachers posed challenges for students, who did not feel equally comfortable as they did with face-to-face interactions, despite the overall tendency of young people to use virtual means of communication.

Pair 3: how do you rate your own development of digital competencies?

Table 4. Rating of development of digital competencies

Digital competencies	Before	During	Difference
Very low (1)	7	7	0
Low (2)	35	16	-19
Average (3)	258	180	-78
Good (4)	507	543	+36
Very good (5)	240	301	+61

Table 4 shows a rise in scores (differently from Tables 1 and 2), with 279 scores increasing, 124 decreasing, and 644 remaining unchanged. The average score increased from 3.90 (SD: 0.81) to 4.06 (SD: 0.76), with a mean difference of 0.17 (SD: 0.78). The z-scores for the Wilcoxon signed-rank test and t-test are 6.55 and 7.02, respectively, indicating statistical significance. Nevertheless, the significance is lower compared to Pairs 1 and 2. This indicates that due to the situation, some students acquired digital skills, but not uniformly. In reality, over two thirds of students did not enhance these skills as mentioned.

Pair 4: how do you rate your achievement of the learning outcomes?

Table 5. Rating of achievement of the learning outcomes

Learning outcomes	Before	During	Difference
Very low (1)	6	13	+7
Low (2)	21	38	+17
Average (3)	255	302	+47
Good (4)	575	505	-70
Very good (5)	190	189	-1

Table 5 offers a more equilibrated depiction. Of the overall scores, 188 rose, 252 fell, and 607 remained the same. The mean score shifted from 3.88 (SD: 0.74) to 3.78 (SD: 0.82), leading to a change of 0.10 (with a mean difference SD of 0.89). The changes seem less significant than in previous cases, as evidenced by the z-scores of 3.37 for the Wilcoxon signed-rank test and 3.51 for the t-test. Although significant statistically, the findings obtained a higher p-value, suggesting that some learners may have been content with their accomplishments during the transitional phase. The lack of clarity in the situation may have resulted in greater challenges, ultimately shaping their perception of relative success.

Pair 5: how many hours per day do you spend on the PC for learning purposes?

Table 6. Daily time spent on a PC

Daily time in front of PC	Before	During	Difference
Less than 1 hour (1)	211	52	-159
About 2 hours (2)	361	125	-236
About 3 hours (3)	185	113	-72
About 4 hours (4)	99	126	+27
About 5 hours (5)	39	122	+83
6 hours or more (6)	57	414	+357

In this case, a sample of 952 students was used after excluding 95 participants who stated, "It's hard to say" in regards to the pre-pandemic period. Significant changes were observed during the analysis, with the amount of time increasing 667 times, decreasing only 83 times, and remaining the same in 297 instances. The average amount of time spent on a computer by students showed a considerable increase, rising from an average of 2.54 hours (SD: 1.37) to 4.45 hours (SD: 1.67), indicating a significant jump of 1.91 hours (with a SD of 1.96 for the mean difference).

The z-scores provide robust confirmation, with the highest scores among all pairs considered being 21.10 for the Wilcoxon signed-rank test and 30.04 for the t-test. These results infer that many students required more time on their computer, with substantial differences observed for a large number of students. However, a small fraction of students did not require extra time and some even required less time. These students likely had sufficient PC experience prior to the shift, indicated by responses to the following set of queries. It is worth noting that these students had a decent level of prior PC usage, as demonstrated by the consistency in reported hours.

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

Table 7. Weekly time spent studying for classes

Learning outcomes	Before	During	Difference
Less than 1 hour (1)	62	85	+23
From 1 to 4 hours (2)	358	303	-55
From 4 to 10 hours (3)	392	353	-39
From 10 to 20 hours (4)	162	188	+26
More than 20 hours (5)	73	118	+45

The final pair of questions demonstrates a more balanced situation again, with the category increasing 295 times, decreasing 218 times, and remaining unchanged 534 times. Additionally, the average score rose from 2.83 (standard deviation: 0.99) to 2.95 (standard deviation: 1.12), showing a mean difference of 0.12 (standard deviation: 1.06). These changes, like those in Pair 4, hold less significance, as demonstrated by the z-scores of 3.59 for the Wilcoxon signed-rank test and 3.63 for the t-test. Therefore, it can be inferred that students are less inclined to increase their study time significantly, and it is possible that some of them had already dedicated enough time to studying before the COVID-19 pandemic. Although the subdivision of the scale may impact these considerations, the close proximity of the numbers in relation to the increments and decrements suggests the lack of a definite trend. Figure 1 shows the six 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 the mean quadratic deviation wide).

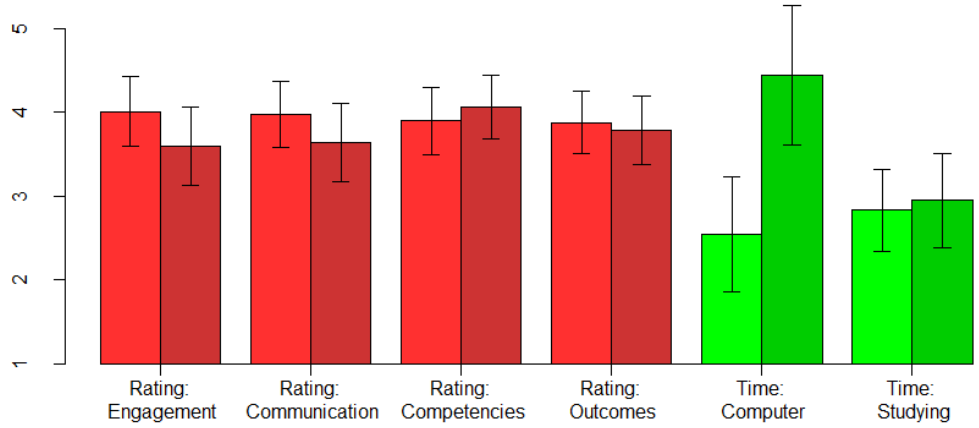

Figure 1. Comparison of ratings (Tables 1-4) and time spent (Tables 5-6) before and during the pandemic

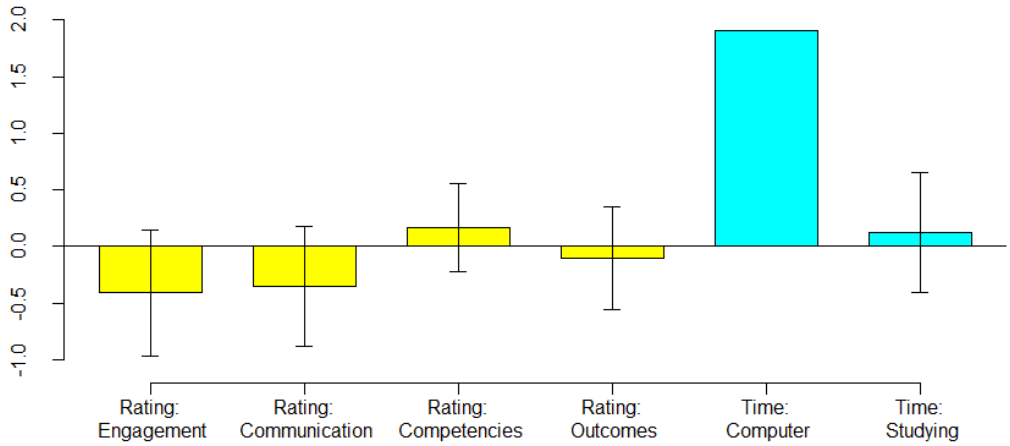

Figure 2. Comparison of ratings and time spent, in terms of differences

Figure 2 depicts the paired trends, that are the same indices, but relative to differences: their standard deviations represent how the students perceived the extent of the changes differently from each other.

Table 8. Pairs of questions versus differences before/during (percentages)

Pairs	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
1		0.4	3.3	11.7	26.2	42.9	12.2	2.3	0.7	0.3	
2		0.9	2.5	9.8	22.5	49.7	11.3	2.9	0.5	0.0	
3		0.2	0.2	1.7	9.7	61.5	22.3	3.9	0.3	0.1	
4		0.2	1.0	5.4	17.5	58.0	14.5	2.8	0.6	0.1	
5	0.0	0.3	0.8	2.6	4.9	21.2	13.4	14.3	15.3	18.1	8.9
6		0.5	0.9	3.7	15.8	51.0	19.4	6.5	1.9	0.4	

Table 8 presents a summary of the changes in students' responses to all question pairs. Asymmetrically negative differences are observed in Pair 1 and 2, while asymmetrically positive differences are observed in Pair 3 and 5, with the most significant disparity being in Pair 5. Pair 4 and 6 exhibit a more balanced distribution. Figure 3 shows it graphically.

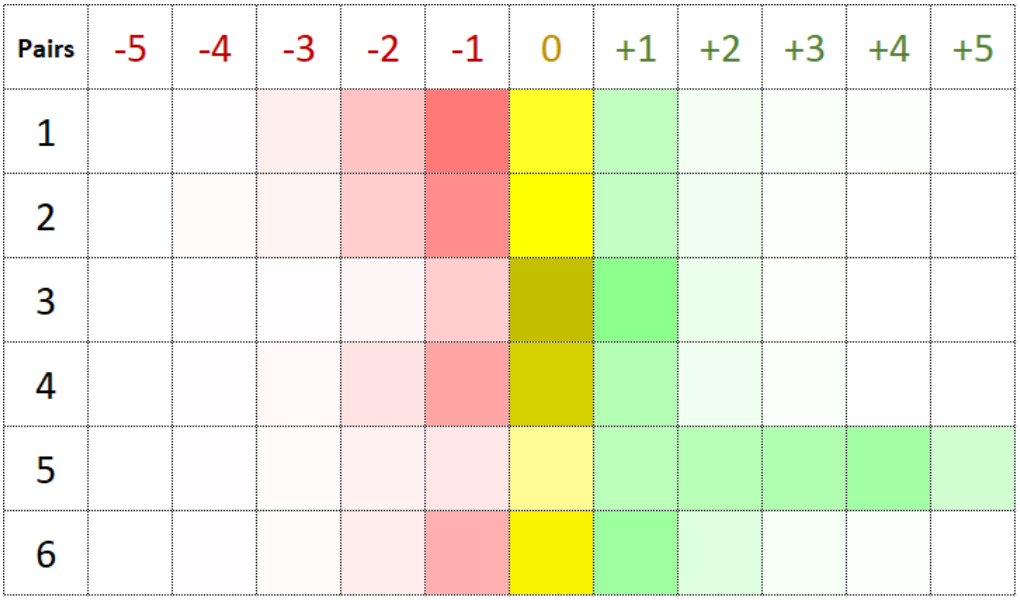

Figure 3. Pairs of questions versus differences before/during (graphics)

Let us now present some qualitative aspects. Students were surveyed regarding their pandemic-related difficulties with activities such as laboratories and projects. Merely 20% of respondents reported experiencing any issues, yet noteworthy responses were obtained:

- "Many times the assessment was not as fair as possible, because it was more difficult to develop connections between the teacher and the student, making it difficult to evaluate in the best way the quality of the knowledge depending on the progress of the student during the semester."
- "I failed an exam because the professor did not hear my correct answer due to audio buffering. Projects were difficult to manage, since there was no face-to-face interaction between students."
- "Very little time to take the test, in face-to-face classes a test would have never been administered under the same conditions; sometimes I also experienced lack of understanding for problems."

From these answers, it is evident that technology can occasionally cause errors, such as buffering. However, the methodological approach is more often the cause of imperfections, necessitating adaptations to assessments under altered circumstances. In a separate inquiry, students were asked to share their effective learning practices during and after the pandemic. Again, only a minority (less than 20%) reported possessing such strategies, but some notable responses were collected.

- "Discipline had a more important role during the pandemic. Before students lived closer one to the other and could hear news from their school easily. During the pandemic, it was necessary to check your e-mail periodically and to evaluate our level of knowledge before an exam ourselves."
- "Organizing the acquired materials from classes on an ongoing basis, controlling and verifying emerging activities in teams so as not to get lost in the course of teaching, subject scope, material..."
- "Reading a lot of scientific papers and books and learning by myself from extra topics than the ones the teachers were presenting."

The overall consensus is that a greater level of autonomy, above what was previously mandated pre-pandemic, may aid in learning within the new circumstances. We also inquired about participants' perceptions of how educators handled the challenges posed by the pandemic in a subsequent question. The response rate was significantly greater, and the following are some examples of the feedback provided:

- "The greatest challenge for many of the teachers was the short attention span that the students had. Some teachers were able to overcome the issue by applying a more severe stance and other by managing to grab the spotlight through sheer charisma. However, from my personal point of view a rewarding environment always yields a better result rather than a punishable one. [...]"
- "Most of them did their best. However, the pandemic showed the teachers' need to familiarize themselves more with the digitization era of learning. Also, some of them rested on their laurels and provided lower effort in terms of teaching."
- "Most of them dealt with it very well, but I would strongly recommend adding students to planning processes and helping with problems, for example by creating configurations and unification for Microsoft Teams channels".

It can be seen that students were generally satisfied by how teachers dealt with those challenges, but not without annotating something interesting. On the one hand, they reported differences in teachers' reactions, with someone taking an easier path at the cost of some results, and other ones taking a harder path being more remunerative in the long run. On the other hand, they noted the importance to have prepared teachers in the use of digital for learning (Marchisio et al., 2022a), and also how students and teachers can collaborate in order to tame some difficulties, even if they sit on the opposite sides of the desk. We asked students also what they thought has changed for the better after switching to remote learning, and what for the worse. Regarding the positive changes, they interestingly answered:

- "Remote learning has provided more flexibility for both students and teachers, allowing them to adapt to their own schedules and learning styles. Students can learn at their own pace, and teachers can adjust their teaching methods and materials accordingly."
- "The possibility to use time more efficiently and in a more comfortable environment than everyday class courses, that led to fatigue at some point where you cannot focus anymore at the task."
- "Teachers realized that many commitments could be done via email or a web conference system. Punctuality was easier to verify for all the stakeholders. Nowadays they pay more attention to the time."

Conversely, concerning the negative changes they gave among others the following answers:

- "The pressure put on the student is one thing that got worse. Some teachers thought that by having these remote classes, the student would be able to do more things than what

was before the pandemic. We had days with more than 10 hours spent in front of the laptop for lectures. Also, the work we were supposed to deliver increased compared to the previous generations."

- "Remote learning can lead to feelings of isolation and loneliness, as students may miss the social interactions and community-building opportunities that come with in-person learning."
- "I perceived some sort of *routine* during the remote lessons, in the sense that practically every lesson nearly resembled each other".

We note that some features are two-sided, having both advantages and disadvantages: for instance, it emerged how time can be managed better in a remote setting, but only provided that proper attention is paid, otherwise the risk is not to be aware of its availability, as teachers unable to calibrate the work students need to perform show. In another example, adaptiveness is a possibility, but at least in some contexts also a strong recommendation, since it is important not to "flatten" the remote lesson to a boring and unengaging standard. Another question, regarding students' perception of the biggest threats that could result from remote education, was asked. Here are some noteworthy answers:

- "From an educational point of view, I believe that my institution has adapted and countered the threats of exam fraud. I believe that the biggest threat is not the online or hybrid learning system, but the isolation of the individual from the collective (individual and not collective work). The military system is based on teamwork, and the exclusive use of online courses can damage the student's integration in the future workplace. I believe that the hybrid system my institution adopted is ideal."
- "At a military level, we need to stay in contact with people and with the military context. In my opinion there are no threats for university studies, so we should study remotely but we should also have some hours where we can do (in presence) only military things."
- "We may risk shifting the focus from deeply understanding the subject to being able to answer quizzes and online questions."

We acknowledge that remote learning cannot be solely held responsible for creating threats. Rather, issues arise from a significant decrease in social interaction, which is particularly critical in the Security and Defence domain where teamwork is essential. Moreover, we recognize that solutions such as hybrid and blended learning, which allow for a combination of in-person and remote learning, can mitigate this problem. From the last observation, it appears that students may be inclined towards engaging in test-specific training that is tailored to the test's format, rather than focusing on truly studying the subject matter. Finally, we asked a question concerning in what direction did students thought remote education should be developed. Some relevant answers were:

- "The possibility of remote classes should be introduced permanently, especially during lectures, so that if they are conducted in a hybrid way, the decision on remote or direct participation should be made by the student. This is a facilitation for the student, since sometimes it is easier to focus on classes by being at a distance. The adaptation of students and staff to remote learning during the pandemic gives such an opportunity."
- "More towards online streaming lessons or even prerecorded ones, so that students can self-manage their time. Indeed, in the case of military students, they have not only studying as their commitment, being present also tactical and physical training. Following morning classes like university students may not always be fit for military students, since everyone is different, and everyone has their own pace."

- "To ensure that all students have access to remote education, it is important to invest in improved technology infrastructure, including high-speed internet, hardware, and software."

It emerges that students would like to see some chances as permanent, since those such as hybrid learning will provide an improvement to the didactical offer, also after the critical phase of the pandemic has ended. Moreover, in the Security and Defence context most students are military as we saw throughout the paper, with their commitments apart from studying that occupy time slots for which a full flexibility is not guaranteed, so these students would take advantage from a better self-management of their time devoted to study. Finally, we clench that technology is the means (not the end) and methodology is more central, but it is nonetheless important also to equip all the stakeholders with proper technical tools. In rich countries, this is mitigated by the fact that almost all the people possess up-to-date devices of their own and institutions have not difficult access to financing aimed at acquiring them, but in less rich nations it could be of some importance to carefully spend what available in order to ensure having an adequate technological equipment.

5. DISCUSSION

These findings establish connections with the theoretical framework and research question. Beginning with the quantitative aspects, it is evident that the decrease in averages for Pairs 1-2 (engagement and communication) and the increasing standard deviations suggest that students, to some extent, respond differently to the challenges posed by the pandemic, likely influenced by their initial circumstances. This is consistent with the findings of Hodges et al. (2020), who emphasized the need for flexibility in learning activities, course policies, and institutional policies. Personalized learning paths emerge as a potential solution to address this diversity. Furthermore, considering the variance in students' digital competencies (Pair 3), targeted training to enhance these skills, as evidenced by Patricia Aguilera-Hermida (2020), is essential, especially for students with no prior online learning experience. Surprisingly, Pair 5 did not show the expected increase, as trained students tend to require less time for technical tasks, reducing the additional time spent using computers. Turning to Pair 4 (learning outcomes) and Pair 6 (weekly study time), the results reflect a relatively stable situation. However, improving student engagement could enhance the quality of study time. Another critical consideration is the need for adaptation: adjusting to changes takes time, even when they offer potential benefits. This aligns with findings indicating that students struggled to adapt to online learning (Patricia Aguilera-Hermida, 2020). In our context, this adjustment hinges on the extent to which students utilize technology in education. It is evident that teachers should set an example by actively employing digital tools themselves. We can also draw comparisons between the recent results and the corresponding survey conducted on teachers, as described in (Marchisio et al., 2022a). Pairs 1-2 directly relate to questions posed to teachers, who rated student engagement (Pair 1) and communication with students (Pair 2). In both cases, a statistically supported decline in ratings is observed. This suggests a shared perception among students and teachers that students encountered greater difficulty in engaging, and communication became more challenging in both directions—teachers found it harder to communicate with students, and vice versa. Similarly, there is concurrence concerning Pair 5, as both students and teachers experienced a significant increase in daily computer usage for educational purposes. However, Pair 3 is less

directly linked to the questions asked to teachers regarding competencies: they assessed the development of students' competencies, while students self-assessed their digital competencies. This resulted in differing outcomes: teachers perceived a significant decline in the development of students' general competencies, while students themselves perceived an increase in their digital competencies. Pair 4 also has only partial relevance to the questions posed to teachers regarding learning outcomes; teachers rated the implementation of learning outcomes, while students rated their own achievement. While teachers perceived a strong difficulty in implementing learning outcomes compared to pre-pandemic times, students had a less negative perception, with difficulties still present but not as pronounced. Lastly, in Pair 6, we return to a higher level of similarity. However, while teachers strongly reported needing more time to fulfill their commitments, the statistical evidence suggesting the same for students was relatively weaker. This can be explained by the fact that adapting learning to new scenarios may be easier than adapting teaching methods. The discussion on the qualitative findings can commence from this last observation: about experiencing problems during practical aspects, approximately one third of teachers answered "yes," which was higher than the 20% of students. This supports the notion that adapting learning is relatively easier compared to teaching. However, the two groups did not perceive the issues in precisely the same way. Many students focused on assessment, highlighting difficulties in ensuring the same fairness as traditional evaluation methods. In contrast, teachers primarily discussed didactic methodologies and practices (Marchisio et al., 2022b). While this divergence is understandable given their distinct roles, it does not imply that students are solely concerned with assessment, as they also recognized the risks of preparing solely for tests rather than gaining a comprehensive understanding of the subjects. Regarding effective practices, there is more alignment between students and teachers, as both groups agree that autonomous organization plays a crucial role in these forms of teaching. Regarding how teachers dealt with the challenges the pandemic required from the students' point of view, we did not ask the former a reverse question considering how students dealt with them, but some responses of the latter highlighted the usefulness in setting up a collaboration that goes over their different roles, by agreeing on certain cornerstones relative to planning. The perception of positive and negative changes by teachers was not tackled in (Marchisio et al., 2022a), but we managed to obtain some impressions later. Starting from the positive features, they presented some similarities with respect to those students explicated, like the better management of time, but also some differences, with several teachers putting the focus on didactical and instructive aspects that students likely do not know in full detail. This also held for the negative features, for instance on the one hand with students highlighting their sensations about not to feel part of a group, and on the other hand with teachers considering the same thematic under a more collective point of view, that is in terms of difficulties in involving all the students in the class. Indeed, they noticed a stronger separation between active and silent ones, with the former having the tendency to intervene even more frequently than what done in presence, while the latter tended practically to avoid interaction. Finally, yet importantly, students and teachers concur also on having a teaching approach comprehensive of blended or hybrid elements to highly consider the human factor, that has to go far beyond the pandemic emergency, by becoming a permanent feature of the didactic offer. Practically, educators and policymakers should address the challenges by means of proper strategies, including the consideration of digital tools to foster collaboration across disciplines and implement creative approaches.

6. CONCLUSION

This research gave valuable insights into the transformations that occurred in students' perceptions of higher education during the transition brought about by the COVID-19 pandemic, thereby addressing the research question (RQ1). Our findings showed a range of challenges students faced, notably their struggles in forging meaningful connections with their instructors, and the noticeable increase in their perceived digital competencies (RQ2). These shifts in perception and behavior hold substantial practical implications for the field of education.

To navigate these challenges effectively, educational institutions and instructors must prioritize the cultivation of digital skills. By equipping teachers with digital proficiency and fostering an environment that encourages students to develop specialized competencies beyond their existing skill sets, difficulties can be mitigated. Moreover, the incorporation of interdisciplinary activities and the application of innovative teaching methodologies through digital tools can significantly enrich students' comprehension of the subject matter. This approach not only enhances their academic experience but also prepares them for a dynamic and technology-driven world. The effects of instructional design and activities on both teachers and students are currently under examination, with a specific focus on the context of DIGICODE Learning, Teaching, and Training Activities, such as the "Systems for Command and Control in Security and Defence Field" school. While a significant portion of our approach is applicable beyond Security and Defence education, DIGICODE project provides a unique and noteworthy context for the study and implementation of suitable educational interventions. In the future, each partner within the DIGICODE project will collaborate further to investigate specific competencies in Security and Defence education, such as mathematical proficiency, critical thinking, and problem-solving skills. Additionally, upcoming research initiatives will encompass surveys and interviews aimed at measuring cultural differences, academic performance, and the degree of satisfaction among students and educators.

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