Research Article

Synergies in Education: Simulation Techniques, Electronic Portfolios, and SDG for Future-Focused Learning

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ARTICLE INFO	ABSTRACT
	The "Competence-based Training and Simulation in Healthcare" project aims to transform healthcare education by integrating simulation techniques, electronic portfolios, and the Sustainable Development Goals (SDGs) into teaching practices across partner institutions. Key activities include needs analysis, teacher training, student mobilities, and the creation of electronic portfolio templates and simulation exercises, all aligned with market needs and fostering collaboration, critical thinking, and innovative pedagogy. By engaging with the 17 SDGs, the project produces a guide for their application in healthcare education, enhancing the professional and personal development of educators and students while strengthening transnational collaboration. This initiative seeks to establish a dynamic, responsive educational framework to prepare healthcare professionals for emerging challenges, with this paper focusing on the project's implementation in the Portuguese context. **Keywords:** education, health care, portfolios, simulations, sustainable development goals

1. INTRODUCTION

The Higher School of Education and the Higher School of Health Care of the Polytechnic University of Santarém (Portugal) are developing the Erasmus+ *Competence-based Training and Simulation in Healthcare Project* [1] in a transnational partnership with Romania (Coordinator), Denmark, Turkey, Spain and Belgium.

This research focused on the Home Support Professional Higher Technical Course of the Higher School of Health Care [2] which is post-secondary education that lasts 2 years (4 semesters, including 1752 hours of autonomous work and 1340 of contact with the teacher at school, in a total of 120 ECTS-European Credit Transfer System).

The aim of this course is to train technicians to provide well-being and quality of life to persons, in their home context, through activities that promote the fulfilment of their physiological, safety and social needs.

Besides Health, Therapy and Rehabilitation, Safety and Hygiene at Work, Social Work and Guidance, Psychology, it also covers other diverse scientific domains, such as Biology and Chemistry, Physics, Management and Administration, Computer Science, Philosophy and Ethics. The curriculum (ESSS, 2024) is taught in 4 semesters and the last one corresponds to an internship in a company/entity of 750 hours (30 ECTS). Providing a level 5 qualification on the National (Portuguese) Qualifications Framework, the course allows qualified integration into the labor market and/or further academic studies.

In terms of job opportunities, students can work in public and private institutions that provide health care and social support at home, including private social solidarity institutions, health centers, hospitals, rehabilitation centers and home care companies.

The CBTS project aims to enhance the quality and relevance of teaching provided by partner institutions by integrating simulation, introducing electronic portfolios for practice, and implementing the 17 Sustainable Development Goals (SDGs), increasing the partners' capacity to operate together at a transnational level, support the professional and personal development of teachers and students.

The needs and competencies analysis of the project that are presented in this paper were based on questionnaire and interview responses of students (questionnaire) and teachers (questionnaire and interview) of Home Support Professional Higher Technical Course.

II. PORTFOLIOS AND SIMULATIONS IN HEALTH CARE EDUCATION AND THE SUSTAINABLE DEVELOPMENT GOALS

A.   *Portfolios in Health Care Education*

According to the study conducted by Moura [3], students recognize that drawing up a reflective portfolio is an opportunity for them to carry out self-assessment and self-analysis and consequently promotes greater self-knowledge.

Its dual formative and evaluative function allows students not only to develop professionally, but also personally, as it allows them to identify the positive aspects of their performance and those they need to improve, helping them to find strategies to achieve their goals.

According to the same author, by reflecting on learning situations, students are themselves building their knowledge and developing transversal skills that they can mobilize in future care situations through a process of critical reflection.

Another aspect highly valued by the students is that using the portfolio allows them to play a more active role in their learning, reinforcing their autonomy.

According to Perez & Corrêa [4], creating a portfolio allows students to problematize their practice and look for solutions with a critical sense, helping to train professionals who are more proactive in problems solving.

B.   *Portfolios and Simulations in Health Care Education*

The main results of the study conducted by AlBalawi *et al.* [5] indicate that Simulation-Based Education (SBE) is considered a very useful tool as it promotes teamwork, improves communication among professionals, and helps them better understand their roles, levels of responsibility, and simultaneously increases awareness of the situation [1]. Students highly value their grades, and those who achieve higher grades perceive simulation as more beneficial to their learning.

In yet another study by Bortolato-Major *et al.* [6], simulation proved to be very positive, not only in developing skills but also as a promoter of critical and reflective learning. However, it is recognized that teacher training is necessary for the use of this pedagogical strategy, as well as a prior alignment of learning objectives with the type of simulation to be used, planning scenarios appropriately for the student's developmental level and the competencies they already possess, as well as those intended to be acquired [6].

C.   *Sustainable Development Goals in Higher Education*

The synergies between the fields of healthcare, education and pursuit of the 17 SDGs might improve the quality of the tools used in healthcare education, for better home support care takers, more action-engaged towards a more sustainable sociocultural and economic development with less environmental impacts.

Crespo *et al.* [7] consider it important to integrate these objectives into teaching, as it alerts students to this problem, helping to train professionals who are more aware of the problem and focused on finding sustainable solutions [3].

2. STUDENTS SATE OF ART

A.   Identification and procedure

The questionnaire was applied to students of the Home Help Higher Technical Course (level 5) who had used simulated practice in their learning, 2 years of the course. is that they have attended classes with simulated practice.

Once the population has been defined and the selection criteria applied, the students were given a brief explanation of the project, and the link was sent to them for answering the questions.

The questionnaire was administered on January 5th, 2024, to 15 students and on the 10th of the same month to 13 students. Out of a total of 28 respondents, one (3.6%) did not authorize the processing of his/her data, and the respective data line was eliminated from the matrix, resulting in a new total of 27 respondents.

B.   Presentation and analysis of results of the questionnaires

Nearly 60% assert that they participated in simulation-based activities or exercises in the curriculum of their study plan: out of these 16, four did not respond to the dependent open-ended question, while of the remaining 12, ten expressed very positive and enthusiastic feedback, with two responses labelled as "workshop," which were clearly inappropriate to the question asked.

All students would like to have more simulation-based activities in their health education.

Regarding the expectations of potential benefits resulting from the integration of simulation into their learning experience, as shown in Figure 1, nineteen respondents (70.4%) marked the maximum on the scale, corresponding to "very many benefits"; the average, with a score of 4.63 on a scale of 1 to 5, also reflects this almost unanimous agreement on the expected benefits.
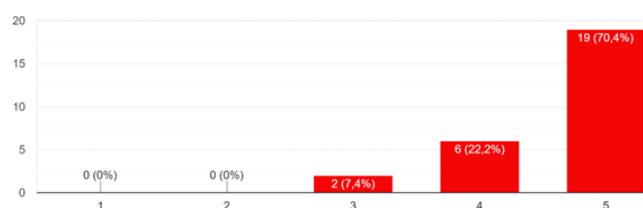

Figure 1 - Expectations of potential benefits of the integration of simulation into students learning experience, according to the students.

There were 22 students who asserted that simulation improves their learning compared to traditional teaching methods, although six did not provide justification as requested. Five respondents (18.5%) did not respond to this question.

An overwhelming majority of 25 out of 27 respondents (92.6%) currently use portfolios in their course.
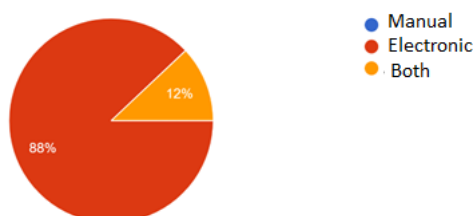

Figure 2 - Forms of portfolios in use, according to the students.

Of these 25, the vast majority (88%) exclusively use the electronic version, while the remaining three (12%) use both versions (see Figure 2); only 15 (60%) responded to the open-ended question inquiring about the main purpose of this usage.

The positive response to the question about the use of portfolios was also unanimous.

In terms of incorporating electronic portfolios into the learning process, an average of 4.63 on a scale of 1 to 5 indicates almost complete readiness. The non-mandatory open-ended question regarding the expected benefits of electronic portfolios for health education had 7 non-responses, with the word 'learn' or 'learning' occurring most frequently in the remaining responses.

With an overall value of 2.96 (slightly below the average centered on 3) on a scale of 1 to 5, the responses show significant dispersion (with ten respondents at the extremes of the scale: six (22,2%) responding the minimum and four (14,8%) responding the maximum (as shown in Figure 3), indicating that some students are not familiar with the United Nations Sustainable Development Goals (SDGs).
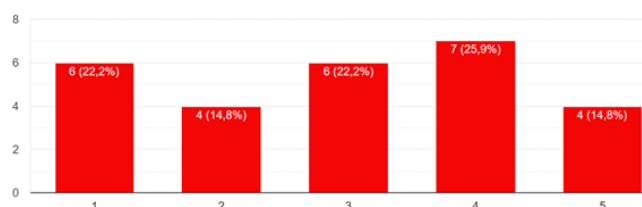

Figure 3 - How familiar students are with the SDGs.

This suggests some inconsistency in notations, as some respondents, not being familiar, find it difficult to assess the alignment of the current curriculum with the principles and objectives of the SDGs. The question related to students opinion about the alignment of the curriculum with the principles and the SDGs objectives (as shown in Figure 4) has an average higher than the previous question, at 3.44 on the same scale. If all three who rated 5 in the previous question also responded 5 in this question, the remaining, except for one, rated at the same level or higher, indicating a certain favorable predisposition.
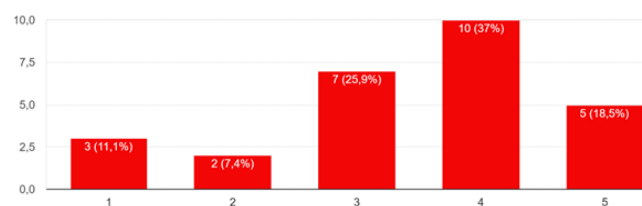

Figure 4 - To what extent do students think the current curriculum is aligned with the principles and objectives of the SDGs.

Regarding their familiarity with the 17 SDGs, knowing that, on average, each respondent marked 12 (with two marking all SDGs and one marking only two), we present the top 7:

Health and Well-being 25

Gender Equality 24

Eradication of Poverty 15

Zero Hunger and Sustainable Agriculture 15

Clean Water and Sanitation 15

Quality Education 14

Peace, Justice, and Effective Institutions 13

The least familiar SDG is Industry, Innovation, and Infrastructure, marked by only three respondents. Asked to name the two SDGs considered most relevant to health education, eight did not respond; one responded with "Combating loneliness," which does not correspond to an SDG (noting that this person confesses to being unfamiliar with the SDG); another responded with only one SDG instead of two. The SDG that stands out prominently is 'Health and Well-being,' marked by 14 respondents. All other SDGs received three or fewer preferences, with seven not receiving any.

Regarding whether there are specific initiatives or projects considered capable of contributing to the fulfilment of

the SDGs in the context of the course (study plan), there are ten non-responses. Out of seventeen respondents, one states not knowing, ten respond yes (of which six even specify, without being asked, which SDG is involved – four referring Health and Well Being, and two Gender Equality), against six responding no (one of whom adds 'but there should be').

To conclude, the findings indicate that students express positive feedback about simulated-based activities and a desire for more in their health education. The integration of electronic portfolios into the learning process received high readiness scores. The students' familiarity with the 17 SDGs showed significant dispersion, with some students not being familiar. While the average familiarity was 2.96, the question about aligning the curriculum with SDGs had a higher average of 3.44, indicating a certain favorable predisposition (on a scale of 1 to 5)

 'Health and Well-being' stood out as the most relevant SDG.

Regarding specific initiatives or projects contributing to the fulfillment of SDGs, while some respondents were unsure or did not specify, others recognized initiatives capable of contributing to the SDGs within the context of the course.

3.   TEACHERS SATE OF ART

A.   Identification and procedure

The participants are teachers who teach the curricular units of the Higher Professional Technical Course in Home Support.   After a presentation about the project and the purpose of the study, they were sent a link to respond. The responses to this questionnaire were received between December 28, 2023, and January 11, 2024.

All ten participating teachers agreed to the processing of their data for research purposes.

B.   Presentation and analysis of results of the questionnaires

Out of the ten surveyed teachers, only one mentions not currently having simulation-based activities or practices in her curriculum.

The assessment of the potential benefits of integrating simulation into health education is very positive, with eight out of ten teachers giving the maximum rating, resulting in an average of 4.8 on a scale of 1 to 5 (see Figure 5).
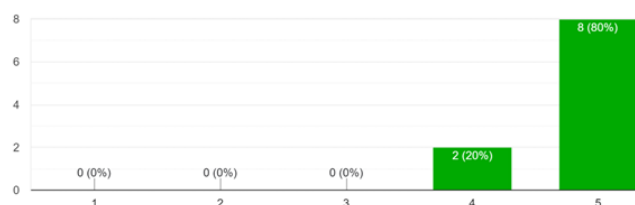

Figure 5 - Potential benefits of the integration of simulation into students learning experience according to the teachers.

The average decreases to 4.4 when inquiring about the level of knowledge and skills as a teacher for simulation in their classes (see Figure 6).
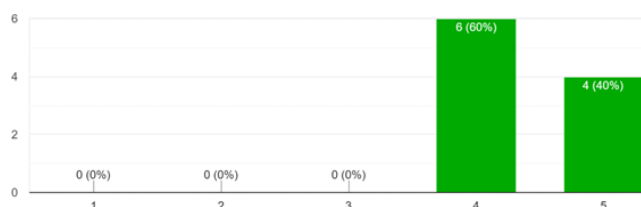

Figure 6 - Level of knowledge and skills as a teacher for simulation in classes.

Only two out of the ten teachers do not use simulation in their classes; among those who do, one does not specify in what manner.

Those who use simulation assert mention practices in First Aid scenarios, laboratory practices, and demonstrations, using real clinical cases as a foundation for simulations. According to 1 teacher, "adapting these

cases for educational purposes while retaining the complexity and nuances of real-life situations provides students with an experience close to reality".

All teachers assert that simulation for their classes is a significant asset, seven of whom rate it as the maximum, resulting in an overall evaluation of an average of 4.7 on a scale of 1 to 5.

Half of the respondents believe they have simulation standards for application as a learning methodology, while only one responds in the negative, and the remaining four respond that they do not know (see Figure 7).
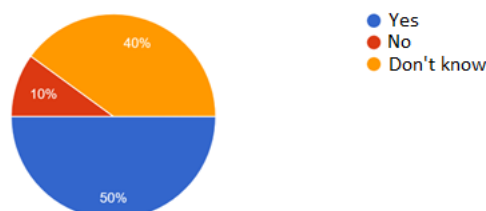

Figure 7 - Simulation standards to support the application of simulation as a learning methodology.

When asked if they have training to apply simulation as a learning method, half respond affirmatively, while the other half responds negatively.

Portfolios are currently used by students of six of the surveyed teachers, in their respective educational institutions.

Of these six teachers, half use the electronic format, one-third use both, and only one teacher exclusively uses the manual format (see Figure 8).
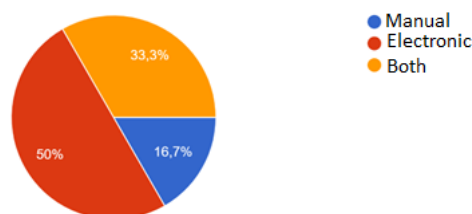

Figure 8 - Forms of portfolios in use, according to the teachers.

Regarding the associated open-ended question about the main purpose of their use, one of the six does not respond.

Half of the teachers state that the main objectives of using Portfolios are: for the student, its usefulness for Independent Study and reflection; for the teacher, as a means to monitor the student's progress in a specific area of learning, compilation of the material taught in classes and as a collection point for assignments for assessment, as well as a means for group discussion and reflection.

All ten teachers unanimously consider the electronic portfolio as an asset to the student's learning process.

Teachers demonstrate great openness to incorporating electronic portfolios into their teaching practices, with more than half marking the maximum (60%), resulting in an average of 4.6 on a scale of 1 to 5 (as shown in Figure 9).
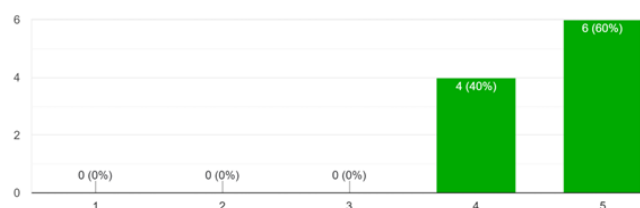
Figure 9 – Teachers' openness to incorporating electronic portfolios into their teaching practices.

Asked about the benefits that electronic portfolios can bring to student practice in health education, only one declares not knowing, with the rest mentioning various benefits without common points. For the student, the portfolio supports independent study, organizing study, reflective capacity and (re)definition of learning strategies, self-training through various portfolio views, awareness of decision-making, and have the benefit of being always available in any context, Development of reflective capacity and (re)definition of learning strategies. It also allows the teacher to tailor content to the student group, and is an active teaching strategy and student-centered methodology, supporting (re)definition of learning strategies.

As for familiarity with the SDGs, as shown in Figure 10, the teachers' rating results in an average of 3.9 on a scale of 1 to 5, with the majority assigning a score of 4 (60%).
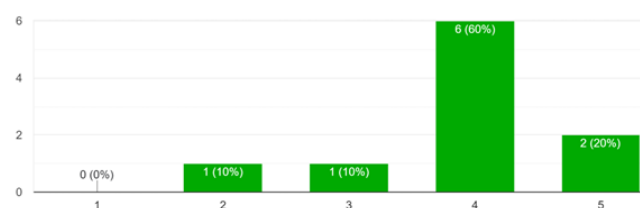

Figure 10 - How familiar teachers are with the SDGs.

Asked to what extent they consider the current curriculum to be aligned with the principles and objectives of the SDGs, the average of the ten teachers is 3, exactly in the middle of the scale of 1 to 5, with only one (10%) assigning the maximum, considering it completely aligned (see Figure 11).
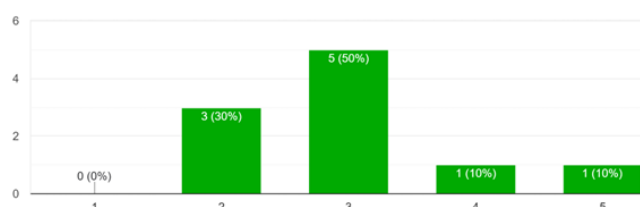

Figure 11 - To what extent do teachers think the current curriculum is aligned with the principles and objectives of the SDGs.

Only one teacher implements all 17 SDGs in her classes, stating that she does so through the mobilization, analysis, and reflection of situations. The nine teachers who responded that they do not implement the SDGs unanimously express interest in learning more about them.

Finally, teachers were asked to mark the SDGs with which they are familiar. Only nine of them marked some of the SDGs, with one teacher admitting not being familiar with any of these objectives: those who responded vary between a minimum of 1 and a maximum of 16 SDGs. On average, each of the ten teachers marks seven SDGs, much less than students, who mark a dozen each. Students declare familiarity with almost twice the number of SDGs as teachers. The most familiar SDG is 'Health and Well-being,' with seven markings, followed by seven SDGs with five markings. Like students, 'Industry, Innovation, and Infrastructure' is the least marked SDG, by only one teacher.

The most important key findings are that currently The Home Support Course includes simulation-based activities in the curriculum. The potential benefits of integrating simulation into health education are highly positive, according to the teachers, but there is a need for defining simulation standards.

Portfolios are used by more than half surveyed teachers, with various purposes such as independent study, reflection, monitoring student progress, and group discussion. Electronic portfolios are unanimously considered beneficial to student learning by all teachers, who show openness to incorporating electronic portfolios into their teaching practices.

Familiarity with Sustainable Development Goals (SDGs) varies, with an average rating of 3.9, and only one teacher saying implementing all 17 SDGs. Teachers express interest in learning more about SDGs, and students appear more familiar with SDGs than teachers.

'Health and Well-being' is the most familiar SDG, while 'Industry, Innovation, and Infrastructure' is the least.

C.   *Presentation and analysis of results of the interviews*

All teachers mentioned the benefits of integrating simulation activities in student learning in the health field, emphasizing the approximation to real-life scenarios. They highlight the improvement of care provided to individuals by developing psychomotor skills, dexterity, clinical judgement, and decision-making.

Positive impacts mentioned in simulation include the Exprax Project[1], increased confidence in real situations, agile transposition from theory to practice, and specific situations such as communication/interviewing individuals, especially in end-of-life communication and training for meeting Basic Human Needs.

Teachers ensure that simulation activities reflect real-world situations, with scenarios created by experienced teachers, drawing from clinical practice with students, preparing the simulation space, reviewing by experts, and using technology, such as mannequins.

Challenges in maintaining scenario realism include adequacy of scenario representation and available materials, creation by experienced individuals, validation by experts, the need for high-fidelity mannequins, lack of materials, and the need for protocols with other institutions. Scenarios become more complex as students' progress in the course.

Teachers always collect student feedback on their simulation experience, albeit informally, using it for continuous improvement in teaching and scenario alteration.

Electronic portfolios are useful materials available to all teachers for simulated practice, monitoring student needs throughout the process, and allowing students to reflect on their actions. Viewing or reading procedures in electronic portfolios enables students to demonstrate practical and behavioral skills in simulation scenarios. Teachers emphasize the management of time and student autonomy.

70% of teachers are aware of electronic portfolios that effectively show students' progress. Most teachers have experienced situations where electronic portfolios or technology are used in health education, including online teacher training and Moodle use.

When asked about dealing with resistance to technology, teachers generally note that resistance may exist initially but can be overcome with training, motivation, and demonstrating the advantages of technology.

The effectiveness of electronic portfolios could be improved through continuous assessment, visibility, and emphasizing their importance to students. There is a need for improved and more intuitive computer resources. Teachers express a desire for electronic portfolio tools, citing Moodle as a tool and highlighting existing tools as well as those not yet available, such as Miro.

As for the 17 Sustainable Development Goals, teachers provide examples of how they include SDGs in teaching, especially in practical lessons and simulation scenarios. SDGs become more relevant and understandable to students through case studies illustrating SDG challenges and reflective work. Analyzing social and economic contexts of the Portuguese population and evaluating resource utilization in health based on SDGs is also emphasized.

There are diverse opinions on the importance of certain SDGs for implementation in teaching. Some teachers mention that certain SDGs are more relevant depending on the course area, while others suggest phased and specific integration of all relevant SDGs.

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[1] ExPrax – Exchange of good practices for excellence. Erasmus+ KA2, 2019-1-RO01-Ka202-064007

When asked about the most important SDGs for implementation in teaching, teachers were not very specific, with only one referring to SDG 3.

Regarding student engagement with SDGs in and out of class, teachers note limited involvement, but awareness, presentation of advantages, and integration into simulated practices could be beneficial.

Concerning student initiatives related to SDGs, teachers who have witnessed them relate them to the application of digital resources and health education strategies in the population.

In healthcare scenarios, students' understanding, and application of SDGs are mentioned as limited, emphasizing practical experience and reflective analysis.

Some teachers mention specific ways to assess competencies related to SDGs, linking course objectives to skills to be achieved.

Integration of simulation, introduction of electronic portfolios, and implementation of the 17 Sustainable Development Goals in your educational institution

Teachers' perspectives on the future use of electronic portfolios and SDGs in health education are very positive. They highlight the importance for future professionals' training, significant improvement in learning, and a fully integrated future reality.

The influence of these elements on health professionals' training is considered inevitable in a constantly developing global world, with their advantages becoming a reality. In the future, healthcare professionals will seek competency development in these formats.

4.   CONCLUSIONS

A.   Dissonances and Consonances of students and teachers' questionnaires

Although 90% of the female teachers mention currently having simulation-based activities or practices in their curriculum, and 80% claim to effectively implement them (apparently, one teacher admits not following her curriculum), less than 60% of the students declare participating in this type of activity or exercise in their respective courses. This is probably due to the difference between the 2 classes to which the questionnaire was applied: one class of first year students and one of second year, so those in the second year have already done more simulation activities.

While almost 93% of the students currently state using portfolios in their courses, only 60% of the teachers mention the current use of portfolios by students in their educational institutions. Even though we cannot infer much without delving into the question of how many students each teacher has, the discrepancy between these values is noted.

Regarding the use of portfolios, students report exclusive use of the electronic version much more intensively compared to teachers: 88%, with only one in eight mentioning other options, compared to one in two teachers. While one teacher mentions using only the paper version, no student confirms this.

As for the consonances, both teachers and students are extremely positive in evaluating the impact of simulation on the learning process: teachers with an average of 4.8 in response to the question about its potential benefits and 4.7 on the scale of 1 to 5 regarding its added value (note some redundancy between the two questions; on the other hand, if we considered the repetition as a test, the high similarity of the result would allow us to conclude the consistency of the responses); students, with ten out of twelve praising it, without the two remaining contradicting (attributed to a misunderstanding in the response) and unanimously expressing the desire for more simulation-based activities in their health education, assessing the expected benefits very favorably, with a rating of 4.6 on the scale of 1 to 5, very similar to the teachers. Even considering a predisposition to comply, identified among students, due to a tendency to assign generous ratings, there seems to be no doubt about the unanimity of the academic community regarding the high pedagogical interest of simulation.

Regarding openness to the incorporation of portfolios, the average between teachers and students is exactly the same: 4.6 on the scale of 1 to 5.

"Health and well-being" clearly emerges as the most relevant Sustainable Development Goal (SDG) for both teachers and students, and the same applies to the one considered less relevant. "Industry, innovation, and infrastructure," with 10% for teachers and 11% for students.

On average, each of the ten teachers marks seven SDGs, much less than students, who mark a dozen each.

Students declare familiarity with almost twice as many SDGs as teachers, possibly explained by learning in non formal and informal education contexts,

B.   Consonances of teachers interviews and questionnaires

All teachers emphasize the benefits of integrating simulation activities in health education, citing improvements in psychomotor skills, clinical judgment, and decision-making. Positive impacts include increased confidence, agile application of theory to practice, and specific training for communication in end-of-life situations. Challenges in maintaining scenario realism include adequacy of representation, availability of materials, and the need for high-fidelity mannequins. Teachers collect student feedback for continuous improvement.

Electronic portfolios are considered useful for simulated practice, monitoring student progress, and fostering reflection. Teachers highlight time management and student autonomy.

Teachers acknowledge resistance to technology initially but believe it can be overcome with training and motivation. Improvements are suggested in continuous assessment, visibility, and more intuitive computer resources.

Teachers integrate SDGs in teaching through case studies and practical lessons. They emphasize the relevance and understanding of SDGs through reflective work and analyzing social and economic contexts.

Opinions on the importance of certain SDGs vary, with suggestions for phased and specific integration. Limited student engagement with SDGs is noted, but teachers believe awareness and integration into practices could enhance involvement.

Teachers express very positive perspectives on the future use of electronic portfolios and SDGs in health education. They foresee significant improvement in learning and anticipate these elements becoming integral to future healthcare professionals' training.

The influence of electronic portfolios and SDGs on health professionals' training is considered inevitable in a constantly developing global world. Teachers believe these formats will play a crucial role in competency development for future healthcare professionals.

C.   Future Perspectives for the project

The findings show that the use of simulation methods and e-portfolios in healthcare education is important and valued by Portuguese teachers and students. To improve the quality of education, it is crucial that CBTS project partners share and compare their documents and practices to develop common tools and standards for students' transversal competences that help them do their internship and adapt to the health care labor market.

It is also clear that there is a need for promoting larger awareness about the human impact on the planet, by offering teachers and students civic education for action-oriented engagement in implementing the 17 SDGs. Self-reflection and training would be of great importance for both students and teachers, and the need to define a strategy and design learning strategies for addressing the 17 SDGs, by incorporating them in the curricula and creating educational resources and opportunities.

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