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The evaluation of educational Robotics in e-learning

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Abstract.

This paper deals with the issue of evaluation in the digital school for the subject of Educational Robotics, especially at the time of the pandemic of new coronavirus COVID (SARS-CoV-2). The research aims to investigate the inhibitory factors for the evaluation of Educational Robotics in the digital school, the ways to ensure the reliability of the evaluation and the degree of difficulty for the teacher to evaluate his learners through the digital school. The methods used in the research are qualitative and quantitative, the technique of semi-structured interview with sample selection of feasibility and the weighted SUS questionnaire with the five-point Likert scale. The data collection and statistical processing showed that the main problems faced by educators with e-learning are mainly the problematic internet connection and the lack of equipment. The hierarchy of problems is followed by the lack of interaction between student and instructor as well as the lack of emotional contact between the two. Educators, on the other hand, suggest ways of ensuring reliability through crisis questions and a combination of theoretical knowledge and laboratory activities. They also attach great importance to evaluation through scalable topics and to the intersection of questions in various ways. Finally, it turns out that the trainers emphasize the warned evaluation since the main purpose is the feedback. Quantitative research shows that online evaluation creates a strong will for frequent use, is not complex and exudes gentle confidence in use. It is easy to learn with gentle to strong agreement as well as easy to use. The help of a technician does not seem necessary and he is not clumsy in its use since no additional knowledge is needed to use e-learning evaluation in educational robotics.

Keywords: evaluation, e-learning, educational robotics

1. Introduction

Digital technologies have revolutionized our society and children are growing up and living in a world where they are ubiquitous. The 4th Industrial Revolution, a term originally coined by Schwab (2016) to describe the spread of digital technologies, affects all aspects of life, from health to commerce, from social interactions to the way people work. Educational systems, then, are no less affected, not only because technology can influence the way education is provided, but also because education must play an important role in preparing young people for a technology-driven world. In addition, as research has long shown, the digital age is

growing and new generations belong to the "digital natives" (Prensky, 2001), inherently capable users of digital technologies. Research shows, in fact, that the use of technology is largely limited to non-school activities related to the use of leisure time, while the use of technology for educational purposes in school is still lagging behind (OECD, 2015b).

The challenges and potential benefits of digital school education are manifold. Firstly, the job market outlook, where there is a skills gap that needs to be filled, as a growing number of jobs require a high level of technology proficiency and many new jobs are based on skilled personnel with digital skills (Cedefop, 2016). From a social point of view, the danger is to divide people into those who do not have or have only basic digital skills and others with higher level skills, which could further widen existing gaps in society and further exclude certain sections of the population. From an educational point of view, the challenge is not only to ensure that young people develop the required digital skills, but also to reap the benefits of pedagogical use of technology (Cachia, 2010).

For all these reasons in the last decade natural mechanical models have been introduced in teaching which perform movements, actions, energies and generally interact with the environment. They are what are known as mechatronics systems and especially robotic systems, particularly effective in teaching the basic principles of computer science, mathematics, geometry, physics, engineering and other subjects. This subject is called Educational Robotics and is very popular with students as through Educational Robotics learning becomes a game.

European and national policies have recognized as a priority the need for all citizens to understand that digital competence must continue to grow throughout human life. Similarly, the European Commission Communication on the Digital Education Action Plan (European Commission, 2018) also defines digital competence in the confident and critical use of digital technology. It focuses on the need to encourage, support and escalate the use of digital and innovative educational practices. Its first two priorities are the best use of digital technology for teaching and learning and the development of relevant digital capabilities and skills for digital transformation.

This report uses the term "digital education" to highlight these two different but complementary perspectives: on the one hand, the development of learners 'and teachers' digital skills, and on the other, the pedagogical use of digital technologies to support, enhance and transform learning of teaching.

Obviously, of course, countries are at different stages of digital education development, which means that for some infrastructure may still be a priority, while for others it may not. At the same time, research has shown that improvements in infrastructure do not systematically lead to the integration and pedagogical use of digital technology in all schools across Europe. However, the quality of pedagogy is the only factor in the school that has the greatest impact on students' learning outcomes. Thus, the digital competence of teachers is a crucial element in maximizing investment in digital technologies as educational systems must keep pace with the needs of the 21st century.

After all, the last years (January 2020) the appearance of the new coronavirus COVID (SARS-CoV-2.) in our lives, is perhaps one of the most critical issues for our country, but also for the whole world. Although we are talking about an issue that affects public health, it could not be disputed that during this period, sectors such as the economy, work and

education have been greatly affected. Because of this emergency, all levels of school education are almost exclusively e-learning.

In this context of e-learning, various difficulties arise, one of which is evaluation. Educational evaluation can generally be defined as an interdisciplinary process of collecting, processing, analyzing and interpreting data related to specific objects, based on specific criteria, with the ultimate aim of giving feedback on activities and efforts, either through relevant information or training. Evaluation is a research process that focuses more on the practical use of the results obtained and less on the production of knowledge. It aims, in particular, to determine the degree of realization of the objectives of an educational system or its components. According to Rogers (1998) evaluation is necessary for at least three main reasons: 1. To improve the performance of trainers. 2. For the design of new strategies, options and priorities. 3. To see how much progress has been made, in what direction and how far we can go. Evaluation is a key element of Learning.

The present paper focuses on the field of education and in particular its purpose is to investigate how easily the evaluation of the course of Educational Robotics is implemented in the new digital school and what are the inhibitory factors in the evaluation. Therefore the research questions are the following:

1. What can be the deterrents to the evaluation of Educational Robotics in the digital school?
2. How could the evaluation be structured in order to be considered reliable?
3. What is the degree of difficulty for the teacher to evaluate his / her trainees through the digital school?

2 State of the art

The integration of evaluation using network technology is necessary in order to fully complete an educational process in distance education. Besides, in e-learning education, web technology and network infrastructure in general are widely used for this purpose. With this logic, the evaluation as well as the automatic decision making can be used to receive feedback from the students, initially in the context of the confirmation of the educational project, but also to be extended to more issues of the educational process, contributing significantly to the improvement of its quality. Electronic evaluation can be implemented in many ways, as the maturation of technology, especially with the use of protocols from the field of electronic voting, allows the implementation of automatic electronic evaluation. The implementation of e-evaluation can in turn give a new impetus to the quality of education provided if it contribute on dynamic educational process, its continuous improvement and its adaptation to modern data.

In particular, as Makrakis (1998) states, evaluation in e-learning is absolutely necessary as this type of education is an innovative educational process, compared to the traditional one, and must convince of the quality of the studies it offers. For pedagogical reasons, the evaluation that refers to the adequacy and effectiveness of the new teaching methods and teaching material is necessary. Also, in terms of the socio-economic dimension, the evaluation is necessary for the quality and the most rational understanding and also the allocation and management of the available resources. Finally, the modernization of distance education with new forms of interactive and multimedia technology raises the issue of continuous evaluation. This is because the lack of personal communication, the inability to provide feedback, the

educational processes that take place in different space and time between educators and trainees and the inability to fully test the learning environment differentiate traditional from e-learning and require different evaluations.
In general, the lack of certified methods or fixed criteria for evaluating e-learning is a deterrent to such initiatives. However, the evolution of New Technologies and the rapid development of Network-based Education makes it necessary to establish stable and reliable evaluation criteria for this type of education.
For Salomon, assessment difficulties arise from the very nature of Network-Centered Education, which is not limited to the evolution of a variable but is an interactive interaction of many parameters (Salomon 1995). The problem of evaluation is a question of searching for a methodology that will cover the individual effort, the interaction of the users, the organization of the learning environment but also the usability of the system.
In essence, the evaluation should cover the field of technological support, the subject matter and the sociological-psychological development of users in a cross-interactive development or the evaluation in such an environment should seek the user's interaction with his computer but also the interaction of stakeholders through technology.
Berggren et al. (2015) in their article argue that evaluation through new technology has gained a solid foothold in the university system in the last decade. They summarize the experiences gained from the introduction of digital examination in recent years at the Royal Institute of Technology in Stockholm, Sweden. Experiences are divided into three different perspectives, teachers, students and administrators. From the teachers' point of view, the experiences were very positive - less time is allotted for grading written exams, grades are considered fairer and time savings can be spent on increasing the quality of other parts of the course. From the students' point of view, the experiences were also very positive - most students enjoy the fact that they get the results much faster, that they can process their exam answers more easily and that the grades are fairer.
Nikolakakis (2016) presents the eportfolio contribution to the evaluation of e-learning students in higher education institutions. In particular, the evaluation, when accompanied by an eportfolio, is linked to the content of the course and is not a "punitive" process. The eportfolio also provides indications of learning, coherence of knowledge and reflection, can improve the completion time of students' assignments and contribute positively to their overall performance. Finally, the portfolio can serve as a tool for professional development and can help individuals come back into the workplace, can be a vehicle for assessing learners' prior knowledge and determining their relevance to current curricula in an e-learning learning curriculum.

3 Methods of survey

Each researcher in order to conduct a research, chooses that methodology which is considered very important, to carry out the conclusions from it. Methodology is the processes, means, materials and techniques that a researcher chooses to conduct his research (Hakim, 2000).
According to Bird et al. (1999), there are no specific rules according to which the method for the study of a research problem should be chosen, as each has advantages and disadvantages. They explain that the choice of the research method is a function of various factors, such as the object itself, the available resources, the available time, etc.

The method that is considered most suitable for conducting the present research, is the qualitative one for the first two research questions and the quantitative one for the other two as according to Bird et al. (1999) intend to study views, experiences and situations.
With the qualitative methodological approach, valid results are carried out without a large sample (Kedraka, 2008), however it is a method that is influenced by the culture and the judgment of the researcher. Every researcher who applies the qualitative research method, interviews, observes, describes and interprets the facts exactly as they are. In addition, this type of research makes the researcher permanently active, as it requires the use of information such as interviewees' comments, information that he observes.
For the implementation of the present research, the tool that was deemed appropriate for data collection is the semi-structured interview, which is considered the most popular form of interview, because it allows participants to express their views freely (Creswell, 2007). For the structure of the interview questions, a specific protocol was followed where according to it, first the topic of the research is listed, then the date and time of the interview, followed by data such as gender, age, years of service in education, specialty and the highest degree. Initially, we asked teachers for some information about the teaching of their lesson to see if their students were able to successfully attend the lesson and understand its objectives and content. In particular, we wanted to see if the objectives of the course were clarified, if its requirements were clear and if a blueprint for its development was available. Also, if there were instructions for access to the information material of their course but also to additional sources of information. If there was a "technical assistance" and if the students knew when the lesson would be available and if there would be a space for them to get acquainted with this new learning objects.
Also, was the organization and sequence of the contents investigated corresponding to the subject of the lesson and the progressively increasing needs of the students, if the organization of the teaching material was adequate throughout the lesson? (if there was an introduction, purposes, preparation, explanations, case study, linking to other websites for additional information, summaries, self-assessment tests, sources, additional material for optional study, exercises or other study activities). Finally, we asked about the language suitability and adequacy of the lesson, whether the language in which the lesson was written was appropriate for the level of the students to whom it was addressed and whether the presentation of the educational material facilitated the educational process.
Finally, emphasis was placed on the design of the lesson evaluation by the teachers as there had to be a correspondence of the evaluation with the goals that had been set from the beginning of the teaching of the lesson. The objectives that had been set had to be: specific, measurable, relevant to the desired behavior of the trainee, understandable and achievable so that the trainee can meet the requirements within the specified time limits. The objectives were designed to be difficult to achieve but not impossible and included practical training for the student to apply what he learnt.
The total of the interview questions is 10, which with the appropriate coding correspond to the 2 research questions as mentioned below: The 1st research question, which deals with 5 questions of the interview, is: “What can be the inhibitory factors for the evaluation in digital school"; The second research question, which deals with the other 5 questions of the interview, is "How could the evaluation be structured in order to be considered credible"?

The research sample consists of 10 teachers, of which 6 are women and 4 men, who have been working in secondary schools for at least the last 2 years. The sampling method used is known as expediency sampling, which is commonly used in cases where the researcher selects specific individuals and locations in order to collect the maximum amount of data. In order to avoid mistakes, omissions or misinterpretations, the interview was piloted on 3 teachers, and after the necessary corrections was carried out with the people in the sample. Finally, it is worth mentioning that the interview with each teacher was carried out after his consent, remotely through the zoom application, in order to record the conversation for the subsequent processing and analysis of data.

Quantitative research was used for the last research question. The value of quantitative research findings lies in the fact that under certain conditions they can be generalized as conclusions that apply to the general population (insofar as the sample on which they are based is representative of this population) and that they are the result of "objective" (statistical and mathematical) analyzes.

The questionnaire used is the SUS (System Usability Scale) which consists of ten questions, and the survey participants answered using the Likert five-point scale, where 1 expresses complete disagreement while 5 expresses complete agreement. The research question addressed by the questions is: "What is the degree of difficulty for the teacher to evaluate his / her learners through the digital school"? The questions on the SUS questionnaire are as follows:

Table 1: SUS Questionnaire

	QUESTIONS	**1**	**2**	**3**	**4**	**5**
1	Does it create the will for frequent use?					
2	Is it complicated for no reason?					
3	Is it easy to use?					
4	Do you need the help of a technician to use it?					
5	Are its various functions well connected?					
6	Is there a great consistency in its operation?					
7	Is it easy to learn?					
8	Is it awkward to use?					
9	Does it exude confidence during use?					
10	Do you need extra knowledge to use it?					

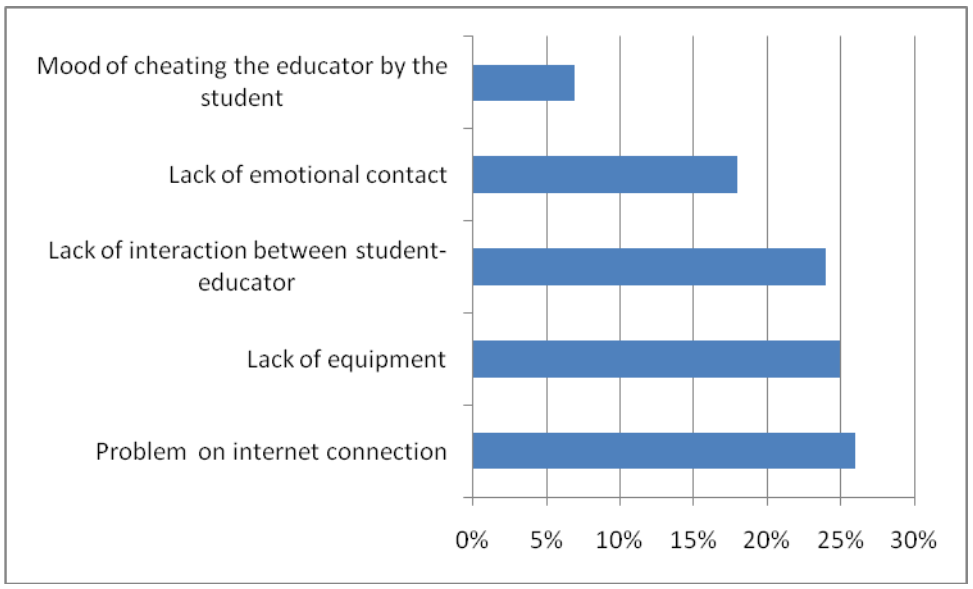
The SUS questionnaire measures the subjective utility (usability) of a product or service. The ease of use dimension of the weighted questionnaire is related to the 3rd question of the research because the success of the evaluation in the digital school is influenced by the medium which is the information system. The research sample consists of 120 Robotics educators, of which 42 are women and 78 are men. In order to avoid mistakes, omissions or misinterpretations, the completion of the questionnaire was piloted in 6 people, and after the necessary corrections that mainly concerned the wording of the questions, it was implemented with the people in the sample.

The results of this primary research were processed with statistical processing tools, SPSS, and rendered with descriptive statistics.

4 Results and Discussion

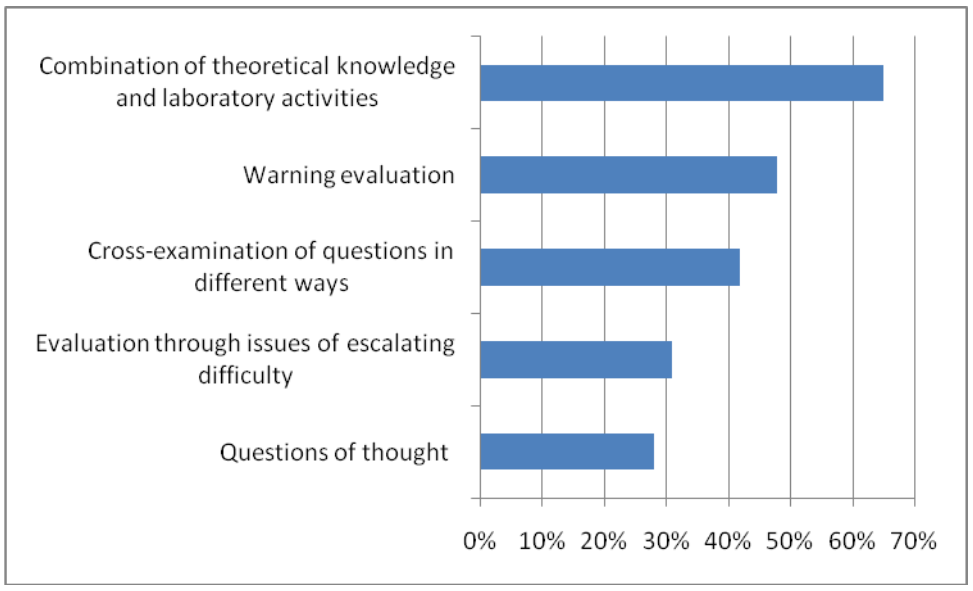
Regarding the first two research questions, the data obtained from the interview process were coded and grouped to draw safe and reliable conclusions. Instructors were asked to select the most inhibitory factor of e-learning evaluation (Fig. 1). From the quality data collected, it appears that the main problems that trainers face with e-learning are mainly related to the problematic internet connection (26%) and the lack of equipment (25%). The hierarchy of problems is followed by the lack of interaction between student and instructor (24%) as well as the lack of emotional contact between the two (18%). It seems that the disposition of the trainer to deceive the trainer does not particularly concern the trainers as the percentage is very low, only 7%.

Figure 1: Most inhibitory factor of e-learning evaluation



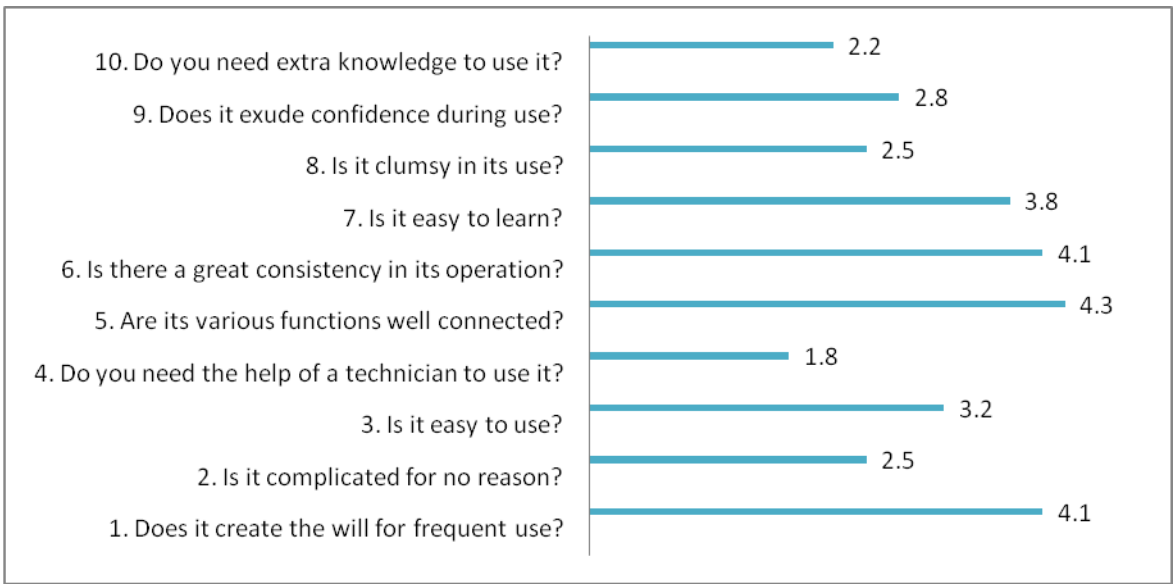
For the second research question, the data showed that robotics trainers have ways to ensure the reliability of the evaluation. For these reasons the trainers suggest crisis questions (28%) and a combination of theoretical knowledge and laboratory activities (65%). They also attach great importance to the evaluation through topics of scalable difficulty (31%) and to the intersection of the questions in different ways (42%). Finally, it turns out that the trainers emphasize the warned evaluation since the main goal is the feedback (48%) (Fig. 2).

Figure 2: Ways to ensure the reliability of the evaluation



The questionnaire technique was used to collect the data of the last research question, as mentioned above. The gender of the respondents as well as the results of this quantitative research are shown in the following diagrams.

Figure 3: The results of the questionnaire (SUS)



From the results of the questionnaire (SUS) we conclude that online evaluation creates a strong will for frequent use (AVG 4.1), is not complex (AVG 2.5) and exudes gentle confidence in use (AVG 2.8). It is easy to learn with mild to strong agreement (AVG 3.8) as well as easy to use (AVG 3.2). The help of the technician does not seem necessary (AVG 1.8)

as he is not clumsy in its use. Finally, the respondents agree that no additional knowledge is needed to use it (AVG 2.2) (Fig. 3).

Conclusion

Educational Robotics leads education to a new, fresh layer, achieving the next evolution in learning and teaching. It is an interactive, multidimensional and appropriate way to prepare students for the future, making them feel more the pleasure of creativity and fun and less duty for homework. The analysis above led to important data regarding the usability evaluation of an educational robotics system. In addition, e-learning is a reality, especially in the context of lifelong learning. The evaluation must therefore be adapted in this context so that it is reliable. In general, based on the present findings, the evaluation of educational robotics through internet that is used today tend to be quite usable for the educators. The results of this research cannot be generalized due to the small number of participants. However, they can be considered indicative and they may conduct a part of an extensive research throughout education, thus upgrading teaching and learning process around the world.

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