Educational Robotics Acceptance by Italian Teachers, Educators, Psychologists and Psychotherapists

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Abstract. The exploration of acceptance of robotics by teachers, educators, psychologists and psychotherapists appears vital for the effective implementation of Educational Robotics (ER). This exploratory study evaluated acceptance of ER by Italian teachers, educators, psychologists and psychotherapists ($N = 88$). This research used a cross-sectional exploratory approach with a self-administered survey based on the Unified Theory of Acceptance and Use of Technology (UTAUT). The results indicated that the professionals' intention to use robotics in their profession was negatively related to anxiety evoked by robotics, but positively related to the following aspects: 1) positive attitudes about the use of robotics, 2) perceptions that there are factors in the environment that facilitate using robotics, 3) perceptions of ability of robots to be adaptive, 4) perceptions of robotics as enjoyable, 5) perceptions that robotics will improve the user's workplace performance, 6) positive perceptions of what other people think about robotics, 7) perceptions that robotics performs with integrity. Teachers, educators, psychologists and psychotherapists declared themselves to be quite favorable towards the use of robotics in their profession. These results showed that ER may be more integrated in educational contexts and for therapeutic and rehabilitation purposes.

Keywords: Educational robotics · Unified Theory of Acceptance and Use of Technology (UTAUT) · Acceptance of educational robotics

1 Introduction

The widely felt need for a school renewal at all levels also passes, and, according to some researchers and professionals, essentially, through the use of a 'good technology'. In the field of education, technology is 'good' if it is not reduced to a new skill to be acquired

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but is rather an incentive to learning tool, a cognitive engine that stimulates interest and gives pleasure to the user. Among the technologies that can be classified like this, there is robotics: the fact that it has been successfully applied in recent years in education is confirmed by the birth of a new expression, "Educational Robotics", that has been coined and currently used in literature with a meaning rich in value and contents.

Research reveals that robotics can be a valuable tool for the educational field in the learning process of average students [1–3] and of students with special needs (SNs) [4]. As for students with special needs, Pivetti and colleagues [4] recently found that ER emerged as a valuable instrument for students with neurodevelopmental disorders (from 3 to 19 years of age). Furthermore, psychologists and educators have shown the positive psychological impact of using robotic construction kits on the development of cognitive and social skills [5].

The study of all those factors that influence behavioral intention and the effective use of educational robotics seems very important because owning the equipment and using it are not the same. Previous studies [6] have found that most teachers have positive attitudes towards ER agreeing to consider it as a powerful tool for promoting several skills for students and children with SNs. However, other studies also highlighted that there is still some suspicion towards the use of robots in the fields of education and care of people [7, 8]. This suspicion could have a negative impact in the integration of ER [7, 8]. For instance, a European survey (European Commission, 2017) [9] showed that only 26% of respondents were comfortable "with having a robot to provide services and companionship when infirm or elderly" and only 35% declared themselves to be comfortable in having a robot assist them at work. Furthermore, Denmark was the only country where at least one in ten respondents use a robot at work (14%), compared to 6% in Italy.

Heerink and colleagues [8] argued that, even in the face of scientific evidence, robots are often not implemented in the fields of education and care of people because of factors like stigmatization, perceptions of (non)adaptability of robotics or negative social influences. Therefore, the authors discussed that it is not only vital to understand the user acceptance of robotics in order to provide insight in the probability of using robotics, but also to understand the factors underlying acceptance propensities. Other researchers argued that understanding people's attitudes and acceptance of robotics is a prerequisite for predicting their intention to use ER and for implementing effective interventions in ER [10]. For instance, factors that influence user acceptance and adoption of ER can inform us about the priorities for fundraising, training needs or research programs [10]. Furthermore, we believe that ER is of extreme interest not only for educators and teachers but also for psychologists and psychotherapists as a valuable tool to support and develop cognitive and social skills, problem solving, critical thinking, innovative ideas, and team working skills among others [11]. Psychologists and psychotherapists often work with teachers and educators for socio-therapeutic purposes, in particular for the evaluation and the intervention in case of special needs students. Therefore, teachers, educators and mental health professionals could benefit from knowing about the wide range of possible applications and implications of ER. Furthermore, these targets of professionals' attitudes towards ER are fundamental in predicting the intention to use robotics in work. Consistent with these premises, the present study aims to expand

the line of research into the acceptance of ER by investigating Italian teachers, educators and psychologists/psychotherapists' attitudes. In Italy, the terms "educators" and "teachers" have several and overlapping meanings. In this paper, we intend educators (in Italian: "educatori dei servizi educativi per l'infanzia") as the professionals working in nursery schools (Decree n° 378/2018, Law n° 65/2017). Teachers are defined as the professionals teaching in kindergartens, primary schools, middle and secondary schools (Contratto Collettivo Nazionale del Comparto Scuola – CCNL, 2006/2009)[1]. In Italy, the profession of psychologist comprises the use of cognitive and operative instruments for the prevention of problems, for diagnosis, and for activities relating to psychological rehabilitation and support of individuals, groups, social bodies and communities, including experimental, research and teaching activities within these areas. The practice of psychotherapy is subject to special professional training (see the National Board of Italian Psychologists, reference number: XV/E/58452/95).

The theoretical background of this study is based on the assumptions of the Unified Theory of Acceptance and Use of Technology (UTAUT) [12].

1.1 The Unified Theory of Acceptance and Use of Technology (UTAUT)

A user's acceptance of technology is defined as "the demonstrable willingness within a user group to employ technology for the tasks it is designed to support" [13]. The first studies on technology acceptance were based on the Technology Acceptance Model (TAM) by Davis in 1989 [14] that was, in turn, grounded on the research of social psychologists Ajzen and Fishbein [15]. The TAM theory specified that the user's perceptions of usefulness and ease of use of a certain technology impact behavioural intention to use it. The theory also assumed that this behavioural intention is predicting the actual use of a specific system. Venkatesh and colleagues [12] unified several models and findings on technology acceptance in the so-called Unified Theory of Acceptance and Use of Technology (UTAUT) that was tested for many different types of technology [16]. This model has been recently extended for the study of acceptance of robotics in the fields of education and care of people [7, 8]. In Conti and colleagues [7] and Heerink and colleagues [8], the UTAUT model comprises 13 dimensions measuring technology acceptance. These dimensions are represented in a questionnaire by a group of questions or statements that can be evaluated. The 13 dimensions are as follows: • Anxiety (ANX), comprising an unpleasant emotional state or condition which is characterized by subjective feelings of tension, apprehension, and worry [17] evoked when using a specific technology; • Attitude (ATT), comprising individuals' positive or negative evaluation about the use of a specific technology [15]; • Facilitating Conditions (FC), comprising all the perceived factors in the environment that facilitate using a specific technology [7, 8]; • Intention To Use (ITU), describing the user's intention to use a specific technology over a long period of time [7, 8]; • Perceived Adaptability (PA), referring to the perceived ability of a specific technology to be adaptive to the changing needs of the

[1] In Italy, according to the law 205/2017, the roles of socio-pedagogical professional educator and the pedagogic professional were also defined. These professionals work in the educational and pedagogical field (not only in schools), in relation to any activity carried out in a formal and informal way, towards people of all ages, from a perspective of personal and social growth.

user [7, 8]; • Perceived Enjoyment (PENJ) representing the extent to which the activity of using a specific technology is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system usage [14, 18]; • Perceived Ease Of Use (PEOU) representing the degree to which the user believes that using a specific technology would be free of effort [7, 8]; • Perceived Sociability (PS) comprising the perceived ability of a specific technology to perform sociable behaviours [7, 8]; • Perceived Usefulness (PU) comprising the user's perception to the extent that a specific technology will improve the workplace performance [14, 18]; • Social Influence (SI) comprising the user's perception of how people, who are important to him/her, think about him/her using the system [7, 8]; • Social Presence (SP) that is a perceived personal experience of sensing a social entity when interacting with a specific technology [7, 8]; • Trust (TRST) comprising the user's perception that a specific technology performs with integrity and reliability [7, 8]; • Use (USE) comprising the actual use of the system over a longer period of time [7, 8].

In the study of Heerink and colleagues [8] the questionnaire based on the UTAUT was administered to 30 participants, recruited both by eldercare personnel and by students, in order to explore the acceptance of assistive social robots (including in this category all those robots that are in any way assistive to elderly adults and that are socially interactive). Results showed that the intention to use the assistive social robots predicted the actual use and it was significantly determined by two factors: 1) a perception of ease of use technologies (e.g.: "I find the robot easy to use"); and 2) positive attitudes (e.g.: "The robot would make my life more interesting"). Results also showed that the perception of ease of use was influenced by the perceived usefulness of technology (e.g.: "I think the robot is useful to me") and this latter was influenced by the perception of adaptiveness (e.g.: "I think the robot can be adaptive to what I need"). In the Italian context, after a brief interactive demonstration of the NAO robot capabilities in a class, Conti and colleagues [7] administered the UTAUT questionnaire to 80 participants (i.e.: 25 educational and rehabilitation care practitioners and 55 university students in psychology or education sciences) with no previous experience of robotics. Their results showed the applicability of the UTAUT model in the context of education and care of children, and suggested a positive attitude towards the use of a robot. Conti and colleagues [19] also surveyed Italian and British-English psychology students after an interactive demonstration using a humanoid robot to evaluate their social robot's acceptance and their intention to use a robot as an instrument for future clinical practice. Results showed that Italian psychologists were more positive toward the perceived usefulness and intention to use the robot in psychological practice compared to English psychologists. Furthermore, all respondents felt they did not have the necessary abilities to make good use of robotics.

2 The Current Study

The exploration of acceptance of robotics by teachers, educators and psychologists/psychotherapists appears vital for the effective implementation of ER [7, 19]. While user acceptance and adoption behavior have been studied for teachers and educators working in schools much less attention has been paid to the study of factors associated with the acceptance of ER for psychologists or psychotherapists. This result could reflect

the difficulty of Italian psychologists/psychotherapists in using educational robotics and knowing its potential, considering the marginal role that in Italy these professionals have in educational contexts where ER activities are mainly integrated [20, 21]. In general, in research it is still unclear to what extent Italian teachers, educators and psychologists/psychotherapists are adopting and accepting ER for their work. In Italy, with the introduction of the National Digital School Plan in 2015, many schools have included ER, recognizing it as motivating, engaging, and a great learning tool particularly when special needs are concerned. In the Italian schools, increasing attention is paid to the topic of Special Educational Needs (e.g., law n° 170/2010). Furthermore, individualized plans for students with special education needs were established (i.e. Piano Educativo Individualizzato – PEI). These plans are developed by learning support teachers in collaboration with students' parents, with all school staff and with socio-health personnel (e.g., mental health professionals). PEI is based on the International Classification of Functioning, Disability and Health (ICF) of the World Health Organization. The ICF is defined as a classification system that aims to describe, not only diseases or disabilities, but also the state of health of individuals in a positive key (functioning and health) and in relation to their environment (social, family, work) in order to grasp the difficulties that in the socio-cultural context of reference can cause disabilities [22]. The personalized teaching defined in PEI is substantiated through the use of a variety of teaching methodologies and strategies, rehabilitative interventions (e.g., psychological interventions), didactic tools and assistive technology, in order to promote educational potential and success in each student. Technologies find a specific location also within ICF, described as learning-interaction tools that can represent facilitation/compensation instruments in the performance of normal activities and in the performance of learning tasks.

Given that there is still some skepticism towards the use of robots in the fields of education and care of people [7, 19] and data on psychologists' and psychotherapists' acceptance of ER are scarce, this exploratory study aimed to evaluate user acceptance of ER by Italian teachers, educators and psychologists/psychotherapists. Specifically, this study aimed to use the UTAUT model to examine factors that affect acceptance behavior of ER in the workplace by Italian teachers, educators and psychologists/psychotherapists. In this study, we used a cross-sectional exploratory approach with a self-administered survey.

We expected that, among teachers, educators and psychologist/psychotherapists, the intention to use a robot in one's future profession would be negatively related to anxiety but positively related to 1) positive attitudes towards robotics, 2) the facilitating conditions (such as the knowledge of robotics), 3) the perceived adaptability of robotics in their own work, 4) the perceived enjoyment in using a robot, 5) the perceived usefulness of robotics for their profession, 6) social influence and 7) perceptions of trust in robotics.

3 Method and Materials

3.1 Participants and Procedures

Participants were recruited by snowball sampling. A total of 111 questionnaires were administered online. Three participants did not give their consent to the participation and so were entirely excluded from the data collection. Twenty-one participants were

excluded from the analyses because they failed at the attention check questions (see Materials section below). They were re-directed to the debriefing section. The final sample consisted of 88 experienced and future professionals (24 psychologists/psychotherapists, 27.3%; 64 educators/teachers), 73 females and 15 males (females = 83%) aged from 23 to 68 years ($M = 43.51$ years, $SD = 13.69$). The sample was composed of professionals with different specializations (e.g., math teachers, psychodynamic psychotherapists among others). The majority of the participants were highly educated with 80.7% having a university degree or a post-graduate degree or a PhD qualification ($n = 71$) and 19.3% having completed secondary school ($n = 17$). According to their working experience, 51.4% of them had been working for at least 17 years (variable ranging from 1 up to 45 years; $M = 18.42$; $SD = 13.55$). Fourteen participants were pre-service professionals (15.9%). Participants originated from regions of the Centre ($n = 28$; 31.8%), the South or the Islands ($n = 24$; 27.3%), and the North ($n = 36$; 40.9%) of Italy.

Twenty-three participants had never heard about ER (26.1%), 18 participants (20.5%) declared that they had few notions about it, 21 participants (23.9%) stated they knew a little about ER, and 26 participants (29.5%) reported they knew it well and very well. Thirty-six participants (40.9%) had never attended a course or a workshop about ER. As for previous experience with ER in their work environment, 53.4% of professionals had been using ER in their work ("few times" $n = 6$; "sometimes" $n = 11$; "many times" $n = 24$; "almost always" $n = 6$), whereas 46.6% of them ($n = 41$) had never used it (comprising all participants who were psychologists/psychotherapists). The questionnaire was implemented using the Qualtrics.com form. The survey was open from October 2019 to October 2020. After reading a description of the study and indicating their willingness to participate in an informed consent form, each participant read a script introducing ER and then they evaluated it (see Materials section below). Respondents read a debriefing statement at the end of their contribution. No remuneration was offered for participation. The research complied with the Ethics Code of the Italian Psychology Association (Associazione Italiana di Psicologia) [23], and was conducted in accordance with WMA-Declaration of Helsinki (1964/2013) [24]. As no Institutional Review Board for Psychology research was available from the affiliations of the social-psychology researchers involved in the study (i.e. University of Chieti-Pescara, Chieti, Italy and University of Bergamo, Bergamo, Italy), no request for approval was submitted.

3.2 Materials and Measures

The Script. After participants indicated their willingness to participate in the study in a complete informed consent form, they were invited to read a scenario describing educational robotics[2]. This description was inspired by the relevant literature on ER [1–3] and revised by one researcher in the ER field. After reading the script, participants answered two attention-checking questions (i.e.: "*Educational Robotics is suitable for students of all ages;*" "*Educational Robotics is suitable for students with special needs - e.g. autism spectrum disorders*;" answers: true or false).

[2] Supplementary materials file: https://mfr.osf.io/render?url=https://osf.io/m76kb/?direct%26mode=render%26action=download%26mode=render.

The UTAUT Questionnaire: We administered a short version of the UTAUT questionnaire (translated in Italian and back-translated in Conti et al. [7]; permission to use the scale was requested from the authors). The participants were asked to indicate their level of agreement to 25 statements on a five-point Likert scale (from 1 = totally disagree; up to 5 = totally agree). Participants first read: "*Take a few minutes and try to imagine using Robotics in your work. What is your first impression?*" They then rated the items corresponding to UTAUT 9 dimensions:

1. Anxiety (4 items; e.g.: "*If I were to use a robot in my work, I would be afraid of making mistakes;*" $\alpha = .84$).
2. Attitude (3 items; e.g.: "*It's good to make use of robots in my work*"; $\alpha = .98$).
3. Facilitating conditions (2 items; e.g.: "*I know enough about robots to make good use of it;*" $\alpha = .63$).
4. Intention to use (3 items; e.g.: "*I am certain to use robotics in my work in the near future*"; $\alpha = .92$).
5. Perceived adaptability (3 items; e.g.: "*I think robots can be adaptive to what I need in my work;*"$\alpha = .62$).
6. Perceived enjoyment (3 items; e.g.: "*I find robots enjoyable*;" $\alpha = .78$).
7. Perceived usefulness (3 items; e.g.: "*I think robots are useful to me in my work*"; $\alpha = .89$).
8. Social influence (2 items; e.g.: "*I think it would give a good impression if I were to use robots in my work*"; $\alpha = .76$).
9. Trust (2 items; e.g.: "*I would trust robots if they gave me advice.*" $\alpha = .62$).

Experiences with Educational Robotics. Participants then indicated their previous experiences with ER answering the following questions: "*Are you familiar with Educational Robotics*?" (responses on a five-point Likert scale from 1 = not at all; up to 5 = very much); "*Have you ever attended a workshop - or a lesson - on Educational Robotics*?" (responses on 5 point Likert scale from 1 = never; up to 5 = very often); "*Have you ever used Educational Robotics in your work*?" (responses on a five-point Likert scale from 1 = no, never; up to 5 = yes, very often).

Socio-Demographic Questions. We also measured the self-reported participants' gender (1 = male; 2 = female; 3 = other), age, region of origin in Italy (1 = Centre; 2 = Northern Italy; 3 = Southern Italy and the Islands), educational level, professional role (1 = educator/teacher or 2 = psychologist/psychotherapist), work experience in their own specialization (1 = no; 2 = yes) and years of work experience in their own specialization.

4 Results

Table 1 Shows the mean and standard deviations among all the variables and the correlations between all measures investigated in the study. The analyses indicated that almost all these measures were related.

Table 1. Means (standard deviation) and zero-order correlations among variables

	Means (SD)	1	2	3	4	5	6	7	8
1.ANX	*M* =1.76 (0.81)	1							
2. ATT	*M* = 4.19 (0.94)	-.35**	1						
3. FC	*M* = 3.02 (1.02)	-.25*	.38**	1					
4. ITU	*M* = 3.73 (1.13)	-.43**	.51**	.75**	1				
5. PA	*M* = 3.13 (0.79)	-.17	.38**	.41**	.45**	1			
6. PENJ	*M* = 4.25 (0.83)	-.28**	.14	.68**	.46**	.48**	1		
7. PU	*M* = 3.72 (0.92)	-.24*	.43**	.71**	.64**	.62**	.59**	1	
8. SI	*M* = 3.45 (0.92)	-.12	.39**	.53**	.45**	.55**	.55**	.71**	1
9.TRST	*M* = 3.52 (0.94)	-.16	.29**	.53**	.42**	.54**	.55**	.65**	.59**

Note. ANX: Anxiety; ATT: Attitude; FC: Facilitating Conditions; ITU: Intention to Use; PA: Perceived Adaptability; PENJ: Perceived Enjoinment; PU: Perceived Usefulness; SI: Social Influence; TRST: Trust. * = p <.05; ** = p < .01

Significant positive relationships were found between facilitating conditions (such as the knowledge of robotics) and 1) positive attitudes, 2) intentions to use, 3) perceived adaptability, 4) perceived utility, 5) social influence and 6) trust. Positive attitudes towards robotics were also positively related to 1) intentions to use, 2) perceived adaptability, 3) perceived enjoyment, 4) perceived utility, 5) social influence and 6) trust. Furthermore, intention to use robotics was related with 1) perceived adaptability, 2) perceived enjoyment, 3) perceived utility, 4) social influence and 5) trust. Perceived adaptability, perceived enjoinment, perceived utility, social influence and trust were positively correlated to each other. Finally, anxiety was negatively related to facilitating conditions, positive attitudes, intention to use, perceived enjoyment and perceived usefulness of robotics in their own work. Furthermore, Fig. 1 shows the mean among all the variables for each subgroup (i.e. teachers, educators and psychologists/psychotherapists).

To test whether the two subgroups of participants statistically differed in terms of study variables, a multivariate analysis of variance (MANOVA) was run with two subgroups as independent variable and all the study variables as dependent ones. The multivariate effect of subgroup was significant (*Wilks's* $\Lambda = 0.71$; $F\,(9, 78) = 3.70$; $p = .001$; $\eta^2_p = .30$). The univariate analyses showed significant differences between the two

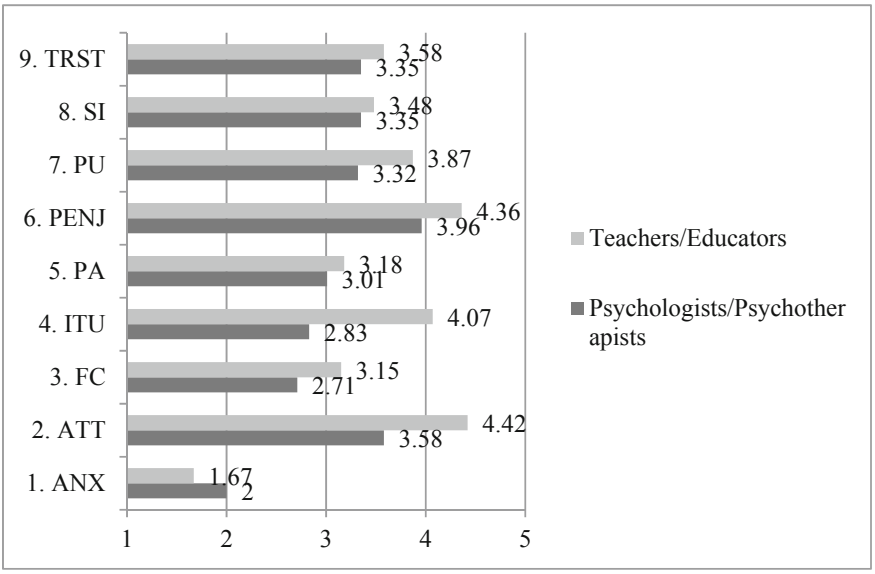

Fig. 1. Means of the examined variables per subgroup

groups. Specifically, teachers and educators showed higher positive attitudes towards robotics (F (1, 88) = 16.24; $p < .001$; $\eta^2_p = .16$), higher intentions to use robotics (F (1, 88) = 26.93; $p < .001$; $\eta^2_p = .24$), higher perceived enjoinment of robotics (F (1, 88) = 4.37; $p = .04$; $\eta^2_p = .05$), and higher perceived usefulness of robotics in their own work (F (1, 88) = 6.68; $p = .011$; $\eta^2_p = .07$) as compared to psychologists/psychotherapists. No other significant differences were found (all $ps > .05$).

5 Discussions

This research indicated that, for teachers, educators and psychologists/psychotherapists, the intention to use robotics in future professional work was negatively related to anxiety evoked by robotics but positively related to the individuals' 1) positive attitudes about the use of robotics, 2) perceptions that there are factors in the environment that facilitate using robotics (e.g. the knowledge of robotics), 3) perceptions of the ability of robotics to be adaptive to the changing needs of the users in their working environments, 4) perceptions of robotics as enjoyable in its own right, aside from any performance consequences resulting from system usage, 5) perceptions of utility or that robotics will improve the user's workplace performance, 6) positive perceptions of what other people think about robotics (that is the positive social influence), 7) perceptions that robotics performs with integrity and reliability. The first remark is dedicated to the evident, even not tremendously big, difference in perception between the group of teachers, educators and the 'therapists'. This is not surprising because this latter group has less opportunity to fully exploit robotics within their specialization and the literature regarding opportunities

within the classroom by special needs support teachers is not so vast. This aspect could also be motivated by the difficulties associated with the introduction of robotics in clinical trials, from the ethical considerations to the recruitment phase where parents have to agree on the participation in the study as well as the involvement of qualified operators [25–27]. Teachers, educators and psychologists/psychotherapists declared themselves as being quite favorable towards the use of robotics in their profession. As for the differences between the two groups, teachers/educators showed higher scores as compared to psychologists/psychotherapists in relation to the positive attitudes towards robotics, intentions to use robotics, perceived enjoyment of robotics, and perceived usefulness of robotics in their own work. The differences are particularly high regarding the *intention to use* and *attitudes*. These two dimensions, together with *perceived enjoyment*, are also the ones with more relevant positive scores, but in general results are rather positive which confirm that ER has broken the barrier of simple curiosity towards a serious consideration of it as a usable learning tool. The *anxiety* negative aspect shows low numbers but *facilitating factors* does not show an outstanding score: evidently the general perception is still that the school system has some inertia in welcoming not widely tested technologies such as ER, which was further confirmed by the relatively low score of perceived adaptability.

In general, these study results show that ER could be more integrated in educational contexts and for therapeutic and rehabilitation purposes. Further studies should include larger and more balanced samples. Furthermore, future studies could explore teachers' opinions concerning the use of ER for engagement given the importance of this topic for psychological field [28] and inspect what other factors in the teaching and social context might influence the attitudes and use of robots. For instance, the focus on curriculum and high stakes testing may also affect the use of the robot in schools adversely [29–31]. Furthermore, the role of gender of the participants and/or sex of the robot could be investigated in terms of positive attitudes towards the use of robots in educational and mental health contexts [32].

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