Brief Report

Learning Support Teachers' Intention to Use Educational Robotics: The Role of Perception of Usefulness and Adaptability

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Abstract: The implementation of Educational Robotics (ER) with special needs students (SNS) has been found to be helpful for knowledge improvement, by keeping students engaged and decreasing the risks of social exclusion. The present study aimed to investigate the relationship between learning support teachers' (LST) perceptions about ER (i.e., perceptions of usefulness and adaptability) and intention to use ER with SNS. The data were collected via a questionnaire administered to 187 teachers at the end of a post-degree specialisation course. The results showed that LST perceived ER as highly useful for any typology of SNS; however, their perceptions of the usefulness of ER were stronger than their intention to use ER, particularly in the case of neurodevelopmental disabilities. In this case, participants reported that ER is less adaptable than useful and less adaptable with neurodevelopmental disorders than with socio-economic, cultural and linguistic disadvantages. Hierarchical multiple regressions showed that the intention to use ER for neurodevelopmental disorders was predicted by the perception of adaptability and the teacher's level of experience with ER. As for socio-economic, cultural and linguistic disadvantages, the intention to use ER was predicted by the perception of usefulness and adaptability.

Keywords: educational robotics; attitudes; learning support teachers; special needs students; intention to use

1. Introduction

Educational Robotics (ER) is a promising educational approach in which robots are used as mediators of concepts and motivators that promote scholastic and academic achievement (particularly, but not limited to, the STEM disciplines, i.e., Science, Technology, Engineering, and Mathematics). It is focused on designing, assembling and implementing algorithms to control robots that interact with children and teachers [1–3]. This approach is based on the constructivism and constructionism theories [4,5] and social learning theories [6,7].

ER has a variety of positive impacts on learning motivation, computational thinking, problem solving, cooperative learning and interest in STEM as well as it is found to offer new socially inclusive opportunities [3,8–15]. Studies have also found that ER activities improve self-confidence, increase the drive to do well in school, provide challenging experiences, allow the application of abstract concepts to tangible tasks, and foster learning of 21st-century workplace skills [16,17].

However, scholars found that possessing the equipment for ER and using it are not the same. Previous studies [1,2,18–20] have found that most teachers have positive attitudes towards ER, agreeing to consider it as a useful tool for promoting several skills for special needs students (SNS). However, other studies have also highlighted that there are still some critical reflections and suspicion in respect of the use of robots in the fields of education and caring for people [21–24]. For instance, Heerink and colleagues [19] argued that,

even in the face of scientific evidence, robots are often not implemented in the fields of education because of factors like perceptions of (non)adaptability of robotics or negative social influences.

Studies have shown that among several factors, perceived usefulness (i.e., the degree to which a person believes that using the system would enhance his or her daily activities) and perceived adaptability (i.e., the perceived ability of the system to be adaptive to the users' changing needs) are important factors in predicting the intention to use—and the actual use—of ER [19,25]. Both perceived usefulness and perceived adaptability can be conceptualised as factors of performance expectancy that represent strong motivators of intention to use a target technology [26,27].

Since 1989, Davis [28] specified that the user's perceptions of usefulness and ease of use of a certain technology impact the intention to use it, and this, in turn, predicts the actual use of a specific system. In 2009, Heerink et al. [19] measured the acceptance of an assistive social robot for elderly care environments. The authors found a strong correlation between the perceived adaptability and the perceived usefulness of the robot and a moderate relationship between perceived usefulness and the intention to use the social robot. Conti and colleagues [25] tested the acceptance of the use of robots in the field of education. Their results suggested a positive relationship between perceived adaptability, perceived usefulness, and the intention to use ER in a sample of Italian rehabilitation care practitioners and university students. All the participants showed a positive global attitude toward the use of the robot. However, practitioners with higher levels of professional experience and older ones considered the experience with the robot less pleasant and this, in turn, negatively influenced their intention to use ER. Conti et al. [25] argued that the practitioners' professional experience allows them to identify negative practical issues that could be encountered with the use of a robot with children affected by severe disabilities.

Special needs can be seen as risk factors that can reduce access to education and limit access to learning in particular areas e.g., [10]. The term "special needs" means different things that may be subject to different interpretations in different countries. In Italy, the Ministry of Education introduced the recognition of students with Special Educational Needs (Ministerial Directive of 27 December 2012) [29], recognising that "every pupil, continuously or for certain periods, may display Special Educational Needs: either for physical, biological, physiological reasons or also for psychological or social reasons, in respect of which it is necessary for schools to offer an adequate and personalised response." However, the definitions of special needs provided by the different Member States in Europe, as well as the policies and the degree of inclusion of students with special needs within the mainstream educational system, have resulted in being unstandardised [30]. In order to enable international policy comparisons in this field, the Organization for Economic Cooperation and Development (OECD) promoted a framework for classifying SNS, dividing them into three categories: (1) certified disability based on genetic syndromes, sensory disorders and intellectual disabilities; (2) difficulties whose organic origin is under discussion and which do not appear to have originated from socio-economic, cultural or linguistic factors (e.g., attention deficits and hyperactivity); and (3) socio-economic, linguistic and cultural disadvantages. However, attention deficits and hyperactivity, autism spectrum disorders and other disabilities were not always consistently diagnosed in every country within a common category of special needs [31], so the distinction between OECD categories 1 and 2 was sometimes blurred and dependent on different diagnostic and educational choices. However, many of the neurodevelopmental disorders as classified by the Diagnostic and Statistical Manual of Mental Disorders (DSM-V, see APA, 2013) [32] were included in the first two OECD categories, whereas the third category included all those students needing special attention because of socio-economic, linguistic and cultural disadvantages.

In schools, learning support teachers (LST) play a fundamental role in guaranteeing the inclusion of all SNS and an inclusive teaching practice using ER [1,2]. Teachers can use ER as a tool for knowledge construction and as an assistive instrument for students

who have problems in specific fields. ER can also be used to change students' attitudes to learning by allowing everyone to be accepted and involved in class [10]. In this sense, ER with SNS plays a role in knowledge enhancement, keeping students engaged and decreasing the risks of social exclusion and dropping out [33,34]. However, ER may also cause negative outcomes if the task is overly complex and pedagogical support is not provided [10]. For this reason, the role of LST is of primary importance.

In Italy, ER initiatives coordinated and supported by the government are recent. Therefore, teachers need to be trained both to design and deliver effective courses for children [35]. Even though teachers appear to be enthusiastic about ER activities, many of them feel uncertainty, anxiety, or even fear regarding the technologies used in daily teaching practice [36–39] which results in the weak presence of ER in the classroom.

The main aim of this study was to explore Italian LST's perceptions (i.e., perceptions of usefulness and adaptability) and intention to use ER with SNS and to investigate factors predicting this intention. In line with recent research, we expected that LST would judge ER as being useful and adaptable to the education of CSN, but at the same time, they would be hesitant as regards actually using this didactical approach with CSN, particularly in the case of people with severe disabilities such as neurodevelopmental disorders (e.g., cerebral palsy; Hp1). We also predicted that LST perception of the usefulness and adaptability of ER with SNS would be significant predictors of their intention to use ER (Hp2). Furthermore, teachers' years of experience and previous knowledge about ER might also impact the intention to use ER with SNS. Indeed, Conti et al. [25] found that rehabilitation care practitioners with lengthier teaching experience perceived ER as being a limited tool, which may provide a real advancement over other established techniques only if it were more synergistically integrated with therapeutic protocols specific to SNS. Other recent studies found that teaching experience and age were negatively associated with positive attitudes toward ER, while knowledge of educational robotics was positively associated with them [38]. Therefore, on the grounds of these results, years of teaching experience could be negatively related to the intention to use ER with SNS. However, in line with other studies revealing that the experience with technology and the extent to which people tend to perform behaviours with the technology automatically are positively related to the intention to use it [26], we also predicted that the specific experience related to ER would have a positive relationship with the intention to use. On the contrary, teachers' age may be negatively related to the intention to use ER [38].

2. Method

2.1. Participants

The participants were 187 Italian teachers with different specialisations (e.g., maths teachers, English teachers) at the end of a post-degree specialisation course for LST in Italy. All the teachers attended a 1-year certification program comprising the required ER course (i.e., one 2-h plenary and three 2-h-long modules) via an online platform due to restrictions caused by the COVID-19 pandemic [40]. Some examples of activities comprised experiences with the Lego Mindstorms EV3 robot and the Open Roberta Lab simulator.

Fifteen participants refused to give their consent to participate and were removed from the data collection. The remaining sample consisted of 172 participants, 157 females (91.3%) and 14 males (8.1%; 1 missing response for gender) aged from 25 to 57 years (*M* = 39.67 years, *SD* = 7.21). Fifteen participants (8.7%) teach at kindergarten, 53 (30.8%) in a primary school, 50 (29.1%) at a junior secondary school, and 51 (29.7%) at a senior secondary school (3 missing responses for the type of school). According to their teaching experience, only five participants reported having no teaching experience (2.9%), whereas 55.2% of them had been teaching for at least 4 years (ranging from 0 up to 40 years; *M* = 6.45; *Mdn* = 4; *SD* = 5.65). Furthermore, 123 participants (71.5%) had had no previous experience concerning ER, whereas 49 participants (28.5%) reported a moderate previous experience.

An anonymous online questionnaire was administered to the participants at the end of the classes in May 2021. The research was compliant with the Code of Ethics of the Italian Psychology Association [41].

2.2. Materials

Participants gave their opinion on how helpful ER is, how adaptable to their work with SNS, and their intention to use ER for a series of special needs. Participants first read the following instructions: "*Below is a list of the major disabilities or difficulties you may encounter among your students with special needs. Think about the application of Educational Robotics in these specific cases and respond to the following statements. Educational Robotics is helpful [adaptable] for . . . [I intend to use Educational Robotics in the near future with . . .].*"

They then rated usefulness, adaptability and intention to use ER for the following eight special needs: Attention Deficit Hyperactivity Disorder—ADHD, Down Syndrome—DS, Cerebral Palsy—CP, Intellectual Disability—ID, Dyspraxia or motor disability, Autism Spectrum Disorder—ASD, Economic or social disadvantages, and Needs of foreign students. Each item was assessed on a 5-point Likert scale (1 = absolutely no; 5 = absolutely yes). Higher scores indicated that participants felt ER was helpful and adaptable for their category of specific difficulty and that they planned to use ER with that specific need in the near future. The original questionnaire is available in the Supplementary Materials. The selection of eight special needs was based on previous studies exploring the attitudes toward ER [1,2] on the basis of the classification of the neurodevelopmental disorders (ND) of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V, see APA 2013) [32], and the literature concerning inclusive education [10]. On the findings of this literature, we computed a mean score from the items concerning neurodevelopmental disorders (including ADHD, DS, CP, ID, Dyspraxia or motor disability, and ASD) and a mean score for the items concerning students with socio-economic, cultural, and linguistic disadvantages (including economic or social disadvantages, and the cultural needs of foreign students). In other words, the application of ER for each of the two main categories of special needs was evaluated by teachers on three dimensions as follows:

1. usefulness of ER (neurodevelopmental disorders: $\alpha = 0.85$; $M = 3.58$, $SD = 0.77$, *Skewness* $= -0.36$, *Kurtosis* $= -0.31$; socio-economic, cultural and linguistic disadvantages: $r = 0.75$, $p < 0.001$, $M = 3.60$, $SD = 1.09$, *Skewness* $= -0.34$, *Kurtosis* $= -0.70$);

2. adaptability of ER (neurodevelopmental disorders: $\alpha = 0.85$; $M = 3.53$, $SD = 0.77$, *Skewness* $= -0.25$, *Kurtosis* $= -0.13$; socio-economic, cultural and linguistic disadvantages: $r = 0.82$, $p < 0.001$, $M = 3.88$, $SD = 1.07$, *Skewness* $= -0.66$, *Kurtosis* $= -0.39$);

3. intention to use ER (neurodevelopmental disorders: $\alpha = 0.91$, $M = 3.34$, $SD = 0.99$, *Skewness* $= -0.55$, *Kurtosis* $= -0.02$; socio-economic, cultural and linguistic disadvantages: $r = 0.84$; $p < 0.001$, $M = 3.49$, $SD = 1.23$, *Skewness* $= -0.35$, *Kurtosis* $= -0.89$) (Cronbach's alpha is a reliability coefficient commonly used in social psychology, providing a measure of internal consistency of tests and measures. For applied research, a level above 0.8 is considered optimal [42]. Pearson correlation coefficient (*r*) is the most common way of measuring the strength and direction of the relation between two variables (items, in our case). The correlations between the two items composing the index of socio-economic, cultural and linguistic disadvantages were 0.75 for usefulness, 0.82 for adaptability and 0.84 for intention to use, all of them were significant at $p < 0.001$ level, showing a strong positive association between the two variables for each index.)

We also measured the self-reported participants' gender (1 = male; 2 = female; 3 = other), age, and education level at which participants were teaching (corresponding to the Italian education stage system: 1 = kindergarten, 2 = primary school, 3 = junior secondary school, and 4 = senior secondary school), teaching subject (e.g., math teacher), years of teaching and level of previous experience in using ER.

2.3. Statistical Analyses

We ran descriptive and correlation analyses to explore the relationships between variables and checked the assumptions of normality. Normality thresholds were defined as follows: lower than 3 and lower than 8 for Skewness and Kurtosis, respectively [43,44]. Subsequently, we tested the predictions using repeated measure Analyses of Variance (ANOVA) and multiple regression analyses. Analyses were performed using the Statistical Package for Social Sciences (SPSS).

3. Results

3.1. Preliminary Analyses

Normality test results using normal analyses of the Kolmogorov-Smirnov and Shapiro–Wilk tests were significant ($p < 0.05$). However, Skewness and Kurtosis values were under 1 and were regularly distributed due to their range [43,44]. Table 1 shows the correlations between measures investigated in the study. The analyses indicated that all these measures were positively related. Table 2 presents descriptive statistics for each specific special need. One-sample *t*-test also revealed that ER was perceived as being quite helpful, adaptable and utilisable for each of the proposed special needs. Indeed, all means were significantly greater than the scale midpoint (= 3).

Table 1. Bivariate Correlations among Variables.

	1	2	3	4	5	6
Neurodevelopmental Disorders						
1. Usefulness	1					
2. Adaptability	0.84 **	1				
3. Intention to Use	0.66 **	0.75 **	1			
Socio-economic, cultural and linguistic disadvantages						
4. Usefulness	0.62 **	0.54 **	0.49 **	1		
5. Adaptability	0.60 **	0.66 **	0.48 **	0.72 **	1	
6. Intention to Use	0.39 **	0.48 **	0.68 **	0.71 **	0.62 **	1

Note. ** = $p < 0.001$.

Table 2. Descriptive Statistics for Each Special Need.

		Usefulness of ER	Adaptability of ER	Intention to Use ER
Neurodevelopmental Disorders	1. ADHD	$M = 3.85$ ($SD = 1.03$) $n = 170$	$M = 3.85$ ($SD = 1.00$) $n = 167$	$M = 3.54$ ($SD = 1.19$) $n = 163$
	2. DS	$M = 3.57$ ($SD = 0.99$) $n = 167$	$M = 3.66$ ($SD = 0.99$) $n = 166$	$M = 3.36$ ($SD = 1.87$) $n = 159$
	3. CP	$M = 3.14$ ($SD = 1.00$) $n = 166$	$M = 2.97$ ($SD = 1.01$) $n = 165$	$M = 2.87$ ($SD = 1.05$) $n = 158$
	4. ID	$M = 3.57$ ($SD = 0.97$) $n = 168$	$M = 3.42$ ($SD = 1.03$) $n = 167$	$M = 3.34$ ($SD = 1.16$) $n = 162$
	5. Dyspraxia or motor disability	$M = 3.66$ ($SD = 1.00$) $n = 170$	$M = 3.61$ ($SD = 0.95$) $n = 168$	$M = 3.45$ ($SD = 1.14$) $n = 156$
	6. ASD	$M = 3.80$ ($SD = 0.98$) $n = 170$	$M = 3.70$ ($SD = 0.92$) $n = 169$	$M = 3.64$ ($SD = 1.19$) $n = 161$

Table 2. *Cont.*

		Usefulness of ER	Adaptability of ER	Intention to Use ER
Socio-economic, cultural and linguistic disadvantages	7. Economic or social difficulties	M = 3.50 (SD = 1.19) n = 170	M = 3.83 (SD = 1.15) n = 168	M = 3.46 (SD = 1.26) n = 159
	8. Needs of a foreign student	M = 3.70 (SD = 1.13) n = 171	M = 3.95 (SD = 1.07) n = 170	M = 3.56 (SD = 1.26) n = 161

Note: The response scale ranged between 1 = absolutely no; to 5 = absolutely yes.

3.2. Main Results

In order to investigate the perception of usefulness, adaptability and the intention to use ER for the two types of special needs, we carried out a 2 (type of special needs: Neurodevelopmental vs Socio-economic, cultural and linguistic disadvantages) $\times$ 3 (evaluations: usefulness, adaptability and intention to use) repeated measure ANOVA with the 6 measures varying within subjects. *Mauchly's test* indicated that the assumption of sphericity had not been violated, $\chi^2(2) = 3.95$, $p = 0.14$. Pairwise analyses adopting the Bonferroni correction were run.

The ANOVA yielded a significant main effect of the type of special needs, $F(2, 159) = 15.69$, $p < 0.001$, $\eta^2_p = 0.17$, and a significant main effect concerning evaluations, $F(1, 160) = 10.25$, $p = 0.006$, $\eta^2_p = 0.07$, qualified by a reliable two-way interaction, $F(2, 159) = 16.30$, $p < 0.001$, $\eta^2_p = 0.17$ (see Figure 1).
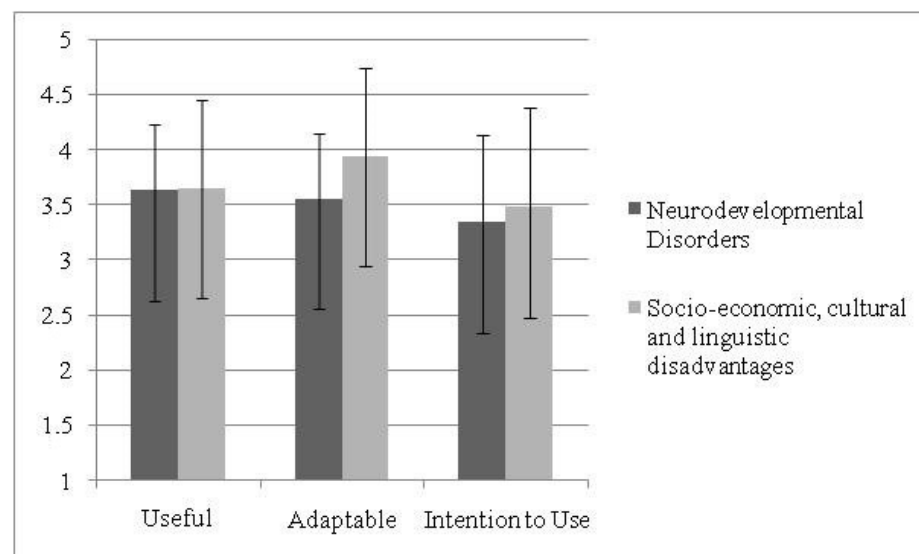

Figure 1. The Teachers' Perception of Usefulness, Adaptability and the Intention to Use ER for the two types of Special Needs.

Pairwise comparisons showed that as for neurodevelopment disorders, participants reported that ER was more useful (M = 3.63, SD = 0.73) than adaptable (M = 3.55, SD = 0.74; $p = 0.02$), more useful than their real intention to use it (M = 3.34; SD = 0.98; $p < 0.001$), and more adaptable than their intention to use it ($p < 0.001$), $F(2, 159) = 12.44$, $p < 0.001$, $\eta^2_p = 0.13$. In other words, participants judged ER as being useful, but at the same time, they expressed lower perceptions of adaptability and intention to use it in their daily practice in the case of neurodevelopmental disorders.

As for socio-economic, cultural and linguistic disadvantages, participants reported that ER was more adaptable (M = 3.94, SD = 1.00) than useful (M = 3.65, SD = 1.00; $p < 0.001$), more useful than their actual intention to use it (M = 3.49, SD = 1.20; $p = 0.02$), and more adaptable than their wish to use it ($p < 0.001$), $F(2, 159) = 17.06$, $p < 0.001$, $\eta^2_p = 0.18$. In other

words, participants judged ER as being extremely adaptable, but they showed a lower intention to use it.

Furthermore, as for its usefulness, participants reported that ER was equally useful for neurodevelopmental disorders and socio-economic, cultural and linguistic disadvantages, $F(1, 160) = 0.98$, $p = 0.76$, but more adaptable in the case of socio-economic, cultural and linguistic disadvantages than neurodevelopmental disorders, $F(1, 160) = 38.13$, $p < 0.001$, $\eta^2_p = 0.19$. They also reported a higher intention to use ER in the case of students with socio-economic, cultural and linguistic disadvantages rather than neurodevelopmental disorders, $F(1, 160) = 4.37$, $p = 0.04$, $\eta^2_p = 0.03$. In other words, participants evaluated ER as being equally useful for didactic purposes both in the case of neurodevelopmental disorders and in the case of socio-economic and cultural disadvantage. Moreover, they found it to be far more adaptable in the case of a socio-economic, cultural and linguistic disadvantage than in the case of neurodevelopmental disorders. Finally, they expressed their intention to use it more in the cases of socio-economic, cultural and linguistically disadvantaged children than in the case of students with neurodevelopmental disorders.

We also used multiple regression analyses to assess and compare the degree to which the participant's age, years of teaching experience, previous experience of ER, perceptions of usefulness and adaptability of ER would predict the variance in the intention to use ER in the near future with SNS. The variance inflation factor (VIF) was used to assess the degree of multicollinearity among the variables. The results showed the VIF for each of the independent variables was below the critical value of 10.00 [45]. To investigate this, we performed two hierarchical multiple regressions, one with teachers' intention to use ER with students with neurodevelopmental disorders as the dependent variable and one with teachers' intention to use ER with students with socio-economic, cultural and linguistic disadvantages. For both analyses, we entered the control variables at stage 1 (i.e., participants' age, years of experience in their work, and previous experience of ER), and then we added perceptions of the usefulness and adaptability of ER at stage 2. The standardised coefficients (β) are presented in Table 3. As for the first analysis with the intention to use ER with students with neurodevelopmental disorders as the dependent variable, Model 1 showed that previous experience with ER was related to teachers' intention to use ER with students with neurodevelopmental disorders. In Model 2, both the teachers' previous experience with ER and adaptability were positively related to the intention to use ER with students with neurodevelopmental disorders. As for the second analysis, with the intention to use ER with students with socio-economic, cultural and linguistic disadvantages as the dependent variable, Model 3 showed that age and previous knowledge of ER were related to teachers' intention to use ER with students with socio-economic, cultural and linguistic disadvantages. In Model 4, the teachers' perceptions of usefulness and adaptability were positively related to the intention to use ER with students with socio-economic, cultural and linguistic disadvantages.

Table 3. Hierarchical Multiple Regressions.

Independent Variable	Neurodevelopmental Disorders		Socio-Economic, Cultural and Linguistic Disadvantages	
	Model 1	Model 2	Model 3	Model 4
Age	−0.09	−0.07	−0.19 *	−0.09
Teaching experience	0.01	0.01	0.01	0.04
Knowledge of ER	0.15 *	0.13 *	0.17 *	0.11
Usefulness	-	0.14	-	0.53 **
Adaptability	-	0.63 **	-	0.24 **
R^2	0.03	0.58 **	0.07 *	0.56 **
ΔR^2	-	0.55 **	-	0.50 **
Adjust R^2	0.01	0.57 **	0.05 *	0.55 **
F	1.65	43.82 **	3.68 *	39.61 **

Note. * = $p < 0.05$; ** = $p < 0.001$.

4. Discussion

Many studies have reported the positive attitudes of teachers towards ER (e.g., [1–3]). More than other technological tools used in the classroom for teaching activities, ER is considered a powerful tool is contributing to student's emotional and intellectual engagement due to the physical embodiment of the robotic kits and the change of promoting students' communication skills in groups [38]. However, the implementation of this didactic approach is sporadic and scattered. In-service teachers tend to have doubts concerning the incorporation of new forms of technology in schools and about how they would introduce ER in classes due to the lack of knowledge, resources, and official assistance [38]. A strong relationship exists between teachers' attitudes towards technology and their intentions and actions [39,46]. This study investigated some of the reasons behind such small-scale implementation by measuring LST perception of usefulness, the adaptability of ER and their relationship with the intention to use it. Specifically, we explored those perceptions for two sets of special needs, i.e., (1) neurodevelopmental disorders; and (2) socio-economic, cultural and linguistic disadvantages. Finally, we investigated the role played by teachers' attitudes, age and level of expertise in their intention to use ER for each of the two sets of special needs.

Results showed that evaluations of ER were generally positive, in line with previous studies (e.g., [47–50]).

Specifically, LST perceived that ER was equally useful for any typology of special needs (i.e., students with neurodevelopmental disorders and socio-economic, cultural and linguistic disadvantages). However, in line with our hypotheses, LST perceptions of the adaptability and usefulness of ER were stronger than their intention to use ER with SNS, particularly in the case of neurodevelopmental disabilities. Concerning neurodevelopmental disorders, participants reported that ER was less adaptable than useful and less adaptable than in the case of socio-economic, cultural and linguistic disadvantages. Furthermore, concerning the socio-economic, cultural and linguistic disadvantages, teachers perceived ER as being more adaptable than useful.

Regression analyses showed that, as for neurodevelopmental problems, the intention to use ER was not predicted by the perception of usefulness, age or years of teaching experience, but it related to the perception of adaptability of ER and to teachers' previous specific experience about ER. As for socio-economic, cultural and linguistic disadvantages, the intention to use ER was predicted by the perception of usefulness and adaptability. One possible explanation for our results lies in the difficulties of inexperienced teachers in imagining the application of ER for neurodevelopmental disorders and needs. Teachers with less specific experience in ER may need more mentoring and professional development to adopt ER effectively. These results are partially in line with those found by other studies that have emphasised teachers' scepticism about using ER with very young or preschool children. For instance, Papadakis et al. [38] found that years of teaching experience and technological competence were influential factors in attitudes towards ER technology adoption in the case of preschool children because experience allowed teachers to integrate curricula that effectively accommodated preschool students' needs.

Although there are many studies reporting teachers' points of view in the case of ER with special needs children (e.g., [51,52]), to our knowledge, our study is the first one that compares teachers' opinions on the implementation of curricular ER in case of neurodevelopmental disorders and of children with socio-economic, cultural and linguistic disadvantages. In general, our results confirm those obtained in other studies revealing that the experience with a technology positively impacts the intention to use it [26]. Results also suggest that teachers' knowledge about the utility, ease of use, and applicability of robotics, and about the benefits of ER in educational contexts, may improve the use of ER, even considering the cost of robotic systems and the lack of specific institutional injunctions [38,53]. Broadly speaking, those results are in line with those of Negrini [48], showing that when robots are seen as educational tools used to foster disciplinary or transversal skills, teachers have rather positive attitudes towards robotics (e.g., [54]).

The presence of a collaborative learning community, the guidance of facilitators or guided practice may be key solutions for improving the intention to use ER, sustaining the sense of usefulness and enthusiasm. Given the important role teachers play in schools and the many challenges they face in their daily work, including lack of infrastructure, shortage of budget, limited training and heavy workload, teachers need appropriate training to learn about new forms of educational technology so that they can effectively integrate technology into their practice. As each new tool requires the necessary facilities, a deeper understanding of its educational relevance and advanced classroom management skills, teachers find themselves at the centre of a considerable challenge. Teachers need to receive appropriate pedagogical and technical support to build confidence and self-esteem to integrate these technologies into their daily practice (European Commission/EACEA/Eurydice, 2019) [55].

In a similar vein, Papadakis et al. [38] highlighted the importance of providing teachers with appropriate curricula, including ER courses and practical experience workshops, as well as peer group learning and mentoring experiences. Schina et al. [56] recommended that in future ER, teacher training research should be conducted on teachers of children with special educational needs and preschool teachers. Also, the positive evaluation of ER among teachers in our study calls for the support of school administrators in planning and negotiating STEM educational work, as well as in providing an appropriate budget, to empower teachers to implement STEM education via ER [57]. This way, school administrators could create communication opportunities to listen to what teachers need in order to support STEM education implementation.

This study had some limitations that ought to be borne in mind when interpreting the results. First of all, the convenience sample is of limited size and is mainly made up of female participants, leading to low representativeness of the sample and low generalisability of the results. This disproportionally female sample is, however, in line with the uneven distribution of gender in the LST role in Italy. Furthermore, the majority of the participants had no previous ER experience. Therefore future research should explore the same topic in a more representative and balanced sample. Also, given the exploratory nature of our study, we consider our findings as preliminary. For instance, future studies could qualitatively explore the major reasons for not implementing robotics in classrooms from the teachers' own words. Furthermore, other factors related to the intention to use ER, such as hedonic motivations and social influences [58,59], should also be considered in future studies. Nevertheless, this study provides some evidence of the factors influencing teachers' intentions to use ER and suggestions for an effective instructional framework for implementing ER in classrooms to help students with different special needs.

5. Conclusions

Teachers seldom receive extensive training on ER outside of a technology-oriented field, causing misconceptions about the usefulness and applicability of robotics in classes. Such barriers, combined with the cost of some ER systems, the complexity of special needs, and the lack of specific and mandatory institutional protocols, may lead to the avoidance of technology usage in schools. The existing studies on this topic mainly presented qualitative data and rarely distinguished between different types of disadvantages. Results of this study showed that Italian LST perceptions of usefulness concerning ER were generally positive. However, their intention to use ER with SNS was related to their previous experience with these technologies and the teachers' ability to visualise the potential adoption of ER, particularly in cases of students with severe disabilities such as neurodevelopmental disorders. This study proposed that ER courses should provide the trainees with practical experiences and knowledge of the potentially useful and adaptable applications of ER with different special needs.

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