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Personality factors and acceptability of socially assistive robotics in teachers with and without specialized training for children with disability

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Abstract

Personality factors can be predictors of acceptability and intention to use new technologies, especially regarding education and care fields in the whole lifespan.
The aim of this study was to evaluate the predictive factors and attitudes of curricular and specialized teachers towards socially assistive robotics and the intention to use robots in teaching activities.
In our research, we investigated the impact of the personality factors measured with the Big Five Questionnaire, on acceptability questionnaires derived by Eurobarometer and by the model Unified Theory of the Acceptance and Use of Technology (UTAUT), administered respectively before and after showing the possible uses of the robot NAO in education and teaching.
The study was conducted in four schools, participants were 114 teachers (52.07 ± 8.22), aged 26 to 68 years, of the primary and middle school level.
The results highlight the primary role of the personality factors Openness to Experience and Extraversion for promoting the acceptability and reduce the prejudicial reject regarding the use of educational and assistive robotic technologies.
In conclusion, for using at best robotics in education, teachers need to receive appropriate training - also on the basis of their attitudes and personality traits - to learn how to plan their educational activities integrating the robotics tools.

1. Introduction

In recent years, the use of new technologies, like robotics, has been tested in many fields of application and has opened up new views in the world of rehabilitation, psychology and education, along the whole individual lifespan from kids to elderly.

Indeed, humanoid robots can assist in tasks ranging from coaching elderly patients in physical exercise (Fasola & Matarić, 2013; Yousuf, Kobayashi, Kuno, Yamazaki, & Yamazaki, 2012) or in the field of education and care on the therapeutic applications for children with developmental disabilities (Diehl, Schmitt, Villano, & Crowell, 2012; Rabbitt, Kazdin, & Scassellati, 2014), to personalise health education for children (Belpaeme et al., 2012; Blanson et al., 2013), to assist either teachers in telling pre-recorded stories to preschool children (Fridin, 2014)or parents in home education (Kang, Freedman, Matarić, Cunningham, & Lopez, 2005). Robots have been used for simulating cognitive dysfunction (Conti, Di Nuovo, & Di Nuovo, 2015) and for the subsequent simulation of rehabilitation treatment (Conti, Di Nuovo, Cangelosi, & Di Nuovo, 2016).

Socially Assistive Robotics (SAR) is the class of robotics that provides assistance to human users through social, rather than physical, interaction (Feil-Seifer & Mataric, 2011). Currently, the main populations in which SAR with children has been tested and applied are patients with motor disorders (Wainer, Feil-Seifer, Shell, & Matarić, 2006), children with autism spectrum disorders (Conti, Di Nuovo, Trubia, Buono, & Di Nuovo, 2015; Villano et al., 2011) and kindergarten kids (Conti, Di Nuovo, Cirasa, & Di Nuovo, 2017).

In the field of child care, several studies have shown the positive impact of SAR on children with social disorders (Kozima, Nakagawa, & Yano, 2004; Tanaka, Movellan, Fortenberry, & Aisaka, 2006) and typically developing children (Kozima et al., 2004).

For this reason, the use of technologies in educational processes, including robotics, has been widely studied and their high acceptance among the students have been proved (Sciutti, Rea, & Sandini, 2014; Conti, Cattani, Di Nuovo, & Di Nuovo, 2015). However, most studies in this sector focused mainly on user characteristics, acceptance of robots in the classroom, and interaction between them and robot but is reduced the literature that focused on the teacher's perspective (Buabeng-Andoh, 2012).

Considering that technology-supported educational practices are becoming increasingly introduced and implemented in the teaching process, the acceptance of innovative educational technology by teachers is a crucial issue (Hiltz, 1994; Jonassen, Peck, & Wilson, 1999).

The results of various studies have shown that the training allowed teachers to advanced knowledge and skills in using and integrating robotics in STEM (Science, Technology, Engineering and Math). Several studies (Chalmers & Macbeth, 2013; Hu & Garimella, 2015) indicated that teachers' development of knowledge affected positively their confidence in implementing robotics in their classrooms, after attending workshops and an increase in the number of teachers planning to use this tool after they have gone through the training. Findings illustrated the importance of training to support teachers' development of knowledge and skills about robotics in the classroom. In another study the author (Eguchi, 2014) noted that robotics provides rich "opportunities to integrate not only STEM but also many other disciplines, including literacy, social studies, dance, music and art, while giving students the opportunity to find new ways to work together to foster collaboration skills, express themselves using the technological tool, problem-solve, and think critically and innovatively."

For this reasons without the teacher's acceptance, educational technology cannot hope to deliver its potential value (Zhao, Tan, & Mishra, 2001). Currently, robot developers and practitioners are concerned about the acceptability of their tools. As a Eurobarometer study of public attitudes towards robots shows, many people in Europe resist this idea of using robots in caring activities: 60% of EU citizens say that robots should be banned from the care of children, elderly people and people with disabilities. There is also still considerable opposition to using robots in other 'human'

areas: 34 % of respondents say robots should be banned in education, 27 % are against the use of robots in healthcare and 20 % oppose their use for leisure purposes (European Commission, 2012).
While on the one hand the studies begin to be concerned with the "personality" of the robot, i.e. the physical and expressive characteristics that this must have (De Ruyter, Saini, Markopoulos, & Van Breemen, 2005), few are still interested in the relationship between the traits of personality and the acceptability of subject who use robotics, especially in the educational field.
It is not new the idea that individual differences, including personality traits, have an impact on the use and success of computer systems. It has long been known that personality traits act as antecedents to attitudes and cognitive behaviours and to the subsequent involvement with technologies (Agarwal & Prasad, 1999; Harrison & Rainer Jr, 1992; Zmud, 1979).
Several studies have used the aspects of the "Big Five Factors" model (Goldberg, 1990; McCrae & Costa, 2003) to study the relationship between personality traits and internet and computer acceptance. These studies examined the five factors that define the model: Extroversion, Agreeableness, Consciousness, Emotional Stability, and Openness to Experience. These factors have been studied also in relation to the use of computer tools and social networks (Rosen & Kluemper, 2008), less about robotics technology.

2. Aims and hypothesis

The aim of the current study was to examine the impact of the Big Five personality traits on robotics technology acceptance by curricular and specialized teachers. With "specialised" teacher we mean additional training/specialisation for work with pupils with disability.
To the best of our knowledge, very few studies on robotics systems have examined this impact; when many professionals in the field of mental health and education begin to use this technology, it is important for researchers to determine if a certainly personality type is more likely than others to use this form of technology. In particular, it was intended to study which specific features are predictors of greater acceptance; it is expected that positive personality factors will correlate with equally positive emotions towards the robot and with the perception of utility and intention of use.
While this study is limited in context to SAR and using NAO humanoid robots, it will be important to know whether certain personality types are more likely than others to accept general forms of robotics technology.

3. Methods

3.1. Participants

All participants had no previous experience of interaction with social robotic platforms and were recruited from four schools of primary and middle level. A total of 114 teachers participated in this experiment; 49 (=42.98%) were specialized for assisting pupils with disabilities. The average age was 52.07 years, standard deviation 8.22; ages ranged from 26 to 68 years. The 84.21% of the sample was female, representing the composition of teacher's general population. As regards education, 62.26% had a Master's degree, 25.43% a High School degree. The average years of experience in teaching were 23.85, while among teachers specialized for disability were 2.17.
The ethical committee of each school approved the experiment protocols, the participants gave us their written informed consent and all the data were collected in anonymous way.

3.2. Instruments

3.2.1. The NAO Humanoid Robotic Platform

The robotic platform used in our experiments is a NAO robot (Gouaillier et al., 2009) that is 58 cm tall humanoid robot that looks like a toy and we used *Choreographe*, a developmental environment provided by the robot manufacturer Softbank Robotics (Pot, Monceaux, Gelin, & Maisonnier, 2009) to program its behaviours. NAO robot has 25 degrees of freedom, which allows it to perform a variety of movements. The robot speaks with a child's voice, expresses emotions (through verbal and non-verbal communication), and uses proper vocabulary. In the various studies that have used it, this robot was perceived by the participants as a smart, non-threatening educational tool (Nalin, Tabor, Bergamini, & Sanna, 2012) with whom children and the elderly can positively interact (López Recio, Márquez Segura, Márquez Segura, & Waern, 2013; Shamsuddin, Yussof, Ismail, Hanapiah, et al., 2012). Furthermore, NAO has pioneered the use of robotic toys as therapeutic and educational aides and it is widely used in SAR (e.g. Fridin & Belokopytov, 2014; Kim, Park, & Shyam Sundar, 2013; Shamsuddin, Yussof, Ismail, Mohamed, et al., 2012), especially in acceptance studies (e.g. Conti, Cattani, et al., 2015; Conti, Di Nuovo, Buono, & Di Nuovo, 2017; De Graaf & Ben Allouch, 2013).

3.2.2. Big Five Questionnaire - BFQ-2 (Italian adaptation of Caprara, Barbaranelli, Borgogni, & Secchione, 2007).
Measures the "5 Big Factors" considered fundamental in personality description:
- Extraversion (E): subjects with high scores on this scale are considered "sociable, gregarious, assertive, talkative, and active",
- Agreeableness (A): trait associated with being courteous, flexible, trusting, good-natured, forgiving, cooperative, soft-hearted and tolerant;
- Conscientiousness (C): reflects dependability; that is, being careful, thorough, responsible, organized, and planful;
- Emotional Stability (ES): absence of feelings of anxiety, worry, insecurity and depression;
- Openness to Experience (OE): commonly associated with traits such as being imaginative, cultured, curious, original, broad-minded, intelligent, and artistically sensitive; this factor helps distinguishing creative from more conventional people (Barrick & Mount, 1991).

3.2.3. Eurobarometer Questionnaire
It was derived from Eurobarometer questionnaire (European Commission, 2012), and consisted of questions aimed at investigating in the participants the knowledge and attitude towards robotics and the use of it before their experimental demonstration. For our purpose, we use only 12 items of the original questionnaire. In particular, are asked to indicate three main areas in which the subject thinks the robot can be used or otherwise be banned.

3.2.4. Unified Theory of the Acceptance and Use of Technology (UTAUT)
This theory of acceptance and usability derives to a questionnaire proposed by Venkatesh, Morris, Davis, & Davis (2003), verified by De Ruyter & Aarts (2004) and further improved by Heerink, Kröse, Evers, & Wielinga (2009), resulting in high reliability.
The original UTAUT English questionnaire was translated into Italian language and then back into English to ensure translation equivalence (Brislin, 1970). Before starting the experiment, we conducted a pilot study with the questionnaire (N = 4) to confirm the clarity of the instructions the wording of the questions and to receive any comments to identify potential needs of modification.
In our version, we use only 29 of the 36 questions of the original questionnaire. Three questions are reversed in negative (12, 17,20) compared to the original and the statements were not grouped by construct but mixed, in order to maintain a high level of attention and avoid random or preference responses of participants.
Definitely, participants indicate their agreement level to 29 statements on a five-point Likert scale including verbal anchors: totally disagree (1) – disagree (2) – neither agree nor disagree (3) – agree (4) – totally agree (5).
Scores are sub-scales that represent specific robotic acceptance constructs that are:
- Anxiety in the perception of robots (ANX): evoking anxious or emotional reactions when using

the robot;
- Attitude to use them (ATT): positive or negative feelings about the appliance of the technology;
- Facilitating Conditions in their use (FC), objective factors in the environment that facilitate using the robot;
- Intention To Use (ITU): the outspoken intention to use the robot over a longer period in time;
- Perceived Adaptability (PAD): the perceived ability of the robot to be adaptive to the changing needs of the user,
- Perceived Enjoyment (PENJ): feelings of joy or pleasure associated by the user with the use of robot;
- Perception of Sociability (PS): the perceived ability of the robot to perform sociable behaviour;
- Perceived Usefulness (PU): the degree to which a person believes that using the system would enhance his or her daily activities;
- Social Influence (SI): the user's perception of how people who are important to him think about him using the robot;
- Social Presence (SP): the experience of sensing a social entity when interacting with the robot;
- Trust (TR): the belief that the robot can perform with personal integrity and reliability.

3.3. Procedure

The experiment was performed in school rooms that had a good light and without background noise. All the rooms were equipped with a high definition projector and with non-fixed chairs.
The experiment was carried out during two different afternoon sessions.
During the first session, the teachers filled out the BFQ-2 questionnaire without any time limit.
After a week, the second session was held, consisting of three parts. First, the participants compiled 12 items of Eurobarometer questionnaire. After return of the questionnaire, a video was screened for the NAO robotic platform in which the robot interacted with children both in the field of education (Conti, Di Nuovo, Cirasa, et al., 2017) and in a clinical setting (Conti, Di Nuovo, Trubia, et al., 2015) of about 7 minutes.
At the end of the projection, each participant was given the UTAUT questionnaire that could be compiled without any time limit. The total time for the second session was about forty minutes.
All participants anonymously filled the questionnaire. A final discussion was held to allow participants to express their own thoughts and, thus, provide more information for the research.
All questionnaires BFQ-2, Eurobarometer and UTAUT, were compiled in anonymous form, with the exception of demographic and cultural characteristics. Furthermore, in order to attribute each questionnaire to a person, each teacher was asked to write a word, number, or letter to remember and use at each session.

4. Data Analysis

The descriptive analysis of the tendency to the use of technology was performed, using Student's *t* to evaluate differences between teachers with and without specialization.
Linear zero-order correlations between BFQ factors, UTAUT and Eurobarometer variables were calculated using Pearson *r*. Pearson's correlation was used also to examine the relationship between educational and assistive use of the robot and educational and assistive rejection of the robot, for curricular and specialized teachers, and the constructs of the UTAUT questionnaire.
A stepwise multiple regression analysis with the backward method (p to remove=.15) to test the hypotheses considering BFQ factors as predictors and acceptation as dependent variables.
All the statistical analyses were performed using the Statistical Package for Social Science (SPSS), version 24.

5. Results

In line with the Eurobarometer research(European Commission, 2012), the perception that teachers have before the experimental demonstration of the fields where the robot can be used with greater profit, mainly concerns industrial production (20.17% as the first choice), search and rescue (16.66%) and home use, e.g. cleaning up (14.91%). None of the respondents predicted the use of the robot for education as the first choice, while it was a second choice for 2.67% and third choice for 3.5% of participants.

At the same time, the first areas in which robots' use should be banned are leisure (14.91%), education (14.03%) and care of children, elderly and the disabled (9.64%). However, the 34.32% of the sample claims that robots "should not be forbidden in any field".

Table 1 reports the comparison and differences between the teachers with and without specialization.

Table 1 -*Differences between the two groups of teachers, and statistical significance.*

	Specialized Teachers		Curricular Teachers		Differences	
	M	*SD*	M	*SD*	t	*p*
Teaching Experience (years)	21.96	10.07	26.67	10.81	-2.03	.04
Do you think that in education the robots should be used as a priority?	.20	.70	.08	.50	.87	.38
Do you think that in care of children, elderly, and disabled the robots should be used as a priority?	.41	.88	.19	.62	1.23	.22
Do you think that in education the robots should be banned?	.88	1.18	1.22	1.26	-1.28	.20
Do you think that in care of children, elderly, and disabled the robots should be banned?	.61	1.03	.75	1.02	-.60	.54
Anxiety	3.17	1.01	2.94	1.08	.99	.32
Intention to Use	2.98	.99	2.80	.84	.88	.37
Perceived Usefulness	3.25	.85	2.98	.86	1.43	.15

Examining the correlations in the participants' sample, emerges with statistical significance ($p < .05$, after Bonferroni's correction) that the Extraversion factor (E) correlates with Perceived Usefulness (PU=.21), Social Presence (PS=.32) and also with Social Influence (SI=.31). Furthermore, teachers' Extraversion correlates with Attitude (ATT=.273), with Perceived Enjoyment (PENJ=.32) and Perceived Adaptability (PAD =.35). Finally, the Extraversion shows a significant correlation with Facilitating Conditions (FC=.36) and Intention to Use robots (ITU=.35); this could explain the correlation existing between Extraversion and the teachers' agreement with the Eurobarometer item affirming that "robots are a good thing for society, because they help people" (r =.27).

The Agreeableness factor (A) is directly related to the general interest that the sample demonstrates for scientific discoveries and technological developments (r=.27), and the agreement that robots are a good social support in the Eurobarometer questionnaire (r=.22). Agreeableness is also related to Perceived Enjoyment (PENJ =.19) and Perceived Adaptability (PAD =.29).

Conscientiousness factor (C) correlates with interest in scientific discoveries and technological developments (r=.25), and with the perception that robots can be a good social support (r=.21).

The Emotional Stability factor (ES), which is the control of emotions and impulses, is directly related to more Anxiety in the perception of robots (ANX=.25), more Perceived Enjoyment

(PENJ=.21), Perceived Adaptability (PAD=.19), Perception Sociability(PS=.21) and Trust (TR=.21) in robotic fields.
The Openness to Experience(OE) correlates directly with interest in scientific discoveries and technological developments (r=.34), with the idea that robots can be social support (= .35) and specifically "robots are needed because they can do jobs that are too fatigued or dangerous for people" (r=.21). Openness to Experience (OE) allows for to find in technology a good ally for Perception Sociability (PS =.19) because it is believed that "the robot will be able to increase future job opportunities" (r=.18). All this is supported by Attitude (ATT=.31), a good perception of technology usefulness (r=.24), Perceived Enjoyment (PENJ=.39) and Perceived Adaptability (PAD=.29) in the Intention To Use (ITU=22) of robot. To confirm this, we find that the factor Openness to Experience(OE) is inversely related to the reject to use of the robot in educational (r=-.19) and assistive (r=-.22) fields. However, a condition of Openness to Experience(OE) involves also a tendency to Anxiety (ANX =.26) typical of the new conditions.
Finally, the Lie scale (L), which provides a measure of the respondent's propensity to give a falsely positive outlook in a social context, is directly correlates with Social Influence (SI=.22), with Social Presence (SP=.20) and with Trust (TR=.22). Finally, the subject who tends to create a favourable self-distortion (with a higher Lie score) tends to give a better perception of assistive robotics regarding the variables of influence and social presence of trust.

Multiple regression analyses have evaluated the incidence of BFQ test factors (considered as predictors) on individual variables of the questionnaires regarding acceptability; only the variables resulted significant in the previous correlational analysis were included in the regression model. The results are shown in Tables 2, 3a and 3b.
In Table 2 we can see that Agreeableness (A) and Emotional Stability (ES) are predictors of Acceptance the social utility of the robot, while Openness to Experience (OE) is a predictor of both interest in technology and also the acceptance of the social utility of the robot.

Table 2 - *Multiple regressions - Predictors: BFQ factors; dependent variables: Interest in technology and Acceptance the social utility of the robot (Eurobarometer).*

BFQ	**Interest in technology**			**Acceptance the social utility of the robot**		
	R^2=.155			R^2=.162		
	β	**t**	***p***	**β**	**t**	***p***
Extraversion	.00	.03	.97	.05	.61	.54
Agreeableness	.06	.58	.56	.25	2.50	**.01**
Conscientiousness	.16	1.61	.11	-.07	-.70	.48
Emotional Stability	-.03	-.36	.71	-.26	-2.81	**.00**
Openness to Experience	.29	2.89	**.00**	.22	2.21	**.02**

Tables 3a and 3b shows that Extraversion is predictor of all of the variables of the UTAUT, with the exception of Anxiety.
Agreeableness is only predictor of Perceived Adaptability, while Conscientiousness besides being a predictor of Perceived Adaptability, is also a predictor of Perceived Usefulness and Perception Sociability.
Finally, Emotional Stability is predictor of Anxiety, whereas Openness to Experience is predictors of Attitude, Perceived Enjoyment and Perceived Usefulness.

Table 3a - *Multiple regression - Predictors: BFQ factors; dependent variables: Anxiety (ANX), Attitude towards robots (ATT), Intention To Use them (ITU), Perceived Enjoyment (PED) and Perceived Adaptability (PAD)*

BFQ	**Anxiety**			**Attitude**			**Intention to Use**			**Perceived Enjoyment**			**Perceived Adaptability**		
	R^2=.115			R^2=.140			R^2=.160			R^2=.230			R^2=.209		
	β	**t**	***p***	**β**	**t**	***p***	**β**	**t**	***p***	**β**	**t**	***p***	**β**	**t**	***p***
Extraversion	-.05	-.51	.60	.18	1.96	**.05**	.33	3.54	**.00**	.22	2.47	**.01**	.26	2.82	**.00**
Agreeableness	.05	.51	.61	.07	.72	.47	.08	.83	.40	.08	.81	.41	.23	2.36	**.02**
Conscientiousness	.05	.55	.57	-.07	-.075	.45	-.16	-1.65	.10	-.15	-1.63	.10	-.11	-1.66	**.09**
Emotional Stability	.19	2.05	**.04**	.05	.53	.59	-.01	-.10	.91	.09	1.05	.29	.07	.86	.38
Openness to Experience	.19	1.91	.06	.22	2.24	**.02**	.11	1.15	.25	.30	3.17	**.00**	.14	1.46	.14

Table 3b - *Multiple regression - Predictors: BFQ factors; dependent variables: Perceived Usefulness (PU) and Perception Sociability (PS)*

BFQ	**Perceived Usefulness**			**Perception Sociability**		
	R^2=.126			R^2=.165		
	β	**t**	***p***	**β**	**t**	***p***
Extraversion	.18	1.85	**.06**	.30	3.19	**.00**
Agreeableness	-.04	-.39	.69	.08	.79	.42
Conscientiousness	-.17	-1.75	**.08**	-.17	-1.80	**.07**
Emotional Stability	.08	.91	.36	.14	1.56	.12
Openness to Experience	.22	2.16	**.03**	.07	.71	.47

A further analysis was devoted to assess separately for curricular and specialized teachers the correlations between educational and assistive use or rejection of the robots, and UTAUT questionnaire constructs Perceived Enjoyment, Usefulness and Intention to use (table 4).

Table 4 - *Pearson correlations separate for curricular and specialized teachers between educational and assistive use or rejection of the robots, and UTAUT questionnaire constructs Perceived Enjoyment, Usefulness and Intention to use.*

	Perceived Enjoyment(PENJ)		Perceived Usefulness (PU)		Intention to Use (ITU)	
	curric.	*special.*	*curric.*	*special.*	*curric.*	*special.*
Do you think that in education the robots should be used as a priority?	-.00	.23	.00	**.31***	-.09	.15
Do you think that in care of children, elderly, and disabled the robots should be used as a priority?	.29	.12	.20	**.31***	.27	**.33***
Do you think that in education the robots should be banned?	-.20	**-.30***	-.10	**-.42****	-.26	**-.28***
Do you think that in care of children, elderly, and disabled the robots should be banned?	-.23	-.07	-.17	-.27	-.14	-.26
Age	-.07	.00	-.12	.07	-.32	.06
Teaching Experience (years)	-.06	.04	-.09	.09	**-.34***	.04

*p<.05 **p<.01

Perceived Enjoyment (PENJ) of specialized teachers is inversely related to the reject to use robots in educational sector (=-.30).
Perceived Usefulness (PU) the teachers with specialization correlate positively to use the robot as a priority in an assistive sector or rather in the care of children, the elderly and the disabled (=.31) and in the educational context (=.31). To confirm this, we find that there is a negative correlation with the reject to use robots in the educational sector (=-.42).
Teachers with specialization also intend to use robotic tools in the assistive context (=.33) and do not reject them in the educational sector (=-.28).
In the teachers without specialization Intention To Use (ITU) is inversely proportional to teaching experience, that is those with less years of work tend to be more willing to use robots during their teaching activities.
Finally, the correlations regarding age and teaching experience are low and not statistically significant (p>.05) for all the variables, except intention to use which inversely correlates with teaching experience.

6. Discussion

In this paper, we reported the results of a study on traits of personality and acceptance of robotic technology in the education field by a group of teachers, both curricular and specialized, of the primary and middle school level.
The study confirmed the reliability of the UTAUT model and questionnaire and its applicability in the context of education.
Results have shown that Openness to Experience plays a decisive role in the interest of scientific discoveries and technological developments, such feelings of joy or pleasure, associated with the use of the robot, develop the belief that the using the system would improve its daily activities.
In addition, Conscientiousness allows perceiving the robot capable of adapting to the changing needs of the user, even of social behaviour, and this leads to think that the use would improve its daily activities.
However, the personality factor that has a determining role is Extraversion, where we find subjects sociable, assertive, talkative, and active. We have reported how all the constructs of the UTAUT are related to this personality factor, with the exception of anxiety. In the teachers without

specialization the Intention To Use is inversely proportional to teaching experience, that is those with less years of work (i.e. the younger teachers) tend to be more willing to use robots during their teaching activities.
In conclusion, we have found that in order to plan the use of robots in the educational field, is appropriate to considerate the personality of the teachers, both with specialization and without specialization. In order to effectively integrate robotics in education and continue to bring the typical Extraversion and curiosity of the early years of experience, teachers need to receive appropriate training to learn how to program and integrate the tools into their teaching (Vollstedt, Robinson, & Wang, 2007).Some researchers (Alemdar & Rosen, 2011) stressed that well-trained teachers along with an appropriate theoretical and pedagogical foundation are essential to successful integration of robotics in the classroom.
We highlight that the meaningful benefits of technology including robotics can be achieved if those tools are accepted, used and implemented by skilful and knowledgeable teachers to support students' educational needs (Thomaz et al., 2009). For this reason, the implementation of robotics requires providing teachers with sufficient training to ensure they feel comfortable with programming and how to integrate robotics in the activities (Santos et al., 2016; Vollstedt et al., 2007).
One limitation of the study is the use of videos as stimuli. We have shown a video to the participants, it is difficult to know their interpretation and imagination. Indeed, the videos are useful to understand indirect interaction and impressions from perception, but in order to understand the effect of embodiment, it is necessary to conduct real interactions among robot and users.

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