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Teaching With the Nao Robot: Teacher - Users' Attitudes

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Teaching With the *Nao* Robot: Teacher - Users' Attitudes

Cristina Gardenghi, Laura Gherardi

Abstract: The proposed paper critically explores the implications of digital educational tools on teaching processes rather than on learning processes by analysing interviews with teachers who have used the NAO robot in three schools near Bologna, within the European project EDUROB (2016-2018). The use of this instrument is considered to be affected by the whole socio-technical *milieu* (the "classrooms"), which includes cultural assumptions about digital artefacts. Hence, our hypothesis is that teachers play a key role in transmitting pre-assumed beliefs and concerns about technology to students, especially if training courses for all the teacher-users are not guaranteed. As an example of possible critical consequences from a lack of training, the authors underline "non-expert" teachers' tendency to use the NAO robot as an assistant in doing their job. In these cases, teachers unintentionally convey to students interpretations of this technology that are likely to be far from the expected ones. Here, the role of the robot ranges from a tool for enhancing education to an "entertainer".

Keywords: educational robotics, training, teacher-workers, critical issues

Introduction: Educational robotics: a brief state of the art

The pervasive digital presence characterizing the current labor market and society at large has introduced debates at national and international levels about technology's use in schools. Precisely, their presence has made it necessary to adjust approaches and educational programmes to teach for the unprecedented 21st century skills (Eguchi, 2014a): logic and computational thinking (Grover, 2011), robotics (Petre & Price, 2004), creativity and curiosity about the elaboration of alternative solutions (Gubenko et al., 2021), problem solving (La Paglia et al., 2017), all of which can be implemented through the construction and programming of robots (Negrini & Bernaschina, 2018). In fact, there are a growing number of pilot projects utilizing robots for educational purposes mainly due the the need for schools need to align themselves with technical-digital methodologies and adequately prepare students with these skills which are generally incorporated in the STEM disciplines (Druin & Hendler, 2000; Alimisis & Kynigos, 2009; Eguchi, 2014b; Jung & Won, 2018), an area where approximately 80% of these experiments are carried out.

The literature that is interested in promoting the use of digital tools for educational purposes has made wide use of Papert's constructionist approach (1986; 1994) and of its possible contemporary applications (Denicolai, Grimaldi & Palmieri, 2017). In addition to Papert, among the most frequently cited authors is Dewey (1910; Benitti, 2012) referring to the *learning by doing* method (Moro et al., 2011), as well as Vygotsky, in reference to the notion of *mediated learning* (Vygotsky, 1978; Haywood, 2008), *proximal development* (Vygotskij, 1978; Calvani, 1998; Alanazi, 2016; Yousif M., 2021) and *engagement*. The latter concept is especially mentioned in several trials as an index of success in measuring the effectiveness of assistive or social robotics interventions (Negrini & Bernaschina, 2018). Within the literature and applications, a separate discussion is made about disabilities, where robots take on an assistive role, as part of Assistive Technologies. They are employed in the aid of disabled individuals as an adjunct to their caregivers, i.e. educators, doctors or support teachers. In fact, robotic assistance is present in hybrid forms for these individuals' education:: the use of robots aims, on the one hand, to enhance interpersonal skills by stimulating interaction (Yousif M., 2021) and communication by training on social signals (Littler et al., 2021; Salimi, et al., 2021) in cases of autism spectrum disorder in particular, and on the other hand, to improve learning outcomes such as computational thinking or problem solving.

Despite its rapid spread, and perhaps also because of the rush (Gui, 2019) typical of technological revolutions, educational robotics is still characterised by critical and unresolved issues. There is an open cultural and scientific

debate regarding the effectiveness (Hughes-Roberts et al., 2018; Belpaeme et al., 2018) and usefulness of robotic interventions (Benitti, 2012; Buffardi et al., 2021), where the effectiveness of robot-based learning is particularly difficult to measure (Gui & Gerosa, 2019). Several studies report critical issues related to the creation of a properly structured and informed context (Sefton-Green, Nixon & Erstad, 2009; Midoro, 2013; Oddone & Firpo, 2015; Pandolfini, 2016) in which to embed robots to avoid negative implications arising from their improper or uninformed use (Calvani & Menichetti, 2013; Capogna et al., 2019), rather than issues with the tools themselves. The literature also stresses the significance of teacher's personal attitudes towards technology (Benigno, Chifari & Chiorri, 2014) and its introduction into educational practices (Buffardi et. al., 2021; Masullo et al., 2021; Benigno Chifari & Chiorri, 2014; Meirink et al., 2009; Wayne & Youngs, 2003; Pitzalis & De Feo, 2019; Lim & Chai, 2008; Liu, 2011). In this article, teacher training is considered as a variable (Donnelli, Mcgarr & O'reilli J, 2011; Vayola, 2016; Calzone & Chellini, 2016; Nirchi, 2016; Muñoz et al., 2016; Argentin, Gui & Tamanini, 2013) in relation to the socio-technical reception of digital tools by teachers and the consequent transmission of certain socio-technical imaginaries to learners through the different uses of these tools in the classroom. Specifically, in this article the analysed artefact is NAO, a humanoid assistive robot produced by SoftBank Robotics; to date, one of the most widely used assistive robots (Zohreh et al., 2021) in both ambulatory and educational settings, due to its extensive functionality and accessibility (Yousif M., 2021, 17).

Data and research methodology

The pilot research presented here originates as a spin-off of the European project EDUROB (Desideri et al., 2017); the Bologna case study was examined, which was one of the two Italian cases and hence provided us with access to the field. The research was conducted in two primary schools in the province of Bologna and, for comparison, in a scientific high school in the city centre. The schools appear in the article as: Inst. 1, primary school "Enzo Biagi", part of the Comprehensive Institute of Medicina, province of Bologna; Inst. 2, primary school "Altedo-Malalbergo", part of the Comprehensive Institute of Malalbergo, province of Bologna; Inst. 3. Scientific High School "Augusto Righi", Bologna.

The article delves into the strengths and limits of the use of the humanoid robot NAO from the viewpoints of the teacher-users interviewed.

The methods

The starting point of this research is therefore fundamentally *grounded*, translating the need to investigate the enhancement or lack of empowerment

of the role of the teacher as a worker - both on a practical and social level -, as a result of the use of this new technological tool. By placing ourselves in the literature which analyses the teacher's standpoint with respect to educational robotics, the present study contributes the social interpretation that teachers as *workers* give to robots as tools to do their jobs, and how this is reflected in different socio-technical "locations" of the robot in the classroom. This ties in to both the research concerning teachers' attitudes as users of new tools (robots, ICTs) and the studies that focus on robotics in classrooms with respect to the technological imaginaries conveyed. Before conducting the interviews with teachers, we decided to submit the interviews to two key informants employed in the EDUROB Research

The methodology used consisted of in-depth semi-structured interviews conducted between January and September 2020[1] with ten teachers, including curricular teachers, support teachers and educators who had experienced using NAO in the classroom. The group of respondents is listed below with some of the main characteristics useful to this research, as the biographical ones (age, gender, work-role and workplace) and the ones related to the uses of robot NAO (mode and time of usage). The respondents were the following:

Institute 1:

- Female, 40, Inst. 1; support teacher; she "met" NAO in 2017 in other training courses; she used it with small groups of students, with the student – target (asd[2] student) and 2 – 3 peers.
- Female, 37, Inst. 1; support teacher; she used NAO during the academic year 2019 – 2020, until the school closures due to the covid pandemic; she used it both with small groups including the student – target (asd student) and with the whole classroom.
- Female, 62, Inst. 1; curricular teacher; she used NAO during the academic year 2019 – 2020, until the school closures due to the covid pandemic; she used it with the whole classrooms.
- Male, 51, Inst. 1; curricular teacher; he used NAO during the academic year 2019 – 2020, until the school closures due to the covid pandemic; she used it with the whole classrooms.

Institute 2:

- Female, 28, Inst. 2; support teacher; she used NAO during the academic year 2019 – 2020, until the school closures due to the covid pandemic; she used it with the student target (asd student) and a small group of peers (2/3).

[1] The experimentation with the schools was not over yet, but it has been interrupted due to the covid – 19 pandemic. The continuing of the project was not defined yet at the time of the interviews.

[2] Autism – Spectrum Disorder.

- Female, 36, Inst. 2; curricular teacher; she used NAO during the academic years 2018 -2019 and 2019 – 2020, until the school closures due to the covid pandemic; she used it with the whole classrooms.
- Female, 49, Inst. 2; curricular teacher; she used NAO during the academic year 2019 – 2020, until the school closures due to the covid pandemic; she used it with the whole classrooms.
- Female, 32, Inst. 2; support teacher; she used NAO during the academic year 2019 – 2020, until the school closures due to the covid pandemic; she used it with the student target (asd student) and a small group of peers (2/3)

Institute 3:

- Male, 27, Inst. 3; educator; he used NAO during the academic year 2019 – 2020, until the school closure due to the covid pandemic;
- Female, 25, Inst. 3; educator; she used NAO during the academic years 2018 - 2019 and 2019 – 2020, until the school closures due to the covid pandemic.[3]

After conducting the interviews, we transcribed them all and only after doing so, we started analysing the thematic areas that emerged in the responses to each questions. In doing so, we found out 4 main most recurring topics:

- The need for new ways to get and maintain the attention of students;
- The "novelty effects" of educational technologies and the "easier engagement" (female, 36, Inst. 2) of students' attention that the technologies enable;
- The limits of not knowing how to programme and then, control, autonomously, the robot;
- The necessity of time to learn the technical part and to prepare lessons with the new technological tools.

After we highlighted these ones as the most recurrent topics, we further analysed them as part of two bigger thematic areas, wich were then particularly explored. These two were:

1. Perceptions concerning the impact of NAO's usage on the teachers' role: both teachers' perceptions of the "empowerment" of their teaching brought by the robot (NAO's role in the teacher-worker's actions) and of the "empowerment" of their role as teachers. The latter was investigated with regard to the reaction of colleagues, parents and students to the in-

[3] Both the educators used NAO robot with the student target (one asd student; one with no specified disabilities) but, in both cases, the robot has been programmed by the peers of the student target with the help of an external expert. In this way the robot here had a double function: for the classroom, a technological exercise, for the target – student, a mean for better learning and socialising with the mates.

sertion of new technologies in the school and in the classroom. This made it possible to consider the different receptions of the same robot with regards to the influence of different *socio-technical milieux*.
2. Elements that enabled/disabled the teacher's use of the technology.

ROBOT-BASED teaching: the perspective of teacher - users

The majority of the interviewees stated that they felt "*facilitated*"[4] and "*empowered*" in performing their work due to the presence of the robot. The effectiveness of the robot was most often referred to with respect to its ability to 'stimulate attention' and 'maintain attention', especially in group work. Some of the teachers mentioned the usefulness of NAO in 'maintaining discipline', while others dwelt more on its playful aspects. Almost all the interviewees remarked on how much it affected making lessons more engaging, especially for children. The enthusiasm of the learners was usually to the extent that, as one respondent reported, the moment that a teacher brings NAO into the classroom, they are greeted as "*Maestr* Wonder Woman*" (Female, 28, Inst. 2). The impression unanimously reported by respondents who had experienced using NAO with groups (or with the whole class) was that students were "*literally thrilled*" by the possibility of having a robot lesson. Some interviews even report that students' enthusiasm was followed by that of their parents, which were happy to see their children so thrilled about a project. This fact was referred as a supplemental reason for the positive social reception of the robot within the school.

As far as the reaction of the teaching staff is concerned, the interviewees reported two relevant factors: the first was the "*admiration*" (Female, 40, Inst. 1) felt towards the first colleagues to use the robot. It should be specified however that in one case[5] an interviewer reported that the early adopters had been encouraged to use NAO by the school principal. This sense of "admiration" was in turn decisive for the following teachers to decide whether to undertake participation in the experiment or not. The second most relevant factor was competition: it was one interviewee who reported that, at a certain point of the experiment, "*some competition even arose for the use of the robot*" (Female, 37, Inst. 1). The initial utilisation of the robot, as it emerged from the interviewees' statements, appears to be linked to their "*personal predisposition*" (Female, 40, Inst. 1) to use technology in their own life, confirming the cited literature. To be "*recognised as those who use the robot*" (Female, 36, Inst. 2) or "*associated with*" those who use the robot at-

[4] The words of the interviewees are given in italics and in inverted commas, indicating that they are pointed quotations from the interviews.
[5] Inst. 1.

tracted "*friendliness*" from the students (Female, 62, Inst. 1; female, 36, Inst. 2) and "*satisfaction*" from the parents (Female, 37, Inst. 1). Thus, over time, particularly in one of the schools, even some of the initially more reluctant and less experienced teachers "*changed their attitude a little*" (Female, 40, Inst. 1) towards technology. What teachers face then, first and foremost, concerns an 'enhancement' of their own working *status*, thanks to the recognition of learners, parents and (often) colleagues. Via the use of the robot, they ensured themselves the "*cool teacher*" image (Female, 37, Inst. 1).

As far as the role of NAO as an assistive robot used to enhance engagement is concerned, the findings of this study are in line with the evidence emerging from the state of the art of current research. Among these findings is the difficulty to verify NAO's effectiveness in the long term, both because of the brevity of the trials (Kanda et al., 2004) and because of the so-called novelty effect that is caused by the newness of the technology (Hughes-Roberts T. et al., 2018). The novelty effect is an interesting variable because in almost all cases the interviewees reported "*difficulties in relating*" and "*having the attention*" of "*digital natives*" (Female, 36, Inst. 2; Female, 62, Inst. 1; Female, 28, Inst. 2). It is worth pointing out that the stereotype of the "digital native" (Margaryan, Littlejohn & Vojt, 2011; Prensky, 2001; Tapscott, 2008; Masullo et al., 2021) reinforces in teachers the belief that learners are impossible to entertain without resorting to robots or other digital technologies, thus enhancing teachers' own sense of inadequacy (cf. Vayola, 2016). This in turn often plays a role in adopting an approach with regards to the robot where the teacher delegates the most difficult part of his or her work in today's classrooms: the aspect of "taking care of attention" (Stiegler, 2014) of young people. In many interviews, the robot was described as "*more capable*" of making children pay attention, hence the delegation. In the words of some interviewees:

> I. "*For me it's a tutor. What I mean is it would be a tutor for the students... and for me it would be a support for the special education teaching.*" (Female, 28, Inst. 2)

In this context, the management of the complexity ascribed to the classroom was experienced by the teacher as a personal responsibility. This responsibility not only includes the acquisition of digital skills, but also, and just as important, the understanding of the learner, who is often not as 'technologised' as one would think (Livingstone & Helsper, 2007; Gui & Argentin, 2011; Calvani *et al.*, 2011; Magnini & Perrotta, 2011). In this regard, one interviewee stated:

> I: " *[...] there was no proposal for these children to be switched on. You could have imagined anything but there was nothing to switch them on. We were looking for something that would also motivate them to study,*

> *in some way that would create some interest […]. When the robot came into the classroom for the first time with the experts, they started to move it, it was interacting in the classroom with the children, it was a discovery for them. So, really, they were waiting for it, even the later meetings: "when is NAO coming?" Even if they were big kids, they were brought in to receive him."* (Female, 28, Inst. 2)

Other respondents considered, more generally, the "difference" of todays students:

> I: "*Anyway, children are a bit different nowadays compared to a few years ago so… anything that attracts them makes any learning meaningful."* (Female, 36, Inst. 2)

> I: "*Technologies help me a lot because they are their world, the world of young kids. It's also our world actually.. I could no longer work without them. And I'm even the oldest teacher in the whole school!*" (Female, 62, Inst. 1)

The relevance of the 'digital native entertainment'[6] factor seems to be called into question because of the difficulty teachers have in recreating enthusiasm in the class without resorting to the novelty effect, extended to all ICT. For example, one interviewed teacher stated:

> I: "*Maybe we're getting used to the interactive whiteboard, it's lost some of its charm, it's almost the norm, by now the children use it almost on their own, there's no longer this discovery if we want to say a point, that charm there… but the rest is really always very captivating. I'm thinking of first year children who see the beebot for the first time and have to discover how it works, and it moves… […]*" (Female, 40, Inst. 1)

Another one reported that:

> I: *"You have to use them* [the technologies] to maintain their attention [of students].. *'cause, otherwise, if you just teach in a traditional way, you lose their focus after a while. For example after I teach 1 hour of math, during which I just write on the LIM the exercises, if I have to*

[6] That digitalisation influences, as a tool, the shaping and proceeding of cognitive processes is now a widespread belief. The hypothesis of a relationship between certain addictions to ICTs and the type of disorders and academic difficulties (Ahmet & Selcan, 2019) associated with the 'digital native' is also beginning to be verified at a scientific research level (Wang, et al., 2019). There is, however, a distinction to be made between two kind of studies: firstly, there is the literature that attempts to solicit a reflection on risks and consequences, insisting, for example, on the strength with which digital offers continuous stimuli that solicit hyper attention to the detriment of deep attention (Wolf, 2007; Bufalino, 2020). Secondly is the body of literature that insists on calling for changes in teaching in order to cope with the alleged new problem of the so-called "digital natives", a narrative that plays into the teacher's feeling of inadequacy (cf. Vayola, 2016).

teach a geography class, I use a video for it, so I switch between different teaching methods. (Female, 62, Inst.1)

Finally, there are those who reported their own, personal, reflections:

> I: "*Of course, why am I not able to recreate the same…? hehe, because look, I can tell you, a little bit because NAO is more fun. They experienced NAO as a moment of leisure, a game of evasion and of curiosity; the same curiosity that you don't always manage to create in class, not always. […] Plus there is this wonderful object, who comes from another planet, with sparkling eyes who moves like a rapper without being one… even I would feel more attracted to NAO than to the teacher.*" (Female, 36, Inst. 1)

The maintenance of discipline was also delegated, at least partially:

> I: "*It works, it works. In the sense that they also paradoxically manage to respect turns better: the rules that you struggle to impose in class, like 'speak one at a time', 'you raise your hand when you speak', work better with the presence of this tool. They knew that NAO asked one question each so they waited when it might be their turn.*" (Female, 36, Inst. 1)

In another interview, it was reported that a teacher used NAO to call the children to order. While sitting behind the desk and controlling the robot, the teacher ordered NAO to say "*shut up*" and "*be quiet*".

The analysis of these descriptions of the practices in which the interviewees were involved led us to investigate the relationship between the teacher's training, the social interpretation of the digital object that the teacher receives from the context (personal and school) and the effects on the teaching practices enacted. The range of different uses, in fact, primarily reflects the variability of interpretations that can be given to NAO in the absence of shared training and considerations on the tool.

Uses and interpretations of NAO: the influence of attitude and teachers' training

When it comes to both involvement in intervention setting and related training, teachers are not guaranteed access to robot programming classes, nor are there any compulsory preliminary lessons to ensure a good understanding of the tool entrusted to them. This has meant, as some interviewees stated, that they sometimes felt limited in using the tool. In the words of one interviewee:

> I: "*I know how to turn it on but I don't know how to programme it*" (28 years old, female, Inst. 2)[7].

[7] The interviewee wonders, shortly afterwards, whether there would have been any train-

Another participant stated:

> I: "*Being a very advanced technology, it is also very advanced and complicated how to use it*" (Female, 40, Inst. 1).

The lack of guarantees in realising the robot's programming related potential was experienced and lamented by many respondents. In these cases, NAO was considered "*a tool with potential*" (Male, 27, Inst. 3) but difficult to learn to use independently. Moreover, if training courses are not provided, or are not compulsory, there is also the issue of finding a suitable training program and this requires resources. In addition to this, since participation in courses is voluntary it is not considered a part of teachers' working hours. In the words of one interviewee:

> "*[NAO] is a tool that if you bypass the programming problem and make it a simple tool, it becomes competitive when compared to other such tools."* (Male, 27, Inst. 3).

The interviewed teachers endorsed different interpretations of the robot, and consequently they used it in different ways. This, in turn, gave rise to different narratives conveyed to the learners, concerning both the robot and the relationship that the teacher, through it, establishes with the classroom. A teacher who employs NAO to "entertain" the class invests the robot with a role that can be defined as a *teaching assistant* aimed at maintaining attention. A more accurate definition hence, would be "*engagement-keeper*".

A robot that, in playful and amusing garb, animates the lesson by drawing attention to itself, invites the learners to interpret NAO in those terms. According to the teachers, at the end of one of the first encounters with NAO, a questionnaire (provided by the Edurob project leaders to the children) was submitted to the learners. The results showed that some students would like the robot as a "*brother*", others as a "*playmate*"[8]; we can assume that these responses were influenced by the storytelling of the robot as proposed by their teachers. Similarly, the few teachers who delegated the maintenance of order and rule to NAO were interpreting it as a *teaching assistant* for the maintenance of discipline - while the questionable interpretation of a *"discipline-keeper"* robot was proposed to the learners. Teachers that for personal or professional reasons were less technologically endowed assigned roles to NAO that were not dependent on know-how of the robot but rather assigned roles that happened naturally or were the easiest. These results confirm that NAO, just like other technological artefacts, plays the role and function assigned to it both technically and socially (Stiegler, 2014). If the technical

ing in NAO coding if there had not been the series of problems brought about by the covid - 19 pandemic. She seems hopeful.

[8] Words reported by interviewees who had followed this project phase.

function of the artefact is difficult to manage, like programming the robot, the actors that are not provided with the necessary skills will tend to assign the artefact the more socially widespread roles, which are also the easiest on a technical level. As cited above, NAO naturally captures attention because of its "novelty effect" without the need to know how to program it, so 'engagement keeper' is an easily assignable role. This confirms also that equally social is the way in which a tool is received, which reflects those initial social ascriptions (Vignola, 2014).

Among teachers with no previous training, many reported the difficulty of coding to program the robot as well as the effort and time required to make the robot work:

> "*NAO needs all its own groundwork, which is no small thing. If you want to do an hour's work, then you have to start preparing the robot half an hour, or even 40 minutes earlier - but I'm speaking as a non-programmer and non-expert [...]*" (Female, 40, Inst. 1).

However, the weight of training in this reception-transmission of the social interpretations of technical artefacts must be stressed. In fact, some teachers had, within the framework of this experiment, the opportunity to apply and refine technical know-how that they already had acquired through previous voluntary participation to lectures and seminars on robotics. These teachers with previous experience and training more often described robot's uses not just in terms of "being an assistant" but as a comprehensive educational digital tool, which allowed them to experience the educational potential provided by NAO.

Conversely, the fact of not being an expert of technologies seemed to be a further limitation, precisely because of the difficulties of self-learning this kind of know-how. As evidence of this, most claimed to have limited themselves to learning the easiest tasks such as recharging the batteries or commanding the NAO to speak and dance at the right time.

Thus, from what we observed, we can affirm that the interpretative distortion of the object appeared more frequently in cases where an informational and formative moment about the technology employed was lacking. These were also the cases in which the narratives of students as "*flat*" (Female, 36, Inst. 2) and the statements concerning the difficulty of running disinterested classrooms appeared to be related to the use of the robot as a solution for this kind of problem.

Furthermore, the propensity to go to training on the use of digital tools appears here to derive from two main factors: the first was personal interest in the digitalisation of education and more or less in-depth training. The second factor was the presence of (at least) one colleague already involved in the world of digitalisation of education. It is apparently the latter who is in charge of disseminating his/her own knowledge within the teaching staff (in

one case, in particular, the role of the curricular teacher who is also a *digital animator* was decisive).

In short, the absence of unambiguous guidelines for teachers involved in this kind of experimentation affects mostly those who, due to personal predisposition or lack of concrete possibilities, are driven to tackle these projects with only tacit knowledge of the technological-digital tools at their disposal (Ranieri, 2011). Where the literature highlights a weak motivation to join these projects (Guastavigna & Vayola, 2013), we decided to underline the lack of trainings for teachers to be better prepared and motivated to these experiments. Consequently, it was found that different uses and different understandings of the robot were provided to the students.

If training can play a role in this dynamic, it appears to be twofold. On the one hand, training can empower teachers to understand digital tools, and therefore, through that, what may be the difficulties or peculiarities of growing up in a digital world. On the other hand, teachers with a better understanding of these challenges may come to comprehend the relevance of their own role in guiding children in understanding such a *social*-technical world. Indeed, if a robot is offered to a teacher who is discouraged at the sight of students who are incomprehensible in their interests and ways of seeing the world, and who is unable to master the tool and convinced that learners react to the novelty effect exclusively, it is quite likely that he or she may, unwittingly, employ NAO as an "*engagement keeper*". In this way, however, the teacher re-proposes in the classroom the role of technologies as 'entertainment to be uncritically captivated by', which is the same role they play outside the school. Conversely, the target of many educational digitalisation programmes is to encourage active and conscious use. Enhancement occurs, in these cases, not by NAO supporting the teacher, but by means of the robot being in favour of the learners' interest in the robot itself (which is not always accompanied by an increased interest in the discipline being taught).

Concluding considerations

In conclusion, it seems safe to say that the teacher's training plays a major role, not only, as the literature states, at the level of technological knowledge then passed on to the learners, but also, and above all, in the ways in which the technological tool is interpreted and received socio-culturally. The value of training is underlined here due to this precise finding. "Uninformed" use encourages teachers to sort of "surrender" to the artefact, precisely because he or she is unable to exploit the potential to enhance his or her knowledge, or that of the students. This translates into the robot being used as an "engagement keeper".

Furthermore, this use reinforces in the social imaginary the idea that in order to 'capture' the attention of young people, it is necessary to employ the latest technological novelty (we refer here in particular to the words of the interviewees who suggested a continuous updating of NAO to prolong its novelty effect). Hence, the young person is impossible to interest on the one side, and the teacher is driven to use the robotic medium as a solution to the situation on the other. The aforementioned imagery, however, seems to facilitate not only a growing mistrust of the teacher in his or her own ability to manage the situation but also, at least from what emerged in this research, a consequent inclination of the teacher to accept (mostly uncritically) *robotic forms of work assistance*. The direction is dangerously close to technological solutionism (Morozov, 2011; 2014); an example of this can be seen in a new project with a robot endowed with social skills, which teaches in the classroom while the tutor pilots it from outside (Stipančić et al., 2021)[9].

Nevertheless, the learning enhancement, if not placed in a context enabled to realise it, seems to disempower aspects such as the teacher's self-confidence or the learners' ability to learn additional uses of technology, other than 'letting themselves be entertained'. The absence of a socio-technical milieu predisposed to these technologies also fosters the risk of delegating to the artefact some of the teacher's own responsibilities such as motivating learning and maintaining discipline. According to Bernard Stiegler (1998), the potential of technical objects in general, which would include the NAO robot, to be enabling for the subject that employs them, derives both from the sociotechnical organisation of the milieu in which the artefact is embedded and from the social interpretation that drives the use of the tool. Departing from an a priori categorisation of users (Prensky, 2001), we wanted to highlight the complexity of the socio-educational situation experienced by the teachers interviewed, in which technology is only supportive under certain conditions. In particular, the robot can be a source of potential and powerful capacitation processes if projects and experiments integrate training specifically designed for teachers, as well as an assessment by the teacher of the effectiveness of both the training and the transmission of knowledge in the classroom (Cicognini, Miotti & Bizzarri, 2019).

[9] The Journal of Pacific Rim Psychology published in 2021 a study testing the effectiveness of a social robot in the shoes of a 'teacher assistant', PLEA, which has 'teaching capabilities'. The robot, aided by an environment set up for such functions, is here enabled to analyse gestures, facial expressions and direction of gaze. These can be interpreted as indices of listening/distraction of learners, useful data for calibrating the way of 'teaching'. This robot, conceived and designed as a teacher assistant, despite explicitly having the role of a social medium, appears to be the only medium of communication, since, as the authors of the article underline, the teacher is placed outside the classroom, which is why learners often believe they are interacting directly with the robot.

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