Teachers' attitudes towards AI: what is the difference with non-AI technologies?

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Abstract

Educational technologies with AI are designed to personalize students' learning, but also to alleviate teacher's workload. However, acceptability of such technologies among teachers may be impacted by factors such as fear of replacement or ethical concerns. The purpose of the current study is to investigate attitudes of teachers towards educational tools with or without AI. The main hypothesis is that technologies with AI would be more negatively judged than technologies without AI, and thus intention to use would be weaker for technologies with AI. Results show that teachers seem to accurately perceive the potential benefit of AI technologies for reduction of workload, without feeling threatened by a replacement in the future. Ethical concerns are higher for AI technologies, but intention to use is similar. Differences between primary and secondary school teachers are discussed.

Keywords: Educational technologies; Acceptability; Teachers; Attitudes; Artificial Intelligence

Theoretical background

AI in education

Educational technologies seem accepted from teachers and widely used. Indeed, studies and reports across occidental populations show that attitudes of US-teachers towards educational technologies are generally positive (Williams, 2015). More than 80% of French teachers use technologies in class (PROFETIC, 2018, 2019), and German teachers report using technologies during 43% of a lesson duration (Sailer et al., 2021). However, uses are mainly passive, with few manipulations of systems by learners (PROFETIC, 2018, 2019; Sailer et al., 2021). Current development of Artificial Intelligence (AI) and its applications in education have the potential to transform educational tools, tasks and roles (Akgun & Greenhow, 2022; Bates et al., 2020; Ninaus & Sailer, 2022). AI systems are designed to replicate human intelligence processes such as learning (i.e., acquisition of information and rules) and reasoning (i.e., apply these rules to infer conclusions) to perform tasks (Chassignol et al., 2018; Gillath et al., 2021; Glikson & Woolley, 2020; Watson, 2019). Differences between AI and non-AI technologies may lie in the methods used to automatize and adapt tasks. AI includes machine learning, natural language processing, or various kinds of algorithms (Zawacki-Richter et al., 2019). AI-powered Educational systems (henceforth AIED) offer new possibilities such as automatization of organizational or administrative tasks, generation of course content, or learner's evaluation and feedback (Bryant et al., 2020; Chassignol et al., 2018). AIED technologies have the potential to make learners more active, as long as teachers actually use them. While educational technologies seem widely accepted (e.g., PROFETIC, 2018, 2019; Williams, 2015), the introduction of AIED implies to consider representations of such tools, especially among teachers, who will be impacted by these technologies.

Teachers' workload. AIED can be considered as the evolution of teaching machines as developed by Pressey (1927) or Skinner (1958). Since then, the main purpose is to act on learning situations to help learners, but also to save teachers from costly and demanding tasks. Major opportunities of AIED are to both enhance interaction and reduce effort (Bates et al., 2020). Organizational or administrative tasks, and generation of course content, are some of the educational activities that have the greatest potential of automatization, and thus are more likely to be processed by AI (Bryant et al., 2020; Chassignol et al., 2018). For instance, AI applications of predictive text using natural

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language processing (e.g., GPT3; Brown et al., 2020) may be used to generate lesson content and training exercises (Bryant et al., 2020; Nye et al., 2014). According to Bryant and colleagues (2020), 20 to 40% of teachers' working hours could be replaced by automatized activities. Then, this new amount of time could be allocated to improve teacher-learners relationships, support students and focus on personalized learning (Akgun & Greenhow, 2022; Bryant et al., 2020). To help even more personalized learning, learner's evaluation and feedback are also activities that can be partly automatized by AI (Bryant et al., 2020; Chassignol et al., 2018).

Personalized learning. Personalized learning may also be named learner-centered learning, or adaptive learning (Regan & Jesse, 2019). It is one of the most-known use of AI-based systems to assist teachers and support learners (Akgun & Greenhow, 2022). These AIED systems aim at detecting what, when and how to teach each learner (Huang, 2018). Their functioning is to 1) *record data* about learners' responses or activity (e.g., answers to questions, logs), 2) *detect patterns* from these data to identify gaps in learning (e.g., link log data to performance), model, profile and predict future learners' activity, and 3) *adapt learning environment* to learners' individual needs (Chassignol et al., 2018; Ninaus & Sailer, 2022). Adaptation is generally possible at two levels: macro-adaptation such as suggestions of next content, and micro-adaptation such as feedback and real time modifications of the task (Ninaus & Sailer, 2022; Plass & Pawar, 2020). Feedback is particularly relevant for self-regulation processes (e.g., monitoring, identification of the gap between current and desired performance; Wong et al., 2019) and positive reinforcements as demonstrated in the numerous studies about testing effect (Mertens et al., 2022). Modifications can be composed of different guidance types (e.g., scaffolds, prompts, visual cues), which showed benefits for learning (Lazonder & Harmsen, 2016; Xie et al., 2017).

Such systems are sometimes defined as Intelligent Tutoring Systems (ITS), and they are built to simulate a human one-to-one learning situation (Chassignol et al., 2018; Gutierrez & Atkinson, 2011). When compared to each other, human and digital tutoring showed similar benefits (VanLehn, 2011), but automatic systems have the advantage to provide numerous, repeated, and immediate feedback or modifications on learners' activity. Thus, digital tutoring through AI could even been considered as supporting "idealized tutoring strategies" (Nye et al., 2014).

However, if AIED systems are designed to help teachers and learners by supporting personalized learning and alleviating teachers' workload, it is not taken for granted that these systems will be accepted and used by teachers. Studies about technology acceptability or acceptance show that intention to use and actual use are predicted by users' perceptions towards the system (e.g., Davis et al., 1989; Venkatesh et al., 2003).

Teachers' attitudes towards AI

Theoretical differences are made between acceptability and acceptance. The two are closely related to the concept of attitude, referring to the tendency to be more or less favorable to the use of a system (Schuitema et al., 2010; Sindermann et al., 2021). Acceptability refers to this judgment before any use of the system, while acceptance refers to this judgment after use (Martin et al., 2016; Schuitema et al., 2010). In studying attitudes towards systems with AI, it is interesting to notice that the term of "AI" itself seems to have an impact on judgments. In a recent study (Ragot, Martin, & Cojean, 2020), paintings presented as generated by an AI are perceived less favorably than if they were presented as painted by a human. Also, when people are asked to say what comes to mind when thinking about AI, more than 51% spontaneously use the word "robot" (Ragot, Martin, & Michaud-Redon, 2020), suggesting likely non-accurate representations of current AI-based systems.

AI representation. The "AI" term is frequently used in media for dystopian projections, even sometimes defined as a potential responsible of humankind extinction (Cukurova et al., 2020; Nazaretsky et al., 2021). In fact, people's attitudes towards AI are more contrasted (Sindermann et al., 2021), and two visions are possible (Fast & Horvitz, 2017). Some may have a *positive* representation of AI, they are people who see advantages and opportunities in AI, such as safer car-driving and better healthcare (Sindermann et al., 2021). Some other have potential *aversion* to AI (Cukurova et al., 2020), and especially show fear about human jobs' replacement (Dietterich & Horvitz, 2015; Fast & Horvitz, 2017; Gado et al., 2021). According to a study, 65% of interviewed students say that loss of jobs will be the major issue about AI in the future (Ghotbi et al., 2022). In parallel with these opposed representations about AI in general, people also have opposed opinions about the role of algorithms: appreciation versus aversion. According to the former, people adhere more to advices given by an algorithm than by another human (Logg et al., 2019). According to the latter, algorithms are known as making better predictions than humans, but people trust more humans (Dietvorst et al., 2015). Overall, an analysis made by Fast and Horvitz (2017) indicates that the number of press articles about AI has increased since 2009, but dystopian projections are finally not the norm: published articles include more optimistic than pessimistic arguments about AI. However, the authors also show that fear of lack of control, negative impact on jobs, and ethical concerns are more present in recent articles than before. The field of education is not exempt from these fears and concerns: according to a recent study, research about education is perceived by people as less credible when it is presented as being from AI field than when presented as from neuroscience or educational psychology fields (Cukurova et al., 2020).

Fear of replacement. AI is already used for educational purposes, especially to support students and teachers (Ninaus & Sailer, 2022). It is generally perceived as helpful for learning (Renz & Hilbig, 2020). However, some researchers (e.g., Nazaretsky et al., 2022; Rienties, 2014) talk about academic resistance towards the adoption of new technologies. Indeed, even if AI deployment will imply creation of new jobs, estimations still predict that AI will replace some human resources (Chassignol et al., 2018) and that 38% of current jobs will be automatized by 2030 (Sindermann et al., 2021). In education, less human resources would mean less teachers (Bates et al., 2020) and the fear of teachers' replacement seems to be still one of the major concerns. In contrast, some other professionals do not feel this threat. Several studies led among physicians (e.g., Ahmed et al., 2022; Asmatahasin et al., 2021; Pinto dos Santos et al., 2019) show that while they tend to agree that AI will help them with diagnoses, they tend to disagree that AI will replace them in the future. And this point of view corresponds to the aim of educational AI: helping teachers, automatizing costly tasks, but not replacing human teachers. They will keep doing tasks that can't be automatized. AI must be an added value to traditional processes, and considered as an opportunity to promote more effective learning (Chassignol et al., 2018). Finally, teachers' roles need to be re-defined, with less time devoted to content presentation and learning tests (AI can do that), and more time devoted to skill development. In this case, AI does not replace teachers, it supports them (Bates et al., 2020)

Ethical concerns. One of the major concerns mentioned in the literature, and one of the most important according to users (Scheffel et al., 2014), is probably about information privacy (e.g., Akgun & Greenhow, 2022; Regan & Jesse, 2019). AI ethics guidelines present privacy as the 5th more important ethical principle (Jobin et al., 2019), but the first, transparency, can also be considered as part of the privacy concern (e.g., Regan & Jesse, 2019; Scheffel et al., 2014). AI systems imply that data are collected, and the question is about what is stored, who owns these data, who can access it, and what use is made from it (Regan & Jesse, 2019; Sharkey, 2016). Authorizations are needed, but in some contexts (e.g., in classes when a system is imposed to learners), users may not actually have a choice (Akgun & Greenhow, 2022). Also, anonymity must be possible if required by the user (Regan & Jesse, 2019). According to experts in learning analytics, privacy is considered as very important, and also as highly feasible (Scheffel et al., 2014). However, the definition of what are and what are not "personal data" needs to be clear (for a legal perspective, see Purtova, 2018). Anyway, data collection may be perceived as surveillance from the system (and people using it): more than users' responses to some tests, their activity is also monitored to predict their preferences or future actions. It implies collecting what they did (e.g., which resources did they read), when (e.g., at what time of the day), and for how long (Akgun & Greenhow, 2022; Regan & Jesse, 2019). Then, the predictions made may restrain learners in the available options, and limit their autonomy, as well as teachers' (Akgun & Greenhow, 2022; Regan & Jesse, 2019). This concern can be related to the notion of perceived control, and to the preference from users to feel they have control on what they do (Hinds, 1998). Thus, AI systems may promote a feeling of lack of control and negatively impact the quality of learning. This control on what is presented may also impact learner's trust towards the system. Indeed, if the system makes an error (e.g., if the adaptation proposed is not relevant), learner's motivation and trust will be impeded (Khasawneh et al., 2003; Ninaus & Sailer, 2022). Trust towards the system is directly related to this system's use: only calibrated trust (i.e., when trust matches system capabilities) leads to appropriate use of the system (Lee & See, 2004), while overtrust leads to misuse of the system (i.e., users rely too much on automation), and distrust leads to disuse (i.e., people don't use the system as expected). Then, to be accepted by teachers, AIED systems need to be perceived as in accordance with their own ethical concerns such as privacy, control, or trust.

Current study

Teachers use educational technologies in class, but mainly in a passive way (PROFETIC, 2018, 2019; Sailer et al., 2021). Most of AIED systems imply an active use from learners, as they are developed to provide adapted feedback (Akgun & Greenhow, 2022), and they are generally be used to alleviate teachers' workload (Bryant et al., 2020). However, technologies with AI may imply some fear of replacement and ethical concerns from teachers. The aim of the current study is to compare attitudes towards educational technologies including AI or not. Four hypotheses are made:

- **Hypothesis 1: Workload.** Teachers will consider that AI technologies are more likely to alleviate their workload than technologies not presented as including AI.
- **Hypothesis 2: Fear of replacement.** AI technologies will be judged by teachers as more threatening for their jobs than technologies not presented as including AI.
- **Hypothesis 3: Ethical concerns.** AI technologies will be judged by teachers as less ethical than technologies not presented as including AI.
- **Hypothesis 4: Intention to use.** AI technologies will be judged by teachers as less acceptable (i.e., fewer intention to use them) than technologies not presented as including AI.

Method

Participants

A questionnaire was distributed via the Internet to professional networks of teachers. Participants were 115 teachers. 25 were primary school teachers, and 90 were secondary school teachers. 36.52% (*n* = 42) described themselves as men, 62.61% (*n* = 72) as woman, and 0.87% (*n* = 1) as "other". Their mean age was 45.36 years old (*SD* = 9.27).

Measures

Workload. The item used to evaluate workload was inspired by Ahmed et al. (2022). Participants had to answer the question "*To what extent do you think these tools developing in the education field can reduce or increase teachers' workload?*" on a Visual Analogue Scale (VAS) from –5 ("*Will reduce workload*") to 5 ("*Will increase workload*") with a neutral point ("*No change expected*").

Fear of replacement. This variable was estimated through three items (Cronbach's $\alpha = 0.75$) related to perceived threat for work and replacement of teachers' jobs by the considered technology. Items were inspired by those from several studies (e.g., Ahmed et al., 2022; Asmatahasin et al., 2021; Pinto dos Santos et al., 2019). Concerning the threat for work, participants had to answer the question "*According to you, can these tools be threatening for teachers' jobs?*" on a VAS from 0 ("*Not threatening at all*") to 10 ("*Totally threatening*"). Concerning the replacement of teachers, participants had to answer the question "*According to you, could these tools developing in the education field replace teachers?*" on VAS from 0 ("*No replacement at all*") to 10 ("*Total replacement*") for two temporalities (i.e., "*in the coming months*" and "*in the next ten years*").

Ethical concerns. This variable was estimated through three items (Cronbach's $\alpha = 0.61$) related to ethical concerns about privacy, control, and trust. Items were inspired by those from several studies (e.g., Anjum & Chai, 2020; Gillath et al., 2021; Scheffel et al., 2014). Concerning privacy, participants had to answer the question "*To what extent do you trust these tools in their use of personal data?*" on a VAS from 0 ("*No trust at all*") to 10 ("*Total trust*"). Concerning control, participants had to answer the question "*When using these tools, to what extent do you think teachers have control over their functioning?*" on a VAS from 0 ("*No control at all*") to 10 ("*Total control*"). Concerning trust, participants had to answer the question "*If you were using these tools in class, to what extent would you trust information provided (results, recommendations, evaluation…)?*" on a VAS from 0 ("*No trust at all*") to 10 ("*Total trust*"). A high score on this variable is associated to low ethical concerns.

Intention to use. The key variable in different models of acceptability or acceptance such as Technology Acceptance Model (TAM; Davis et al., 1989), Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh et al., 2003) or more recent AI acceptance model (Gado et al., 2021) is "intention to use". Indeed, all of these models were created to predict this variable. Intention to use can be focused on the system (e.g., AI-powered) in general (e.g., Martin et al., 2020), or on specific tasks the system can perform (e.g., Cojean & Martin, 2022). In the current study, this variable was estimated through two items, one related to global intention to use, and one specifying different tasks to judge. These three tasks corresponds to three of the most potentially automatized tasks (Bryant et al., 2020). Concerning the item related to global intention to use, participants had to answer the question "*To what extent could you use these tools in your professional activity?*" on a VAS from 0 ("*Never*") to 10 ("*Very often*"). Concerning the item related to the specific intention to use, participants had to answer the question "*More precisely, to what extent could you use these tools for these purposes ?*" on a VAS from 0 ("*Never*") to 10 ("*Very often*") on three possible uses (i.e., "*Prepare courses (generate contents)*", "*Do class (help students, personalize contents)*" and "*Evaluate students (identify achievements and difficulties)*").

Procedure

The questionnaire was distributed online. On the first page, the study was described, and participants had to 1) accept the consent form and 2) confirm they are elementary or middle-school teachers to access to the questionnaire. Then, participants were randomly assigned to two conditions: they had to judge "interactive digital educational tools" ($n = 65$) or "educational tools including Artificial Intelligence (AI)" ($n = 50$). All participants had to judge the technologies on several variables: workload, fear of replacement, ethical concerns, and acceptability. Finally, they had to inform some demographical information (i.e., age, gender).

Results

Workload. Analyses of variance (ANOVAs) revealed a significant difference between the two groups (AI technology versus non-AI technology), $F(1, 113) = 16.62$, $p < .001$, $\eta^2 = 0.13$. According to descriptive data (see Table 1), participants believe that technologies without AI would increase their workload compared to AI technologies. Moreover, they believe that an educational tool with AI would have almost no cognitive cost.

Fear of replacement. ANOVAs revealed no significant differences between the two groups, $F(1, 113) = 0.16$, $p = .694$, $\eta^2 = 0.00$. Interestingly, the overall ratings are pretty low indicating a moderate fear of replacement.

Ethical concerns. ANOVAs revealed a significant difference between the two groups, $F(1, 113) = 4.02$, $p = .047$, $\eta^2 = 0.03$. According to descriptive data (see Table 1), participants have more ethical concerns about AI technologies than technologies without AI (interpretation of this variable is reversed).

Intention to use. For global intention to use, ANOVAs revealed no significant differences between the two groups, $F(1, 113) = 0.67$, $p = .414$, $\eta^2 = 0.00$. For intention to use for content generation, ANOVAs revealed a significant difference between the two groups, $F(1, 113) = 6.77$, $p = .011$, $\eta^2 = 0.06$. According to descriptive data (see Table

1), participants are more willing to use traditional technologies without AI than AI technologies for this purpose. Concerning intention to use for personalization (help students during class), ANOVAs revealed no significant differences between the two groups, $F(1, 113) = 0.17$, $p = .678$, $\eta^2 = 0.00$. Concerning intention to use for evaluation, ANOVAs revealed no significant differences between the two groups, $F(1, 113) = 2.47$, $p = .119$, $\eta^2 = 0.02$.

Table 1. Descriptive data

	Interactive digital educational tools		Educational tools including AI	
	M	*SD*	*M*	*SD*
Workload [-5; 5]	1.90	1.98	0.31	2.17
Fear of replacement [0; 10]	2.86	2.24	3.02	2.29
Ethical concerns [0; 10]	5.19	1.94	4.47	1.87
Global intention to use [0; 10]	5.46	2.66	5.03	2.96
Intention to use for content generation [0; 10]	6.13	2.69	4.71	3.15
Intention to use for personalization [0; 10]	5.55	2.89	5.33	2.90
Intention to use for evaluation [0; 10]	4.52	3.05	5.45	3.02

Discussion

AI technologies are developing for educational purposes, but their acceptability from teachers is not a given. The purpose of this study was to investigate teachers' attitudes towards educational tools with AI in comparison with educational tools without AI. AIED systems are designed to alleviate teachers' workload (Bryant et al., 2020), and results of the current study show that they seem to be accurately perceived by teachers. Indeed, technologies with AI are perceived as generating less workload than traditional tools. The main result is that technologies with AI are perceived as having much less cost on workload than traditional tools. Hypothesis 1 is then validated, even though technologies with AI are not judged to decrease workload.

The use of AIED systems to alleviate teachers' workload was supposed to be perceived as threatening teachers' jobs. Results show that teachers are no more threatened by technologies with AI than by technologies without. Thus, Hypothesis 2 is not validated. It is consistent with previous research among physicists (e.g., Ahmed et al., 2022; Asmatahasin et al., 2021; Pinto dos Santos et al., 2019), who admitted the potential added value of AI technologies in their job, but disagree with a potential replacement. Whether it will be the case or not (as a reminder, 38% of jobs are estimated to be automatized by 2030; Sindermann et al., 2021), fear of replacement is not a concern for teachers. However, primary and secondary school teachers may differ in their practices. Some previous studies (e.g., Martín et al., 2014; Midgley et al., 1995; Wolters & Daugherty, 2007) show that teachers' instructional goals are different depending on their level: primary school teachers would be more focused on the task in order to develop student's abilities, while secondary school teachers would be more focused on student's performance. It could be possible that secondary school teachers would be less threatened by AIED systems than primary school teachers, as these tools would be considered as a help to achieve their goal of performance. Oppositely, primary school teachers would fear that the interaction between teachers and students, which is crucial in their job, would be replaced by an AI-student interaction (Cojean & Martin, 2022). An explanation may also be the impossibility for AIED users (or potential users) to imagine negative consequences of technologies (see the definition of the Promethean Gap by Fuchs, 2017). These hypotheses need to be addressed in future work.

Results also show that teachers are less comfortable with ethical concerns for AIED systems, thus validating Hypothesis 3, even if the effect size is small. As no definitions of "interactive digital educational tools" nor "educational tools including Artificial Intelligence (AI)" were provided to the participants, their judgments were only related to what these terms evoked in them. Previous studies showed that representation about AI may lead to more negative judgment (Ragot, Martin, & Cojean, 2020), but also that representations of AI are not always accurate (Ragot, Martin, & Michaud-Redon, 2020). It may be interesting to investigate more precisely what representations are associated with AI educational tools, and if privacy, control or trust are objectively judged or not.

Finally, whereas results showed that acceptability is similar for technologies with or without AI, traditional tools keep an advantage for generation of course content, thus partially validating Hypothesis 4. According to the literature (e.g., Ritzhaupt et al., 2012), the use of digital technologies in class by teachers is positively influenced by their use outside the classroom. Then, it may be hypothesized that their use of AI technologies in class may also be influenced by their use of AI technologies outside the classroom. However, inaccurate representations of what AI is can lead individuals to be unaware of the AI technologies they use in their daily lives. This may lead to an underestimation of teachers' actual use of AI technologies. The links between representation, use in daily life, and intention to use need to be further explored.

Major limits of this study are related to the measures: the Cronbach's alpha value obtained for the "ethical concerns" dimension is a point of interest to improve the measure, as well as missing links between teachers' school level (i.e., primary or secondary), attitudes towards AI in general, use in daily life, and current study's dependent variables. Moreover, progress in AI may imply that the list of methods differentiating AI from non-AI technologies is not exhaustive. Then, it is difficult to provide a clear distinction between the two, and perceptions about what is AI or not may evolve with time. Finally, online recruitment of teachers may have induced some bias in the participants' profile. Indeed, representations of digital tools (with and without AI) may differ for teachers unfamiliar with technologies (i.e., teachers not contacted with an online questionnaire). These results should be strengthened with better representability of the teacher population. Despite these limits, this study provides interesting results about teachers' attitudes towards educational technologies with and without AI. Benefits of AI technologies are well identified in terms of workload, but their acceptability is still similar to non-AI technologies. It might be interesting to focus on the reason why teachers don't identify AIED systems as more useful than non-AI technologies for generation of course content, personalization or evaluation. It can be hypothesized that teachers' representations of AIED systems are not sufficiently accurate, and that presentation of AI methods, possibilities and functioning of these technologies may improve their acceptability.

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