Distance learning and teaching as a consequence of the Covid-19 pandemic: a survey of teachers and students of an Italian high school taking into account technological issues, attitudes and beliefs toward distance learning, metacognitive skills

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Abstract

The Covid-19 pandemic has forced the education system to a rapid and unprepared transition to distance learning, inducing many teachers to organize lessons via information and communication technologies (ICTs), albeit often without sufficient technological and organizational support. Our study aims to evaluate teachers' and students' experience with ICTs during the first lockdown, considering three categories of relevant factors: technical issues, attitudes and beliefs towards online learning, and metacognitive skills. Participants were 486 students and 83 teachers of a Northern Italy high school, who were administered a self-reported online questionnaire. Video-lessons and audio-lessons emerged as overlooked teaching modalities. The desktop was the less used device, teachers preferred the tablet, while students preferred the smartphone. In general, students displayed appreciation of distance learning, even if they wished for more interactive activities. Teachers' level of metacognitive competence and self-efficacy were rather high. For students, the perception of the e-learning environment predicted positively the perception of distance education and negatively the experienced anxiety, with anxiety also being higher among females. For teachers, the evaluation of distance learning was positively predicted by their beliefs about ICTs. This demonstrates the importance of promoting positive ICTs beliefs to motivate teachers in engaging in distance learning. Moreover, higher perceived self-efficacy was associated with lower levels of anxiety, thus showing the need to engage in training activities enabling teachers to feel confident when using ICTs.

KEYWORDS: Distance Learning, e-Learning, Remote Teaching, ICT, Covid-19

1. Introduction

The global emergency of Covid-19 represents an unprecedented shift in education. More than 1.725 billion children worldwide were affected by the closure of schools in response to the pandemic (Holme, 2020). UNESCO (2020) recommended the use of distance learning programs and open educational applications and platforms that schools and teachers could use to reach learners remotely, limiting the disruption of education. This sudden shift to online learning prompted teachers to rapidly shift the traditional ways of teaching online. This hasty transition, a general lack of

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preparedness, and technical problems led, in many cases, to an unfulfilling virtual learning experience for both teachers and students, fostering the perception of virtual learning as being of lesser quality compared to face-to-face education (Sindiani et al., 2020).

Some countries specifically witnessed a lively debate between Information and Communication Technologies (ICTs) supporters and those who think that ICTs are ineffective or even harmful for education (Schleicher & Reimers, 2020).

When the relation between ICTs and students' learning outcomes was directly analyzed, results were mixed: some studies indicated better learning outcomes by using new technologies (Chen, Chiang, & Lin, 2013), while other studies did not provide evidence of significant differences between traditional and e-learning (Higgins, Beauchamp, & Miller, 2007).

In this study, we aim to provide a general assessment how ICTs have been perceived by both teachers and students during the first lockdown due to the COVID-19 pandemic. Indeed, teachers and students can have similar, but also different or complementary perceptions, and may place greater importance on some factors over others; therefore, departing from most research, we decided to investigate ICTs perceptions from both points of views. Specifically, we conducted a study aimed at investigating the perception of ICTs use among teachers and students of a high school in Northern Italy which, like many others, had to resort to ICTs during the lockdown. Moreover, while studies on the use of ICTs in educational environment generally focus on few specific aspects, we considered several factors, broadly included in three main categories, namely technological issues, attitudes and beliefs toward ICTs, and metacognitive skills.

1.1 ICTs in learning/teaching environments

With the Covid-19 pandemic, Italian teachers resorted to remote teaching as a replacement for traditional teaching. However, the general idea emerging from the public discourse is not that of making an effort to exploit their potential but using them as a temporary replacement before returning to traditional teaching.

According to many research, digital devices can be effective in delivering content and fostering pupils' motivation (Amiri & Sharifi, 2014), promoting social interaction, peer education, and collaboration (Somyürek, Atasoy, & Özdemir, 2009), favoring a constructive didactic approach (Jonassen, Howland, Marra, & Crismond, 2008), and ultimately leading to meta-cognitive learning and to learning how to learn, rather than a specific skill (Monteith, 2002).

Of course, many factors can influence online learning: materials, activities, motivation, students' learning styles, and self-regulation (Ligorio et al., 2010).

Assuming that the students' outcomes will automatically increase by employing technologies may be wrong and even dangerous, since it can lead to overly optimistic and unrealistic expectations. In this sense, digital devices should not be understood as 'teaching machines', but as 'tools' that allow students to co-construct their own learning path, to socialize it and, therefore, to tailor it according to their personal cognitive style (Battro, 2010). Introducing ICTs in school and using them as traditional tools is not sufficient. ICTs should match the characteristics of the individual and foster an active and efficient learning process. In this sense, the real challenge does not concern introducing the ICTs in educational environments per se but using them to effectively stimulate the students' learning process, taking advantage of their potential and allowing them to overcome their learning weaknesses. These considerations lead us to underline the importance of teachers in the efficient use of ICTs (Drossel et al., 2017).

Several aspects need consideration to plan effective and motivating ICTs learning environments. Most studies focused on a single issue, from the perspective of either teachers or students. In order to provide a more systematic account of potentially relevant factors and their impact on e-learning, we grouped them into three categories.

1.2 Factors impacting online learning

Technical issues

ICTs effectiveness can be influenced by many factors, including technology availability, accessibility of ICT equipment, and technical and administrative support (Fu, 2013). According to Venkatesh and Davis (2000), when teachers are presented with new technology, two factors influence their decision to use it: external variables and perceived usefulness. Amongst the external variables, limited ICTs facilities, accessibility and network connection, lack of effective training and technical competency are the main limitations. Toprakci (2006) found that a low number of computers (in relation to the number of students), obsolescence or slowness of ICT systems, and scarcity of educational software in the school constitute barriers to the successful implementation of ICTs in schools. However, according to Becta (2004), the inaccessibility of ICTs resources is not necessarily due to the unavailability of hardware, software, or other materials within the school. It may also be the result of various factors, such as poor resource organization, poor quality of hardware and software, or lack of personal access for teachers.

ICTs competency, internet connectivity, technical issues and usability can hinder students' use of ICTs (Silin & Kwok, 2017). Volery and Lord (2000) proposed a framework to identify the critical factors for online education to succeed, focusing on three aspects: technology (ease of access and navigation, interface design and level of interaction), instructor (attitudes toward students, technical competence and classroom interaction), and previous knowledge and use of the technology.

Attitudes and beliefs toward online learning

Positive attitudes of both teachers and students towards ICTs can facilitate the process of integrating technological innovation into teaching and studying (Sang et al., 2010). Several studies have shown that teachers' and students' perceptions of whether the use of ICTs in class improves learning outcomes and motivation predict the use of ICTs in school (e.g., Davis et al., 2013; Eickelmann & Vennemann, 2017; Teo et al., 2009). Negative attitudes toward ICTs lead to being less informed about them and, in turn, to a less frequent use of digital devices (Drossel et al., 2017).

Teachers' self-reported competencies regarding pedagogical and technical knowledge have been shown to predict ICTs use (Fraillon et al. 2014). Other relevant personal characteristics analyzed are the teachers' willingness to change, their self-efficacy with respect to the use of ICTs (Roca & Gagne, 2008), as well as their expectations about their students' interest and learning outcomes (Perkmen, 2014). Balanskat et al. (2006) have shown that a low self-perceived competence of the teacher is a strong barrier to the integration of technology into education and one of the key predictors of resistance to change. Edmunds, Thorpe, and Conole (2012) reported that perceived usefulness and perceived ease of use of ICTs are key dimensions to encourage teachers' acceptance of new technologies in learning processes. Other fundamental elements endorsing the perceived usefulness of ICTs are the possibility to work faster, increased job performance and increased productivity, and superior teaching effectiveness (Venkatesh & Davis, 2000). Watson (1993) identified a wide range of features that teachers look for in a technological tool; specifically, it should be easy to learn and remember how to use it, and it should be easily understandable and controllable.

Research has shown that also students' attitudes and their readiness to accept technology in teaching are critical to their successful learning (Teo et al., 2009). Sun and Zhang (2008) showed that students' anxiety about the use of ICTs affects their satisfaction in e-learning courses. Kubiatko (2010) found that the effective use of ICTs within students improves both attitudes towards technology and computers skills, which, in turn, empower the effectiveness of ICTs, thus creating a positive feedback spiral.

Metacognitive skills

There is consistent evidence that effective ICTs use requires changes in attitudes, values, and beliefs that develop confidence for ongoing learning and adaptability to change (Phelps, Graham & Kerr, 2004). Such approach requires teachers to challenge their pedagogical beliefs and practices, identifying what they still need to learn, and what kind of teachers they are (and wish to be) in a life-long learning perspective. Teachers' understanding and use of ICTs depends on many factors, such as self-efficacy, anxiety, support, encouragement, perceived usefulness, pedagogical

orientation, goal orientation, volition, problem-solving, playfulness, help-seeking, learned helplessness and attributions (Phelps & Graham, 2008).

According to Phan and Dang (2017), training, attitude, technical competence, time constraints, pedagogy and methodology are among the main predictors of efficient distance learning education. Providing pedagogical training for teachers, rather than simply training them to use ICTs tools, is of primary importance (Becta, 2004). Some studies showed that after a professional course in ICTs, teachers still did not know how to effectively integrate them in classrooms, because the courses only focused on practical skills rather than on the pedagogical implications of ICTs (Balanskat et al., 2006; Cox, 2003). Metacognitive competences allow people to think about themselves as computer learners, taking control over their learning and teaching processes and developing confidence and willingness to integrate ICTs in school.

Finally, we acknowledge the role of background variables, such as age and gender. In general, studies showed that older teachers have a lower tendency to use ICTs in class (Fraillon et al. 2014), whereas gender is related to the frequency of computer use in class: male teachers seem to use computers more frequently than their female colleagues (Eickelmann et al. 2017). Other studies however did not detect gender differences in the use of ICTs in class (Shapka & Ferrari, 2003).

With respect to students, there are mixed results regarding gender differences in attitude toward ICTs. While some studies found that males have a more positive perception of technologies than female students (e.g., Liaw, 2002), other studies did not find any significant difference (e.g., Adenuga et al., 2011).

We believe it is necessary to deeply reflect on the use of digital technologies in school, to make remote teaching a positive experience for both students and teachers. It appears crucial to investigate the availability of technologies, as well as the difficulties experienced by both students and teachers and their attitudes, to design effective distance learning interventions that do not respond only to temporary crisis.

We conducted a research on a sample of students and teachers from an Italian high-school taking into account the three main categories of factors affecting ICTs use and effectiveness, that is technological issues, attitudes and beliefs towards ICTs, and metacognitive skills. Specifically, we collected data on teaching and learning modality, tools used (devices, platforms), and problems that emerged during the lockdown caused by the pandemic. We also investigated psychological variables such as perceptions, attitudes, beliefs, metacognition, anxiety, and self-efficacy, which can contribute to bringing people closer (or not) to new technologies, thus facilitating a smooth transition to distance learning. The ultimate goal was to understand which variables predict a positive evaluation of distance learning in both students and teachers.

2. Materials and Methods

2.1 Participants and Procedure

Participants were 486 students (11.9% males, mean age = 16.3 years) and 83 teachers (24.1% males, mean age = 53.47 years) of a high school located in Reggio Emilia (Northern Italy). Participants were administered a self-reported online questionnaire.

2.2 Procedure and materials

Teaching modality. Participants were administered a list of teaching modalities among which to choose the one(s) used during the lockdown (the list was similar for students and teachers): streaming or video-lessons; audio-lessons; videos, documentaries, and other online resources; lecture notes or other school material; homeworks to be delivered to the teacher; online questionnaires and tests; individual study; projects.

Device. We asked participants to report the device used for online learning, by using the following options (participants could report more than one device): desktop, laptop, tablet, smartphone.

Problems emerged. Participants were asked to indicate the extent to which they experienced difficulties in online learning (see Table 1). All answers were provided on 5-points scales, anchored to 1 (*not at all*) and 5 (*very much*).

Anxiety. Participants were administered the STAI S-Anxiety Scale (Spielberger et al., 1983), a 20 items self-report questionnaire to measure the presence and severity of anxiety symptoms. We asked teachers and students to think about how they feel when they are about to start remote teaching, and indicate how true each statement was for them by using a 4-points scale ranging from 1 (*not at all*) to 4 (*very much*) (alpha = .94).

Students' perception of distance education (students). Participants were administered 6 items (Educational Factors) of the Distance Education Questionnaire (DEQ) (Gok, 2015) to investigate the college students' opinions about distance education courses. All answers were provided on 5-point scales, from 1 (*not at all*) to 5 (*very much*) (alpha = .79).

Students' perception of the e-learning environment (students). The students were asked to respond to a questionnaire made of 24 items loading on 11 scales, measuring various aspects of their perception of the e-learning environment (Martens et al., 2007); the different subscales are shown in Table 2. All answers were provided on 5-points scales, anchored to 1 (*not at all*) and 5 (*very much*) (alpha = .89).

Teachers' metacognitive experience (teachers). We used the Teacher Metacognition Inventory (Yingjie, Lin, & Liang, 2016), consisting of 21 items that investigate different aspects of metacognition in teachers (reported in Table 4). All answers were provided on 5-point scales, anchored to 1 (*not at all*) and 5 (*very much*) (alpha = .84).

Measure	Students		Teachers	
	M	*SD*	*M*	*SD*
Problems with online connection	3.21	1.16	2.81	0.98
Unavailability of device	1.66	1.15	1.25	0.60
Difficulties in using apps or programs	2.48	1.27	2.31	0.97
Scarce collaboration with peers (for students) or communication problems with students (for teachers)	2.51	1.38	2.64	1.00
Emotional or personal problems	2.73	1.50	2.46	1.15
Difficulties in organizing learning	2.62	1.25	/	/
Difficulties in time planning	2.72	1.24	/	/
Difficulties in translating traditional lessons in online lessons	/	/	2.72	1.16
Low preparation in how to organize a non-traditional lesson	/	/	2.49	1.15
Insufficient knowledge on how to motivate/teach in distance learning	/	/	2.69	1.02
Insufficient preparation on how to evaluate students in distance learning	/	/	3.28	1.17
Necessity of reducing the contents presented	/	/	3.18	1.12
Discomfort in being repeatedly online	/	/	3.47	1.31

Table 1 - Means and standard deviations for students (*N* = 486) and teachers (*N* = 83) in relations to problems emerged.
Note. The response scale for all measures ranged from 1 to 5.

Measures	Students	
	M	*SD*
Perceived authenticity of the e-learning environment	2.76	0.89
Extent of confusion regarding the e-learning environment	2.84	0.93
Experienced support in the e-learning environment	3.16	0.82
Extent of explorative behavior of the learner	2.58	1.10
Extent of collaboration with other learners	2.34	0.96
Positive opinion about the use of role-play	2.22	1.19
Opinion about the usefulness of discussion with other learners	2.67	1.06
The e-learning environment urges exploration	2.40	1.14
E-learning is innovative	4.14	0.86
Intrinsic motivation	2.65	1.14
Total score	**2.81**	**0.65**

Table 2 - Mean scores and standard deviations (subcomponents and total score) for students' perceptions of the e-learning environment (*N* = 486).
Note. The response scale for all measures ranged from 1 to 5.

Teachers' beliefs about ICT (teachers). We administered the Teachers' beliefs about ICTs, a Likert-type scale containing statements of beliefs towards ICTs and their application in education (Jimoyiannis & Komis, 2007). The questionnaire consists of three subscales (shown in Table 5). All answers were provided on 5-point scales, anchored to 1 (*not at all*) and 5 (*very much*) (alpha = .65).

Teachers' self-efficacy (teachers). Teachers were asked to answer to a 12 -item questionnaire aimed at measuring three domains of self-efficacy (see Table 6) (Klassen & Ming, 2010). All answers were provided on 5-points scales, anchored to 1 (*not at all*) and 5 (*very much*) (alpha = .84).

Evaluation of remote teaching (teachers). Teachers were administered a 12 items *ad hoc* questionnaire, created to measure the positive attitude towards remote teaching. All answers were provided on 5-points scales, from 1 (*not at all*) to 5 (*very much*) (alpha = .91).

3. Results

With respect to teaching modality, 73.5% of teachers declared the use of streaming video-lessons. The use of registered video and audio-lessons was reported by 38.1% of students, and by 15.7% (registered video-lessons) and 18.1% (audio-lessons) of teachers (for teachers, two items were used to tap response to the two modalities). Most students (55.6%) and teachers (68.7%) reported having used videos, documentaries, and other online resources. Similarly, the use of lecture

notes or other school material was reported by 74.7% of students and 78.3% of teachers. Another popular modality concerned homeworks administered to students and to hand back to the teacher (91.8% students, 90.4% teachers). Interestingly, the use of online questionnaires and tests was reported by 89.3% of students and 44.4% of teachers. Finally, 68.7% of students reported resorting to individual study, and 13.3% of teachers reported having worked on projects.

The desktop was indicated as the less used device by both students (12.8%) and teachers (30.1%). In contrast, students (65.4%) and teachers (78.3%) used to a greater extent their notebooks. Tablets were used more by teachers (44.6%) than by students (24.1%); the opposite tendency emerged for smartphones, used more by students (63.2%) than by teachers (34.9%).

As can be noted in Table 1, participants experienced various types of difficulties. However, the average levels of difficulties expressed were relatively low.

Descriptives for the measure of students' perceptions of the e-learning environment are presented in Table 2. Both the global score and the single values for the different components of students' perceptions of the e-learning environment were moderate, with lower values for the components "Extent of collaboration with other learners", "Positive opinion about the use of role-play", and "The e-learning environment urges exploration." In contrast, relatively high values emerged for the dimension "E-learning is innovative."

The evaluation of distance lerning, as resulting from the average score obtained for the measure of students' perceptions, was moderately negative (*M* = 2.69, *SD* = 0.79), as also indicated by the difference from the mid-point (3), *t*(485) = 8.57, *p* < .001. Additional analyses revealed that age or gender were not reliably associated with any of the students' variables with the exception of "Students' perception of distance education". A one-way ANOVA with Class as the between-subject variable revealed that "Students' perception of Distance Education" depended on the class, $F(1,4)$= 4.67, *p*=.001. Differences on this variable among school grades are presented in Table 3.

In contrast, anxiety was moderately high (*M* = 2.84, *SD* = 0.88), with the average score higher than the mid-point (2.5), *t*(485) = 8.52, *p* < .001.

To understand the incremental contribution of demographic factors and students' perceptions of the e-learning environment on the evaluation of distance education and anxiety experienced, we ran a linear regression analysis. Results are reported in Table 4.

As can be noted in Table 3, students' perceptions of the e-learning environment were positively associated with both outcome variables over and above the effects of demographics. These associations were quite strong, with students' perceptions of the e-learning environment positively associated with students'

perceptions of distance education and negatively associated with anxiety.

We present in Table 5 descriptives for teachers' metacognitive experiences. As can be seen, average scores are rather high (except for "Metacognitive knowledge about the self", which is moderate), as is the global score.

We present in Table 6 descriptives for teachers' beliefs about ICTs. For both subcomponents and global scores, means were moderate, although teachers showed higher scores in the component "Teachers' beliefs about ICT integration in education."

Descriptives for teachers' self-efficacy are presented in Table 7. Scores were generally indicated moderate-to-high levels of self-efficacy in teachers.

Evaluation of distance learning in teachers was rather negative (M = 2.84, SD = 0.88), with the average score lower than the mid-point (3), t(82) = 8.91, p < .001. Teachers also revealed average levels of anxiety (M = 2.49, SD = 0.53); the average score did not differ from the mid-point (2.5), t < 1.

To evaluate the relative contribution of the measured factors and demographics in determining teachers' perception of distance education and their anxiety, we ran linear regressions. Results are presented in Table 7.

As can be seen in Table 7, teachers' beliefs about ICTs emerged as the only significant predictor of a positive perception of distance learning. In contrast, the only predictor of anxiety was teachers' self-efficacy, with greater perceptions of self-efficacy associated with lower levels of anxiety.

Measure	Gr. 1	Gr. 2	Gr. 3	Gr. 4	Gr. 5
Students' perception of distance education	2.74 bc (0.74)	2.80 b (0.81)	2.56 c (0.84)	2.90 b (0.76)	2.40 a (0.60)

Table 3- Mean scores (standard deviations) for the measure of Students' perception of distance education by school grade (Gr.). Different letters on the same row indicate that means are significantly different, p<. 05.

	Students' perception of distance education	Anxiety
Age	-.05*	-.02
Gender (1 = male, 2 = female)	-.03	.10*
Students' perception of the e-learning environment	.81***	-.51***
F	317.72***	57.89***
R²	.66	.27

Table 4 - Linear regression testing predictors of students' perception of distance education and anxiety (*N* = 486). *Note.* *p* < .05. **p* < .01. ***p* < .001.

Measures	Teachers	
	M	*SD*
Metacognitive experiences	3.89	0.83
Metacognitive knowledge about pedagogy	4.14	0.86
Teacher metacognitive reflection	3.66	0.80
Metacognitive knowledge about the self	3.01	0.90
Teacher metacognitive planning	4.07	0-80
Teacher metacognitive monitoring	3.92	0.66
Total score	**3.76**	**0.54**

Table 5 - Mean scores and standard deviations (subcomponents and total score) for teachers' metacognitive experience (*N* = 83). *Note.* The response scale for all measures ranged from 1 to 5.

Measures	Teachers	
	M	*SD*
Teachers' beliefs about ICT as a teaching and learning tool	3.07	0.70
Teachers' beliefs about ICT integration in education	3.54	0.46
Teachers' beliefs about ICT in the educational process	3.03	0.77
Total score	**3.24**	**0.36**

Table 6 - Mean scores and standard deviations (subcomponents and total score) for teachers' beliefs about ICT (*N* = 83). *Note.* The response scale for all measures ranged from 1 to 5.

Measures	Teachers	
	M	*SD*
Job satisfaction	3.09	1.00
Classroom management	3.89	0.71
Student engagement	3.67	0.77
Instructional strategies	3.44	0.88
Total score	**3.54**	**0.68**

Table 7 - Mean scores and standard deviations (subcomponents and total score) for teachers' self-efficacy (*N* = 83). *Note.* The response scale for all measures ranged from 1 to 5.

	Students' perception of distance education	Anxiety
Age	-.17	-.07
Gender (1 = males, 2 = females)	-.08	.17
Teachers' metacognitive experiences	-.08	.05
Teachers' beliefs about ICT	.48***	-.11
Teachers' self-efficacy	.17	-.36**
F	8.83***	4.39***
R²	.36	.22

Table 3 - Linear regression testing predictors of teachers' evaluation of distance learning and anxiety (*N* = 83). *Note.* *p* < .05. **p* < .01. ***p* < .001.

4. Discussion and Conclusions

The first part of our study descriptively investigated how e-learning has been implemented during the lockdown. It is worth noting that registered video-lessons and audio-lessons, that is the two modalities that require more planning and self-commitment by teachers, emerged as overlooked teaching modalities. Not surprisingly, the desktop is the less used device by both teachers and students, while the laptop is way preferred. Interestingly, while teachers prefer the tablet over the smartphone, the opposite tendency emerges among the students. Part of these differences may be due to the different use that teachers and students make of these devices (with teachers using them proactively to provide lessons, and students likely using them more passively). However, one may speculate a change in cultural use of these devices. Teachers prefer tablets probably because they have larger screens and keyboards, while students prefer smartphones because they are familiar with these tools, almost representing an extension of the self. In general, it is evident that portability and usability influenced the users and will certainly influence the choice of devices more and more in the future.

With respect to the students' perception of distance education and anxiety level experienced, we found that females felt higher anxiety during the distance learning experience, and that and students displayed a greater appreciation of distance learning when compared to teachers. In general, while students consider e-learning an innovative practice, they recognize that the extent of collaboration with other learners is critical, and that the e-learning environment promotes little exploration. These results suggest that students would like to participate in more interactive activities (research, projects, group activities), rather than following traditional lessons conveyed via digital tools.

Findings revealed that students' perceptions of the e-learning environments are critical in determining how students evaluate distance education. The explained variance was very high (81%). In addition, in a situation largely determined by the ongoing Covid-19 pandemic, the anxiety experienced is also a function of students' perceptions of the e-learning environment. In other words, appraisal of the e-learning environment contributes to well-being related to distance education, in addition to shaping how this is evaluated.

The teachers' level of metacognitive competence was generally rather high. This result suggests that the teachers have gained good pedagogical knowledge, but they have not achieved sufficient awareness of themselves. This result seems to be confirmed by the reported levels of self-efficacy: they perceive to have a good level of competence and control in classroom management, student engagement and the use of instructional strategies, however, they do not seem very satisfied with their job. Job satisfaction is a condition that is achieved more easily with a good awareness of oneself, of one's needs, objectives and desires. Interestingly, for teachers, the evaluation of distance learning and anxiety were a function of different predictors. Evaluation of distance learning was positively predicted by teachers' beliefs about ICTs, demonstrating the importance of promoting positive ICTs beliefs to motivate teachers in engaging in distance learning. In contrast, higher perceived self-efficacy was associated with lower levels of anxiety, showing the need to engage in training activities that would make teachers feel confident when using ICTs. Our results suggest that students would like to participate in more interactive activities during distance learning. This means that teachers should make every effort to transform "traditional" frontal teaching into practical activities. Teachers, on the other hand, reported low levels of self-awareness and low levels of job satisfaction when engaged in remote teaching activities. Taken together, these evidences suggest that during the remote teaching experience, teachers felt inadequate, without the necessary skills effectively deliver knowledge, which turned out to be little motivating and engaging for students. With this respect, one of the main strengths of our study is indeed to have considered both perspectives. We therefore derive that, if the distance education keeps proposing a transmissive teaching model, it is doomed to fail, as it leads to low involvement and motivation in students and high frustration in teachers. Therefore, it seems necessary to provide teachers with technical and pedagogical knowledge that allows them to exploit new technologies by taking advantages of the features that make them unique: tools capable of promoting an active role of the student, encouraging participation and peer collaboration.

In Italy, during the pandemic, one of the main problems has been the absence of central coordination: in most cases, teachers had to decide at the individual level (not even at the school level, with a few relevant exceptions) whether and how to use remote teaching. Without training and collective guidance, the introduction of ICTs is going to fail and support the expectations of the many who believe that it is not only useless but even potentially harmful. The situation caused by the pandemic should represent a stimulus to rethink teaching contexts by integrating new technologies in a more informed way to make students motivated, metacognitive, autonomous, and capable of self-regulation, all skills that support lifelong learning and that will be crucial for the citizens of the future.

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