

The Relationship Teachers have with Technology, Implications of the T.A.M. Model

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Abstract

Keywords:

teachers, technology, online platforms, TAM model

Mobile applications and the relationship with online platforms became more important for all of us with the pandemic. The way teachers managed to transition online during the pandemic led to the speed with which they could adapt to the new conditions of lockdown, and the teaching-learning processes. The relationship that teachers managed to develop with the use of technology resulted in its continued use (or not) in education after the pandemic, contributing to the narrowing (or, conversely, widening) of the disparities between digital natives - the students, and digital immigrants - their teachers. The study utilizes the TAM model to capture how teachers interacted with technology at different points in time (during the pandemic and two years after its start) and how they might continue or not to use it in the future. The obtained results emphasize which categories of teachers accepted more easily the modification of the teaching-learning process, thus ranking in the area of being an indicator of change in education. Compared to these first results, it is highlighted that age is an indicator in the acceptance of technology. The other results aim to identify the factors that could determine the change in attitude towards the use of devices.

Zusammenfassung

Schlüsselworte:

Lehrer, Technologie, Online-Plattformen, TAM-Modell

Mobile Anwendungen und die Beziehung zum Online sind mit der Pandemie für uns alle wichtiger geworden. Die Art und Weise, wie es den Lehrkräften gelang, während der Pandemie online zu gehen, führte dazu, dass sie sich schnell an die neuen Bedingungen, die des Lockdowns, die Lehr- und Lernprozesse anpassen konnten. Die Beziehung, die Lehrer mit dem Einsatz von Technologie aufbauen konnten, führte dazu, dass diese nach der Pandemie immer noch in der Bildung eingesetzt wurde (oder auch nicht), was zur Verringerung (oder umgekehrt) der Diskrepanzen zwischen Digital Natives – Schülern und Digital Immigrants – beitrug - ihre Lehrer. Die Studie verwendet das TAM-Modell, um zu erfassen, wie Lehrkräfte zu unterschiedlichen Zeitpunkten (während der Pandemie und zwei Jahre nach Beginn der Pandemie) mit Technologie umgingen und wie sie diese in Zukunft möglicherweise weiterhin nutzen oder nicht. Die erhaltenen Ergebnisse verdeutlichen, welche Kategorien von Lehrkräften die Veränderung des Lehr-Lern-Prozesses leichter akzeptierten und rangieren somit im Bereich eines Indikators für Veränderungen in der Bildung. Im Vergleich zu diesen ersten Ergebnissen wird hervorgehoben, dass das Alter ein Indikator für die Akzeptanz von Technologie ist. Die weiteren Ergebnisse zielen darauf ab, die Faktoren zu identifizieren, die die veränderte Einstellung zur Nutzung von Geräten bestimmen könnten.

1. Introduction

The world we live in has increasingly directed us towards the use of technology, and the pandemic has demonstrated more than ever that we need to turn towards online and technology. Since 1986, Davis has proposed a model called the Technology Acceptance Model (T.A.M.), drawing attention to the dimensions on which this process occurs. The dimensions Davis refers to are the perception of the ease of technology use, of the utility of technology, behavioral intention, the attitude towards technology, and how often it is used. It is not enough to look at the relationship between humans and technology only from the human perspective; it is necessary to add the one of the speed at which technology appears and develops in our lives.

Starting from these realities – the speed of the emergence and development of technology in our lives, as well as the impact of the pandemic on its use, the study focuses on the relationship between teachers and the use of technology in education. The questions that education worldwide was called upon to answer during the pandemic were – can we transition the teaching-learning process online? Do we have enough "tools" at our disposal for this (platforms, internet etc.)? Are people (teachers, parents, students) prepared to do this? In every educational system, the faster these questions were answered, the better it was for the smooth running of the process without interruptions or with only minor ones. The history of recent years proves that the Romanian educational system had



multiple difficulties in doing this in a linear manner, but it sought solutions for it throughout the years of the pandemic and post-pandemic. One of the crucial links in these changes was provided by teachers. Educators are the ones who influence generations through their work, as well as through the models they provide for those they teach various subjects to. Today, we are witnessing a paradigm shift in education, namely, digital natives are being educated by digital immigrants. The first studies to bring attention to this classification – digital immigrants, digital natives – are the studies of Prensky, and they refer to how these two categories understand the world (Prensky, 2001). The intersection between the ways digital natives and digital immigrants understand the world has led to this paradigm shift in education (and beyond). The perspective of changing education is given by how educators need to rethink the way they educate, considering that those they educate are immersed from the beginning in a technologized world that influences them and that they understand at a higher level compared to their educators. For this, educators should start from four phases of the process they have to go through, as follows:

- understanding digital natives (the different way they function in the world),
- reacting to them – to the differences stemming from their age, the fact that they belong to another generation (the differences in this case are more than generational disparities), and how they relate to the world and life differently,
- adapting to the new conditions – devices, technology are part of our lives, and this influences us daily, every moment of every day (devices can serve as a bridge between generations but can also create a gap).
- reconceptualizing the learning/educational process – for a new generation (or new generations) that is different compared to others but also for a new educational environment that is undergoing significant change.

Studies draw attention to the main modifications reported in the way of being within the world between digital natives and immigrants, which include: multitasking, issues associated with social media, educational benefits associated with social media, different ways of relating, and the development of new strategies that are more suitable for the digital natives' way of being (Evans & Robertson, 2020).

2. Theoretical foundation

Several statistics draw attention to the impact of technology and the internet in our lives. The initial results suggest that, concerning education, students use computers daily in a percentage ranging from 80-99.9%, and phones in a percentage ranging from 88-90% on a daily basis. The only impediment to using devices can be the lack of signal in certain areas or the inability to purchase a device (in areas where the standard of living does not allow for this). Of course, this data also highlights the category that most frequently uses devices among all categories present in education (preschoolers, students and college students). Studies also emphasize that devices are used from a very young age (even before kindergarten), and as children grow older, they use them more frequently. Technology has been used for a long time in all learning processes, and one of the well-known e-learning methods is the one offered by Moodle, a method known more by students than by other categories (Hsu & Chang, 2014). Acceptance of technology streamlines the use of study platforms and makes learning accessible not only for students but also for teachers (Alfadda & Mahdi, 2021; Ghani et al., 2019; Mailizar et al., 2021a; Mailizar et al., 2021b; Zhang et al., 2008).

Regarding accessing virtual libraries, currently, they are used in a percentage of about 2%, while other web sources are used to a much larger extent, approximately 80-90%. Of course, inappropriate use of information, failure to verify information sources, and inadequate processing of information lead to a superficially loaded education, the dispersion of information, or even the emergence of illiteracy (Courant, 2008). In recent years, for digital natives, studying at the library hasn't really been a pleasure because they predominantly use sources related to devices rather than printed books, so e-books would represent a more suitable option for them (Liao et al., 2018).

Technology influences all of us, but especially young people in who they are, what they do, choose, in who they become, how they think, and how they learn. There are both positive and negative aspects to this way of being, but young people are increasingly situated between two worlds – the real and the virtual – and often these are not very well connected. The greater the difference between these two worlds they inhabit, the more negative effects are found in their lives (Judd, 2018).

The main changes that should be made in education and their implications focus on the following aspects:

- Aligning technological offerings with pedagogical strategies to facilitate learning in new technological conditions, suitable for current generations and their typology.
- Digital literacy to supplement information literacy in all educational domains.
- Research in the field of education to provide relevant data for educators on how education can be adapted to digital natives (Smith et al., 2020).

Considering all these, after the pandemic period, digital literacy has become an obligation, not an option.

Some of the questions brought to attention by the pandemic and its aftermath include:

- Are teachers prepared to embrace technology?
- What are the factors that could determine this change (acceptance of technology in the teaching-learning process)?
- What is the attitude of teachers towards this change (acceptance of technology in the teaching-learning process)?

The model used to address these questions is that of Davis (TAM Model), supplemented by the studies of Pavlou (2003), Gelik, and Veysel (2011). The new model of Pavlou encompasses dimensions such as the quality of factors (referring to the quality of information, service quality, quality of accessed systems), experience (relating to ease of use, attitude towards devices and platforms, perception of their utility), behavioral intention, and the use of devices and technology.

3. Research methodology

3.1. General objective

The overall objective of the study aims to capture the differences existing among various categories of teachers (categories determined by age) regarding the acceptance and usage of technology.

3.2. Specific objectives

SO1. Specific Objective 1 – Highlighting differences in the acceptance of technology based on the teachers' age.

SO2. Specific Objective 2 – Capturing differences in the acceptance of technology at two different time

points – during the pandemic (2020) and two years later (2022).

SO3. Specific Objective 3 – Identifying the factors that could determine a change in attitude towards the use of devices.

3.3. Sample

Subjects were selected from multiple schools in the Western region of the country. They voluntarily participated in the study, were informed about the study procedures, and were assured of the confidentiality of the obtained data. The age categories of the subjects range from 20 to over 60 years and are grouped as follows: 20-30 years old - 15 subjects (18.75%), 30-40 years old - 17 subjects (21.25%), 40-50 years old - 17 subjects (21.25%), 50-60 years old - 16 subjects (20%), over 60 years old - 15 subjects (18.75%). Out of the total subjects, 65 are women (81.25%) and 15 are men (18.75%). This variable was not taken into account due to the large number of subjects in one category compared to the other category. All selected teachers have taught/are teaching high school classes, and the subjects taught cover all categories. The questionnaire that has been applied is Davis's questionnaire (TAM model questionnaire), in which the word "iPad" was replaced with the term "online platforms" (Skype, Zoom, Webex). This questionnaire addresses the following categories: perceived usefulness of platforms (PU), easy-to-use platforms (PEU), and user acceptance of platforms (UA).

4. Results

The results of the first objective - in line with the first set objective, the response methods of the subjects to Davis's questionnaire addressing the TAM model were studied.

Table 1. Results - objective 1

Age categories	PU	PEU	UA
20-30 years	6.13	6	6.4
30-40 years	5.17	5.58	5.41
40-50 years	5	3.82	4.47
50-60 years	4.	3.12	3.06
Over 60 years	4.46	2.86.	2.66

The results from Table 1 draw attention to the fact that regarding the perceived usefulness (PU) of platforms, the subjects have a positive perception (results place them in the above-average utility class). The results confirm that they consider the platforms

useful in their activities. They also rate their relationship with the platforms as moderately difficult (PEU), but this is only for the first two age categories – 20-30 years and 30-40 years. Regarding the other three age categories, it is evident that the score decreases drastically, indicating that they perceive the use of platforms as challenging. In terms of the last evaluated category (UA), the results confirm that individuals between 20-30 years old frequently use platforms, but then beyond that age range, the frequency of usage decreases significantly. All these results obtained during the pandemic underline the fact that devices, platforms, and online tools have rapidly come into our lives, and the teachers' category responded to this novelty by trying to adapt. Some age categories managed to do this better, while the older age categories adapted less successfully. It is relevant to emphasize that, in the school environment, institutions that managed to adapt quickly influenced both teachers and students to make this change. Therefore, to understand the issue of changes at the teacher level, it is not enough to look only at what teachers have done, but also at what the institution they worked for has done, as the organizational environment in which they operate has a significant influence on how they work.

Results for objective 2 – The second objective set out aims to capture the differences recorded regarding the use of platforms after two years, i.e., in 2022. The same Davis questionnaire was used, but this time partially, namely using only the items related to PU and UA.

Table 2. Results - objective 2

Age categories	PU (2020)	PU (2022)	UA (2020)	UA (2022)
20-30 years	6.13	5.26	6.4	5.26
30-40 years	5.17	4.58	5.41	4.41
40-50 years	5	3.94	4.47	3.29
50-60 years	4.	3.25	3.06	2.5
Over 60 years	4.46	2.66	2.66	2.33

Results from Table 2 emphasize that two years post pandemic, both the manner in which online work platforms were used and the frequency of their use have decreased. This has led to the perception that the need to use them is not as crucial. This is most evident for age categories over 50 years. The possibilities to use online platforms or devices during classes, in teaching activities, have increased significantly since

the pandemic. Additionally, students are very accustomed to using them and find it enjoyable, often linked to a game or recreational activity. This is precisely why teachers should maintain the use of devices and platforms in the teaching-learning process to capture the attention of students through this method. This way, students would learn that using devices or platforms can be interesting not only in entertainment and games, but also in learning. Likewise, it could be a common way for them to engage in an activity with their teachers, bringing the two categories - teachers and students - closer and, at least partially, reducing the differences between digital natives and digital immigrants.

Results for objective 3 – The third objective set out aims to identify the factors that could change the attitude towards devices and online platforms.

For this, we started with the fact that studies confirm the following: a high score in perceived usefulness and ease of use leads to the formation of a positive attitude towards the use of devices and platforms, directly related to the intention of use (Teo, Ursavaş & Bahcecapili, 2011). In addition, beliefs on the usefulness and accessibility of devices and platforms, beliefs formed in the "relationship" with them, are also added. All these beliefs refer to the credibility of utility, secure communication, the perception of risk in use, and the fact that if a person is satisfied with the interaction with the device, they will recommend it in turn (AlKailani, 2016; Harryato, Muchran & Ahmar, 2018, Rafique et al, 2019). The questions addressed to the participants for this objective were: Is your attitude (A) towards using devices and platforms better in the last two years compared to before? Do you consider the quality of information (C) transmitted through devices and platforms to be better? The response options were 1 to a small extent, 2 is the same, 3 to a large extent. The results of data processing are found in Table 3:

Table 3. Results - objective 3

Age categories	A	C
20-30 years	2.53	2.8
30-40 years	2.47	2.64
40-50 years	2.23	2.11
50-60 years	1.75	1.5
Over 60 years	1.73	1.46

The results confirm that even after a period following the pandemic (two years), age categories

between 20 and 30 years have a positive attitude towards devices and platforms. They consider that information transmitted/received in this way does not affect its quality. Age categories over 50 are less receptive to forming positive perceptions about the use of devices and platforms, and therefore, they may not consider activities conducted in this way as safe. These categories will have reservations about using and recommending devices and online platforms, often opting for traditional teaching methods in their relationship with their students. The results also emphasize that the friendlier we perceive the interaction with devices and platforms, the more eager we are to use them.

5. Discussions

The use of technology in education is not just something teachers can consider for the future but rather a natural option that becomes relevant in the present, through their adaptation to the many transformations occurring in this field. The study's objectives bring information about the possibility of adopting technology in Romanian education and about the possible dimensions that influence it. It is a well-known truth that the acceptance of technology is related to age and to the perception of its usefulness in our lives (Liao et al., 2018; Smith et al., 2020; Teo et al., 2011; Zhang et al., 2008).

The study's results highlight the fact that although teachers in the pandemic accept to use technology more frequently in their work (a level of usage above average), this usage decreases proportionally with advancing age. The age category of over 50 years old considers that although technology is useful (devices have penetrated their lives as well), it can be used in parallel with traditional teaching methods but not necessarily to complement or replace them. The changes regarding the use of technology are very important not only during the pandemic or post-pandemic period but also going forward. Adopting devices in education will primarily contribute to reducing the distance between digital natives (students) and digital immigrants (most teachers). Another argument for adopting the TAM model is the multitude of changes in the field of artificial intelligence and the fact that they will impact our entire lives and therefore education (both here and anywhere in the world). Individuals with fewer digital skills will suffer in the long term because they will not be able to adapt to all these major changes in the world, remaining somewhere outside or even in a marginal zone.

The pandemic had a major impact on the transition from the physical to the online environment, and this also changed the way teachers and students approached the educational process, but it is relevant to emphasize what happened after the pandemic. In the following two years, after the pandemic, the level of technology usage in education decreased, which also had an impact on the decrease in the perception level of their usage. This decrease was observed to exist even in older age groups (over 40 years old), compared to the 20-30 age group. In the long term, this decrease in the level of technology usage in the educational process could lead to the creation of a greater distance between the two categories involved - students and teachers. The impact of the changes brought by artificial intelligence (A.I.) could be used in education to increase students' engagement in subjects, to make them more participative or curious about learning using methods that are friendly to them. However, for this to happen, it is necessary for teachers, in their vast majority, to learn the ways of using A.I. in schools.

People adopt new technologies based on whether they perceive their usefulness in their lives or not, and this aspect has also been seen regarding the adoption of technology in education. The age groups of 20-30 years old wanted to continue using technology in their work even after the pandemic, while those over 50 years old chose to gradually give it up. Moreover, the perception of usefulness is one of the determining factors in the long-term use of devices (Chen et al, 2007, Gangwar, Date & Raoot, 2013). When teachers surpass the initial (unfavorable) impression about the use of technology, they become more concerned with the content mediated by technology, and this will increase students' adherence to this content. These conclusions could have a long-term impact on changing teaching and learning methods, through the involvement of devices and platforms in this process. The pandemic and post-pandemic period have highlighted conclusions that were clear even before them. Digital literacy is not an option but a necessity because currently, most things function this way, mediated by devices (Chen, 2011; Chiu & Wang, 2008; Lee, 2006).

6. Conclusions

The study highlights the differences between age categories in terms of technology use. The conclusions draw attention to the disparities between teachers over 50 years old and the other age groups included in the study regarding their use of online platforms and their attitude towards them. The fact that these age groups

use online platforms to a lesser extent in the long run increases the gap between them and their students. A small effort for these age groups would make them more willing to use online platforms to facilitate access to their materials for students who are more inclined to use the "online" for activities and interaction. The study also shows that those under 50 years old have a positive attitude towards the use of online platforms, perceive their utility, and use them much more frequently. This leads to greater accessibility and ease of navigation in platforms, providing multiple opportunities for teachers under 50 to interact with their students. The pandemic has drawn more attention than ever before, and suddenly, to these discrepancies between students and teachers regarding digitalization and its use. This is one of the many lessons that the pandemic has forced us to learn – to view digitalization as a valuable resource in many areas (which until then had been, at least with us, largely overlooked), to see devices and platforms as tools in the teaching-learning process. If teachers change their attitude towards everything related to digitalization, the results will lead to the streamlining of teaching-learning processes, greater access to information, resources, multiple possibilities for conducting classes (from various platforms used to interactive and user-friendly methods), ways to make learning collaborative (joint projects for groups of students in class, constant changes in workgroups for better communication and group dynamics, communication with students from anywhere in the world, etc.) (Al-Rahimi et al., 2013, Gangwar et al., 2013; Gangwar et al., 2015; Liao & Lu, 2008; Padilla-Meléndez, et al., 2008). Also, digitalization has an impact on environmental issues (lower paper consumption, involvement in sustainability, etc.).

While the study provides insights into the use of the TAM model in education, there are some limitations. These include a relatively small number of subjects, the inability to generalize the data to a larger population until the study is expanded with a larger number of subjects, and the fact that the study only includes high school teachers, neglecting other categories such as middle school teachers, primary school teachers and educators.

Authors note:

Roxana Maier – has over 20 years of teaching experience. She is currently an Associate Lecturer with a Ph.D. at the “Babeş-Bolyai” University in Cluj-Napoca, in the Department of Special Education. She

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