

Teacher Profile and Factors Impacting Teacher Technology Use: A Practical Investigation

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Abstract. *This work aims to understand teachers' use of technology, their profiles, planning process and maturity of technology use. 15 teachers in different contexts were interviewed to understand what tools they are using, as well as why and how they were used. Data have shown that this use is still in the first stages of maturity. Teachers' personal skills, experience with technology and circumstances at their workplace had an impact on this result.*

Resumo. *Este trabalho tem como objetivo entender o uso de tecnologias por professores, seus perfis, processo de planejamento e maturidade do uso da tecnologia. 15 professores de diferentes contextos foram entrevistados para entender quais ferramentas estão usando, bem como por que e como elas estão sendo usadas. Os dados mostraram que esse uso ainda encontra-se nos estágios iniciais de maturidade. As habilidades docentes, suas experiências prévias, e seu contexto de trabalho impactaram nesse resultado.*

1. Introduction

The use of technology can be currently considered widespread in education, nevertheless, it does not always convert into better results. As despite the impulse of the market to get more and new equipment, little transformation is noticed in educational practice and everyday school life or even in informal educational procedures [Matta et al. 2014].

We use the term technology to refer to digital technologies or the so-called “new technologies”. [Kenski 2007] explains that the term new technologies refers to: “(...) processes and products related to knowledge from electronics, microelectronics and telecommunications. These technologies are characterized by being evolutionary, that is, they are in permanent transformation. They are also characterized by having an immaterial basis, that is, they are not technologies materialized in machines and equipment. Its main area of action is virtual and its main raw material is information.”.

Studies have shown that there are many factors impacting teachers' technology adoption in the classroom. Some of them are: teachers' confidence and computer self-efficacy, their skills, their educational beliefs and attitudes concerning technology; as well as their work environment [Vermette et al. 2019].

This work aims to characterize teachers' use of technology and understand their profiles, planning process and maturity of technology use in order to discuss and reflect on best practices to achieve more mature uses of technology that promote successful learning.

2. Related Works

The Future Classroom Lab proposed a maturity model to understand how mature and advanced is the level of innovation in the schools [Future Lab 2014]. This model also explores the importance of the social system in innovation adoption. It proposes a reference guide for the maturity model, in which they acknowledge 5 levels of use and explain how they are expressed concerning five dimensions: (a) teachers' and (b) learners' roles, (c) learning objectives and assessment, (d) school capacity to support innovation in the classroom as well as (e) tools and resources. It goes from using technology as a substitute for traditional methods, in isolation of teaching and learning (level 1) to extending learning and teaching through ongoing whole school innovation, with teachers and learners empowered to adapt and adopt new approaches and tools (level 5).

According to this model, from the third level onward, the learner can work more independently and creatively supported by technology. The Future Classroom model is a self-review tool that enables schools to reflect on their teaching and learning and their capacity for technology-supported innovation. As a school moves from one level to the next, its capacity to be innovative in technology-supported learning and teaching increases. It is important to note that good practices and effective learning can happen at all levels, and that level five does not mean that further innovation is not possible.

Some of the factors impacting teachers' technology adoption in the classroom are: (a) teachers' confidence and computer self-efficacy; (b) their educational beliefs and attitudes concerning technology; (c) their personal skills and experience with technology; and finally (d) their workplace environment [Vermette et al. 2019]. These aspects play an important role in the selection and decision to use technology. A strong sense of computer self-efficacy of school teachers can impact the extent and the way technology can be used in everyday practice, significantly changing both teachers' and students' roles [Paraskeva et al. 2008]. There is also a correlation between teachers' beliefs and their subsequent classroom activities [Ertmer and Ottenbreit-Leftwich 2010]. Evidence suggests that teachers with more traditional beliefs will implement more traditional or "low-level" technology uses, whereas teachers with more constructivist beliefs will implement more student-centered or "high-level" technology uses.

3. Methodology

In order to characterize teachers' use of technology, teachers were interviewed either online (through programs, such as Skype or Google Hangouts) or face to face according to their availability.

The main criterion for participation was to have experience using technology in education. Participants were requested to read and sign a consent form¹. Since this first stage was exploratory, we aimed to recruit participants that represented a broad

¹Available at <https://rb.gy/ia2grc>.

cross-section across teaching levels and subjects. Participants were recruited from social media communities related to education and technology as well as previous connections to the first author. Additionally, the participants were requested to invite teachers they knew used technologies to participate, a method known as snowball or chain sampling [Naderifar et al. 2017].

The interview protocol covered three themes: (1) Teacher's background; (2) Teacher's planning process; (3) Role of technology in the school. The questions for this interview were: (1) What is the teacher's profile?; (2) How is their planning process?; and (3) What is the role of technology in their schools?.

3.1. Data Analysis

We carried out a qualitative approach to analyze the data generated from the interviews. This data was treated using thematic analysis which "is a type of qualitative analysis. It is used to analyze classifications and present themes (patterns) that relate to the data" [Alhojailan 2012]. Phrases and sentences, called codes in the thematic analysis methodology, were created and grouped by themes. Coding means highlighting sections of the unprocessed data and creating shorthand labels or "codes" to describe their content. This step corresponded to what [Saldaña 2013] labels as "themeing the data". A theme captures and unifies the nature or basis of the experience into a meaningful whole. The themes and their subdivisions were organized in tables as will be shown in the following subsections. All the phases of the thematic analysis are displayed below [Braun and Clarke 2006]. The unit of analysis was all teachers' responses considered together.

4. Results

Fifteen teachers were interviewed. They were identified by T (teachers) and their corresponding numbers. The semi-structured interviews were conducted from September, 2016 to March, 2018.

4.1. Participants' Background

Teachers work in a variety of scenarios and subjects. There are twelve females and three males. They teach mostly humanities (10 teachers) and STEM (5 teachers). Overall, they had the following characteristics:

1. Have been teaching for 13.7 years (on average);
2. 35 years old (on average);
3. Have undergraduation and an additional specialization (7 teachers) or master degree (4 teachers);
4. Brazilian (most of them located in Recife). Other nationality included is Austrian;
5. Most work in elementary or high school.

4.2. Teacher's Planning Process and its Impact in Technology Use

We identified two types of planning process: advanced planning and planning in action. Although most teachers planned their lessons in advance, 46% mentioned the need to adjust those plans throughout the lessons due to classroom management, technical issues or

even to welcome student's suggestions or feedback. T4 argued that in one of the universities she teaches, she needs to have a plan B in case the projector is not working.

This category also revealed that most teachers choose the content to be thought based on official documents and textbooks. Other factors that influence teacher's choice of content were: internet and specific websites; content related to exams and workbook collections. 13% mentioned that their schools did not offer a curriculum to be followed so they had to choose one by themselves.

As regards teacher's planning time, 40% of teachers spent 4 to 10 hours planning per week. Planning time was mostly done with either sporadic exchanges or regular exchanges with colleagues (7 and 5 teachers, respectively). 2 teachers reported to plan lonely, 2 teachers reported to receive help or feedback related to their practice and 1 teacher revealed that they built the plan collaboratively. Peer support is, thus, an important aspect related to teacher planning. Even support among teachers from other classes. The lack of this type of support may make it difficult to align content properly and might hinder students' performance in national exams. As T3 explains: *"(...) there is no dialogue between the sixth year teacher with the ninth year for example or the seventh year and eighth year in order to achieve this alignment (referring to content alignment that would enable better performance in the exams)."* Little support from the coordination has been reported. Some teachers mentioned more than one aspect in their choice of content and planning style, especially the ones that worked in more than one institution.

4.3. Rationale for Technology Use

Technologies used varied widely from presentation slides, computers and projectors to interactive boards and tablets. These resources varied according to the schools where participants teach and some teachers worked in more than one institution.

Four main reasons were identified as a justification for technology use, namely:

- *Methodological or pedagogical facilities:* This aspect encompassed the technology ability to facilitate visualization or display of content, such as the use of presentations with 3D animations to present Chemistry concepts or YouTube videos to present content to students. The use of videos to present content to students as a replacement for an activity that would not be feasible to do in real life. Also, to facilitate contextualization, discussion, exploration and understanding of a certain concept or theme. For example, through the use of social media;
- *Improvement of student learning, attention and engagement:* Aspect mentioned in the speech of some teachers. For instance, T5 explains that *"I always put a lot of images in motion, a lot of videos inside my slides to attract students and to keep them always attentive."*;
- *Structural conditions:* 46% of teachers teach predominantly in a traditional way, which means exposing the content followed by a set of exercises in order to practice it. T3 mentioned that she does not see much need for technology in her Portuguese classes. She uses technologies sporadically in her lessons. Other aspects that played a role were institutional limitations either cultural or physical, such as lack of internet access, physical resources such as paper, glue or brushes or incentives for innovation. On the other hand, some schools imposed the use of specific software, but teachers do not always see the connection of these equipment with

their own lessons or they find the logistics of use too demanding for them. For example, T10's school received tablets, but she mentions that she has not used them yet because there are 20 children in her classroom and she is alone to handle the children and the 20 tablets;

- *Demand for technology use:* In most cases teachers acknowledged an implicit demand or at least the expectation of technology use. These demands were expressed in varied ways, such as requiring the periodic use of certain equipment or facilities (e.g: Google or Lego rooms); motivating and encouraging teachers by indicating possible resources in the syllabus or textbooks adopted; promoting training and encouraging teachers to share their materials with others as well as giving prizes or medals in order to motivate them to use technology. 33% mentioned that the use of technology was mandatory in their schools. *“the discipline that does not use these resources is pointed out very firmly by the coordination.”* (T4). 13% used technology voluntarily. Students also demanded technology use. T8 explained that her students associated language lessons as being more playful. 6% did not know if there was an official demand for technology use.

4.4. Maturity Level of the Practices Proposed

The use of technology described by most teachers lie in the initial levels of maturity as described in the Future Classroom model [Future Lab 2014]. Most of these practices could be described in levels 1 (10 entries) and 2 (9 entries), which describe a narrow range of technology use. The first level is named exchange and consists in a narrow range of technology effectively used in less than 5% of lessons. In level 2, named enrich, technology is effectively used in 5-25% of lessons. It sometimes replaces more traditional approaches for learning and teaching.

Many teachers used slides or videos to replace traditional approaches of presenting content in a more interactive way. They also described the use of online web pages to replace more traditional exercises. Technology was sometimes seen as something extra, which was done only when there was time available as illustrated in T2's speech *“this semester I have to use three books. By the end of the year I managed to finish one. Then I am already in the second one, but there is still another one. We are almost in October so I will have to rush. I will have to explore the book more and I will have to leave other resources aside, do you understand? But at the same time it gets exhausting and the students complain. Then you feel like you are limited and it is not the case. It is something you have to rush.”*

As regards to school support, many teachers worked in schools with little or no training and support regarding digital learning (characteristic of level 1), and some of them in schools that encouraged technology use, but, school leaders were commonly reactive to change (characteristic of level 2).

As concerns learner's roles, most practices also reflected levels 1, in which learners use digital learning materials occasionally provided or presented by the teachers; and 2, in which they use digital resources a few times and are able to use it both individually and in collaboration in a pre-defined task. We found some examples of more advanced levels. T9's experience was classified as level 3, in which the learner is able to learn more independently and be creative, supported by technology providing new ways to learn

through collaboration. She took students outside the classroom to record interviews with subjects for a research. She also made changes in the syllabus based on students previous knowledge and background. In some cases (e.g: T13 and T14), the experiences have characteristics of more advanced levels, however one aspect that is commonly missing regards learning assessment as the model states that in level 3 learners are involved in deciding learning objectives, which include higher order thinking skills and progress through the task being tracked. The learning goals in these cases were decided by the syllabus.

4.5. Strategies for Technology Use

The strategies for technology use were divided into three categories:

- *Learning objectives*: 53% of teachers used technology to allow students to experience, discuss and/or practice content. For example, teachers might use videos to encourage further discussion or use digital games so students can explore concepts in practice. Another popular use was for content introduction. This usually happened through the use of presentation software (e.g: Power Point). Less popular uses included content review and self-evaluation (6% each).
- *Infrastructure conditions*: Most teachers (8 or 53.3%) reported the presence of a technology department in their schools. It is important to highlight that 2 teachers mentioned that although they did not have a technology department in their schools, there was a department in the city hall that promotes training. The technology department was usually responsible for managing, maintaining and repairing equipment. 2 teachers mentioned the presence of training or support for technology use. However, the training offered was not always satisfactory.
- *Resource management*: The equipment available in the classroom for most teachers consisted of projectors and computers. 13% of teachers had access to interactive whiteboards. 40% had access to equipment in other rooms, which they could book previously. The booking process as well as the antecedence needed depends on the school and its context. Although the process of taking students to other rooms might be time consuming, T3 found this change of environment beneficial to change student's moods. As regards to access to internet, 33% of teachers have no access to it in their schools. 20% bring their own device or use students own devices for the activities. T13's school encourages students to use their own devices.

4.6. Authorship with Technology

As regards technology authorship, three categories have been created:

- *Content creator*: 60% worked more as content curators as illustrated by T15: "I have a collection of more than 2 TB of images, videos, documents, ready-made classes, tests, things that I managed to accumulate throughout this digital experience." Among the teachers who created content, 5 teachers created content by themselves. Usually the content created are presentations or worksheets for students to practice. T13 maintains a blog to share her experiences with Virtual Reality and other technologies with other teachers. 5 teachers used technology for students to create their own web pages or content for the school's web page as well as games. Some teachers might use multiple strategies such as creating

content themselves and also have students create it depending on the student's needs (T9). The Future Classroom model states that from the third level onward, the learner can work more independently and creatively supported by technology. Some teachers managed to use technology creatively so students could create content independently and share it online. However, many examples of teacher-centered authorship were found, in which technology creation is enabling educators to show content to students and direct content practice in more interactive ways;

- *Purpose*: The purpose for content creation is usually to introduce content to students or to make it easier for them to visualize it or to experience, discuss and/or practice content. As explained by T9: *“I usually prepare a presentation whether it is a prezi or a powerpoint, a video or some images for them to see and problematize. We use this to have a debate or some discussion.”*;
- *Conditions to facilitate technology authorship*: This category encompasses the need for institutional support and infrastructure. T5 missed institutional incentives to innovate, whereas, T12 payed for resources he wanted to use. Three teachers mentioned the lack of time to prepare lessons and share with colleagues. T1 mentioned the lack of knowledge: *“I would like to have more technological knowledge to be able to be creative, to prepare classes with a program that maybe gives more three-dimensional view or to be able to do virtual experiments.”*.

5. Conclusion

Technology is already part of everyday life and its demands permeate society including schools. However, for more mature uses, technology must be aligned with pedagogic goals. In our sample, the maturity also varied in terms of teacher's workplace, with teachers reporting practices with different maturity levels depending on their schools. Our research has shown that there are some aspects that still hinder its mature use in schools. The uses reported are still classified as in the first stages of maturity.

Our study reinforced some of the factors mentioned in the literature as having an impact in teachers' technology adoption. The workplace environment played a role either in terms of work culture or physical infrastructure, such as lack of internet access, physical resources such as paper, glue or brushes or incentives for innovation. These results show that digital technologies are one of the instruments that can be used to promote learning and that low tech equipment (e.g: paper, glue) might also be necessary, especially in areas such as arts. Digital technologies must be considered as a great addition to a range of resources as teachers should make sure there is sufficient variety in techniques to keep the lesson lively and interesting [Brown 2000]. However, unreliable technology affects negatively teacher's decision and management. As shown in this work, this might lead teachers to alter their lesson plans and adjust lessons on the go.

On the other hand, some schools imposed the use of specific software, but teachers do not necessarily see the connection of these equipment with their own lessons or they find the logistics of use too demanding for them. The large curriculum to be followed also played a role as some teachers might see technology not as part of their lessons, but as something extra, to be done whenever they have extra time. Peer support was also shown as an important aspect to teacher planning as well as use and share of effective practices with technology.

Hence, we conclude that environmental changes are needed in terms of infrastructure and technology access. Moreover, teachers need training and support to feel confident in technology use and to incorporate technology into the curriculum in a meaningful way. Teachers need to be empowered as curators and creators of technology experiences with students. This would help them to transition to more student-centered practices as advocated by the maturity model [Future Lab 2014].

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