M-LEARNING ADOPTION:
COMPARING ADOPTERS AND NON-ADOPTERS INSTRUCTORS

A ADOÇÃO DO M-LEARNING: COMPARANDO PROFESSORES ADOTANTES E NÃO ADOTANTES

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ABSTRACT

This paper investigates higher education instructors' attitude towards mobile learning (m-learning), focusing on the motives behind their decision to adopt m-learning in their daily activities. Supported by the diffusion of innovations theory, the researchers interviewed both instructors who had already adopted m-learning and instructors who had not. Data from the interviews were subjected to content analysis and results suggest that, no matters the difference in perception between adopters and non-adopters, there are three fundamental pillars that allow for innovation in teaching practices: (1) the instructor's personal interest in innovating and changing those practices, (2) institutional support, and (3) government support.

Keywords: M-learning. Mobile Learning. Higher Education. Instructors. Innovation.

RESUMO

Este estudo investiga a atitude dos professores do ensino superior a respeito do mobile learning (m-learning), em especial, os motivos atribuídos pelos professores que podem impactar na decisão de adoção desta inovação como método de trabalho. Com base nos construtos da teoria de difusão de inovações, a pesquisa de campo se deu por meio de entrevistas a professores não adotantes e adotantes do m-learning. Os dados coletados foram submetidos à análise de conteúdo e apesar de divergências de percepção entre adotantes e não adotan-

*tes, os resultados sugerem três pilares fundamentais como necessários para sustentação de práticas docentes
inovadoras: (1) o interesse do professor de inovar e adequar suas práticas docentes, (2) a importância do apoio
institucional e (3) do apoio governamental.*

Palavras-chaves: *M-Learning. Aprendizagem Móvel. Ensino Superior. Professores. Inovação*.

1 INTRODUCTION

Information and Communication Technologies (ICT) are a common reality in modern
societies, as the increased presence of mobile devices such as smartphones and tablets in
people's daily activities shows. Nine in ten Brazilian youngsters have their own cellphone and
20% of them use it to search for information in the Internet. Add on to this fact the exponential
increase in tablet sales and you will start see the bigger picture. In August, 2014, tablet sales
increased 118% compared with the same period in the previous year (NIELSEN, 2014). The
use of cellphones and internet access through mobile devices became so important for daily
life that the survey for the Brazilian National Research on Households (Pesquisa Nacional
por Amostra de Domicílios/PNAD) now include questions about cellphone and Internet usage
(IBGE, 2015).

Taking all this in account, many sectors have been attempting to adapt themselves to this
trend, and the Education sector follows the same path (MARTIN-DORTA; SAORIN; CONTERO,
2011). You can now observe students using mobile technology in their academic environment.
Moreover, Higher Education Institutions seek to update academic practices by developing new
teaching propositions (MERHI, 2015; SHUIB; SHAMSHIRBAND; ISMAIL, 2015). One of these
new practices is mobile learning (or m-learning), which has presented itself as an innovation
in higher education (FERREIRA *et al.*, 2013). According to the authors, mobile learning is a
practice that can help people acquire knowledge in ubiquitous ways with the support of mobile
technologies.

Mobile learning possibilities are countless, and among them we can find: (1) learning
anytime, anywhere; (2) contextual learning; (3) connectivity and continuity between different
learning contexts; (4) convenience for students; (5) opportunities for autonomy and personali-
zation of content and learning processes; and (6) authenticity and collaboration, made possi-
ble by the multitude of converging medias present in mobile devices (SHARPLES; TAYLOR;
VAVOULA, 2007; TRAXLER, 2007; WINTERS, 2007; KUKULSKA-HULM *et al.,* 2011; FER-
REIRA *et al.,* 2013; KEARNEY; BURDEN; RAI, 2015).

Considering the advances in mobile technologies, UNESCO supports the idea that ins-
tructors should plan to include m-learning among their teaching activities. With that concept in
their minds, Kurtz *et al.* (2014) investigated the perceptions of higher education instructors who
have not adopted m-learning. Results show that, even when instructors know what m-learning
is, it is not perceived as an innovation, which may work as a barrier to its adoption as a tea-
ching practice. Capretz and Alrasheedi (2013) defend that in order for m-learning to be accep-
ted it can't be limited only to the development of mobile device applications, but also consider
the instructor's role in introducing innovative practices in the classroom.

Some m-learning initiatives can be detected in Brazilian and foreigner higher education institutions. However, those are isolated attempts and, ultimately, serve to show the importance of understanding which factors lead instructors to adopt m-learning and which factors act as barriers. Besides, there are few studies regarding m-learning adoption among instructors. So, considering the existing gap in literature referring to m-learning adoption among higher education instructors, the objective of this paper is to investigate the perceptions of instructors, both who have and who have not adopted m-learning in their teaching activities, aiming to offer a contribution regarding motivational factors and inherent barriers to m-learning adoption. Because of its exploratory basis, this work seeks to broaden the ongoing discussion on the use of new technologies in instructors' classroom methods.

2 LITERATURE REVIEW

2.1 M-learning

According to Ferreira *et al.* (2013), m-learning can be described as a teaching modality that, through wireless digital networks, uses mobile devices, such as cellphones, tablets and smartphones, to facilitate information exchange, instructor-student interaction, content access and sharing and consultation of a plethora of material anytime and anywhere.

Kearney, Burden and Rai (2015) suggest that the attributes that sustain the m-learning from an educational perspective are personalization, authenticity and collaboration. Personalization is supported by concepts of customization and property. Higher levels of customization allow students to enjoy higher degrees of control over a certain subject throughout a m-learning experience. On the same page, the possibility of personalizing and adapting tools and activities leads to a stronger sense of property. Authenticity promotes collaborative, contextualized and situated learning opportunities. Context and situation are important concepts in engaging students in rich tasks. Students may create their own contexts, with or through their mobile devices. Deep contextualization of tasks, taken in physical or virtual spaces, can be supported by geolocation and data capture, for example. At last, collaboration involves concepts of conversation and data sharing. Through networking with other individuals and groups, students can engage into potentially rich exchanges, sharing information and resources across time and space.

Traxler (2007) states that m-learning is often seen as an extension of e-learning. However, besides their similarities, m-learning and e-learning are quite distinct, mainly because m-learning's core concept is adding mobility to learning. This mobility unfolds into physical mobility, technological mobility, conceptual mobility, social or interactional mobility and temporal mobility (SHARPLES, 2000; KUKULSKA-HULME *et al.*, 2011).

2.2 M-learning use in teaching processes and the role of the instructor

Several studies describe the challenge higher education institutions face in order to stimulate instructors to adopt technological innovations in teaching-learning processes (LEFOE *et al.*, 2009; WONG; LOOI, 2011; FREITAS; BANDEIRA-DE-MELLO, 2012; KOC, 2013).

Capretz and Alrasheedi (2013) indicate that m-learning practices in universities require studies that classify and hierarchize these experiences critical success factors while considering the distinct groups involved, such as managers, students and instructors. Among the factors involved in m-learning implementation processes in higher education that deserve more investigation is the need for instructors to assume a new role (CAPRETZ; ALRASHEEDI, 2013; UNESCO, 2014).

Martin and Ertzberger (2013) suggest that nowadays videogame and interactive entertainment culture drive students to expect high levels of engagement from their instructors during their learning activities. Yet, the use of mobile devices by instructors in classroom activities is incipient. The authors' conclusion indicates that there is a need for more studies on how to better employ m-learning in teaching.

Following this line of thought, Littlejohn, Margaryan e Glasgow (2010) propose that a student's learning attitude seems to be influenced by the teaching methods applied by the instructor. Teaching modalities such as m-learning may come to fill in specific learning needs and humanize teaching actions instead of being only modernization planning targets, once institutions start to stimulate the exploration of new learning opportunities.

In addition, Wengrowicz (2014) alerts for technology's role as a tool in educational processes, as a provocateur of curiosity, as a stimulant to imagination, intuition and emotions, as a promoter of deductive capacities, supporting the process and the instructor's role in the process instead of being the center of it. Thus, the challenge of introducing m-learning in higher education processes requires the instructor's point of view as well as the student's.

2.3 Diffusion of innovations

Rogers' innovation diffusion theory (IDT) is the basis for researches in innovation regarding the decision process involved in the individual acceptance (or rejection) of an innovation and what attributes of that innovation are relevant to that decision (ROGERS, 2003).

According to Rogers (2003), the process of acceptance of an innovation by an individual occurs in five stages: (1) awareness; (2) attitude formation; (3) decision to adopt or reject it; (4) implementation; and (5) reinforcement or reversion of decision.

Regarding the innovation attributes that may affect the decision process, Rogers (2003) suggests that people take into consideration 5 attributes: (1) relative advantage – the degree to which an innovation is perceived as better than the idea it replaces; (2) compatibility – the degree to which an innovation is perceived as being consistent with the existing values, past experiences and needs of potential adopters; (3) complexity - the degree to which an innovation is perceived as difficult to use or understand; (4) trialability - the degree to which an innovation

may be tried on before the decision to adopt it, allowing potential adopters to find out how it works and if it can fulfill their needs; and (5) observability - the degree to which the results of the use of an innovation are visible.

Several studies focused on attitude and intention to adopt innovations associated to mobile digital technologies employed IDT. PÜschel, Mazzon e Hernandez (2010) investigated mobile banking acceptance, and Nickerson, Austreich e Eng (2014) examined smartphone applications adoption. The meta-analytic study of Kapoor, Dwivedi e Williams (2014), in particular, investigated adoption and acceptance processes studies in a 15-year period and pointed eight relevant attributes related to Rogers's IDT:

- Ease of operation – the degree to which an individual believes that using a particular technology is free of effort. It is the opposite of Rogers's complexity;

- Image – the degree to which an innovation is perceived as to boost personal image or social status;

- Cost – the degree to which necessary investments are perceived as high or low;

- Riskiness – a multidimensional construct consisting of six components: performance risk, financial risk, social risk, physical risk, psychological risk, and time loss;

- Visibility – the degree to which the use of an innovation is apparent;

- Voluntariness – the degree to which the use of an innovation is perceived as being a free conscious choice;

- Result demonstrability – the degree to which the results of the use of an innovation are perceived as tangible and communicable. It is directly related to Rogers' observability;

- Social approval – the degree to which the adoption of an innovation is perceived as an approved behavior by one's reference group.

In one hand, ease of operation, image, visibility, result demonstrability, and social approval are constructs positively related to the adoption of innovations. On the other hand, high costs and high risks may represent barriers to adoption in such way that their decrease can enhance the intention to adopt an innovation. Finally, voluntariness presents both positive and negative impacts on innovation adoption. It seems that voluntary introduction of innovations leads to better adoption rates while forced adoptions only leads to resistance (KAPOOR; DWIVEDI; WILLIAMS, 2014).

The study of Kurtz *et al.* (2014) uses Rogers's five innovation attributes as basis to evaluate the perceptions of Brazilian instructors who decided not to adopt m-learning. Their results indicate that relative advantage (i.e. portability, mobility and connectivity) and compatibility (i.e. previous experience with mobile technologies and e-learning) are perceived as positive by non--adopters while complexity (i.e. adaptation of content for mobile use) was perceived as negative. Besides these three IDT attributes, the study identified other relevant attributes as being fundamental to understanding m-learning adoption process among instructors that have yet to adopt it, such as: (1) m-learning disadvantages (i.e. less instructor-student interaction, mobile phones small sizes); (2) other barriers to m-learning (i.e. increased workload for the instructor, lack of student motivation to use m-learning); (3) need for technological and educational training; and (4) institutional support.

Thus, supported by this theoretical background, our study aims to advance on the work of Kurtz *et al.* (2014), broadening the investigation with new analyses and including the perceptions of instructors who have adopted m-learning. By doing so, this study seeks to increase the understanding about critical factors that enable or act as barriers to m-learning adoption in teaching practices by higher education instructors.

3 METHOD

In order to address the objective of identifying attributes that enable or act as barriers to m-learning adoption by higher education instructors, 18 university professors were submitted to in-depth semi-structured interviews. Six of the interviewees were adopters of m-learning, and 12 were non-adopters.

The non-adopters group consisted of 12 professors who work in the same private higher education institution in Rio de Janeiro. Six of them work exclusively for the institution, whereas the other six teach at the same institution but also have jobs in companies from other market segments. The adopters group consisted of professors identified and selected during the 2014 Games and Mobile Learning Meeting in Coimbra, Portugal. These professors work in different higher education institutions in Brazil or in Portugal. Table 1 summarizes the main characteristics of each interviewee.

Interviews lasted an average of 60 minutes. Interviews took longer among adopters, who felt motivated to talk about the theme, in some cases reaching two hours in length. All interviews were recorded and afterwards transcribed. Interviews with professors who didn't live in Rio de Janeiro were conducted via Skype.

We employed content analysis in order to identify the presence of words and/or concepts within the whole set of interviews, and the relationships between those words and concepts. According to Bardin (2011), the categorization process in a content analysis is the sorting of the components of a set, first by differentiation, and then, by regrouping according to analogy and commonality. First, categories were formed based on citations, which are fragments of speech that give empirical support to the analysis, and then these categories were grouped into families. Content analysis was carried out using the Atlas.ti software.

Table 1: Interviewees' profile

Groups	Interviewee	Academic position	Management position	Years Teaching
Group 1: **Non-adopters** who work exclusively in higher education institutions	1	Professor of undergraduate and graduate courses, Lato Sensu and Stricto Sensu, in a Brazilian private institution	Academic coordinator of a Lato Sensu post-graduation course and head of department.	30
	2	Professor of undergraduate and graduate courses, Lato Sensu and Stricto Sensu, in a Brazilian private institution	Academic coordinator of a Lato Sensu post-graduation course.	26
	3	Professor of undergraduate and graduate courses, Lato Sensu and Stricto Sensu, in a Brazilian private institution	Head of department and ex-vice-chancellor.	30
	4	Professor of undergraduate and graduate courses, Lato Sensu and Stricto Sensu, in a Brazilian private institution	Academic coordinator of a Lato Sensu post-graduation course and head of department.	32
	5	Professor of undergraduate and graduate courses, Lato Sensu and Stricto Sensu, in a Brazilian private institution	Academic coordinator of Lato Sensu post-graduation and extension courses and head of department.	35
	6	Professor of undergraduate and graduate courses, Lato Sensu and Stricto Sensu, in a Brazilian private institution	Head of department	36
Group 2: **Non-adopters who work in other professional**	7	Professor of undergraduate and graduate Lato Sensu courses in a Brazilian private institution	Civil servant in the oil and gas sector with experience in finances	10
	8	Professor of undergraduate, extension and graduate Lato Sensu courses in a Brazilian private institution	Consultant in communications with experience in branding	15
	9	Professor of undergraduate courses in a Brazilian private institution	Private company employee in the education sector with experience in IT	2
	10	Professor of undergraduate, extension and graduate Lato Sensu courses in a Brazilian private institution	Consultant in business management with experience in human resources	35
	11	Professor of undergraduate, extension and graduate Lato Sensu courses in a Brazilian private institution	Consultant in business management with experience in process management	9
	12	Professor of undergraduate and graduate courses, Lato Sensu and Stricto Sensu, in a Brazilian private institution	Civil servant in the corporate finance sector	4
Group 3: **Adopters who work in higher education institutions** in Brazil or Portugal	13	Professor of undergraduate courses in a Brazilian federal university and a public school	None	18
	14	Professor of undergraduate courses in a Brazilian private institution	Consultant in Education with focus in innovations	16
	15	Professor of undergraduate courses in a Portuguese private institution	None	14
	16	Professor of undergraduate courses in a Portuguese private institution	None	16
	17	Professor of undergraduate courses in a Portuguese private institution	None	32
	18	Professor of undergraduate courses in a Brazilian private institution	Head of department	25

Source: Research data

In order to identify and organize our categories and families, we adopted the semantic categorization criteria, thus grouping words and concepts by their meaning in the message while taking into consideration the constructs used by Rogers (2003) and Kapoor, Dwivedi e Williams (2014). Then, analyzing relationships between categories and their possible inter-pretations, we identified and developed attributes relevant in the mobile learning adoption by instructors.

As a strategy to hold the search for new data we employed data saturation (GLASER; STRAUSS, 1967). We analyzed the first group (non-adopters) until we had reached saturation and only then moved to analyze the second group (adopters). We assumed that saturation was reached when we could no longer perceive new information emerging from data regarding enablers and inhibitors of m-learning adoption into the speech patterns of the interviewees (BOWEN, 2008).

Finally, we evaluated the interviewees' attitude towards m-learning and compared both groups. We decomposed the speech of each interviewee into units, looking for the object of each attitude and also their verbal connectors and predicates, in order to identify the evaluative load of each unit by analyzing the direction of each assertion – favorable, unfavorable, ambiva-lent and neutral (BARDIN, 2011).

5 RESULTS

Results suggest that mobile learning, just as any other teaching practice, must be planned with both students' and instructors' interests in mind in order to improve the performance of all involved.

Following the objective of this investigation, which involves identifying factors that con-tribute to attitude formation in m-learning adoption processes by instructors, Rogers (2003) diffusion of innovations theory, extended by Kapoor, Dwivedi e Williams (2014), had a relevant role in the identification of these factors in higher education contexts in Brazil.

The attitude analysis for non-adopters showed results similar to those found by Kurtz et al. (2014). Non-adopters' attitudes appear to be divided between positive, negative and ambivalent, whereas adopters' attitudes showed high receptiveness not only to m-learning, but to any new practices that could contribute to teaching-learning processes. It seems important to highlight that the work of Kurtz et al. (2014) was a preliminary investigation, focused on understanding factors that affect the decision to accept or reject m-learning, while this study sought to further the research on m-learning use among higher education instructors. Our analysis included both adopters and non-adopters, and compared both groups, thus allowing the identification of new factors involved in m-learning adoption processes within the interviewees' speech.

5.1 Main attributes

At first, there was an intentional attempt to find within the professors' speech clues that represented attributes from the works of Rogers (2003) – Relative Advantage, Compatibility,

Observability, Trialability, and Complexity – and Kapoor, Dwivedi e Williams (2014) – Ease of Operation, Image, Cost, Riskiness, Visibility, Voluntariness, Result Demonstrability, and Social Approval. Citations were coded and grouped according to these attributes definitions. Then, new categories, absent both in Rogers (2003) and Kapoor, Dwivedi e Williams (2014), were identified. The different conceptions, understanding and uses for m-learning present in the speech of the professors show the presence of different categories for each group. Table 2 illustrates categories for each group and how each one is grouped in families, which represent favorable and unfavorable factors m-learning adoption as well as its requirements.

Categories in bold are the commonality between the two groups of interviewees, indicating shared perceptions related to m-learning adoption in higher education teaching practices. As we compare the perceptions of the two groups, relative advantage and compatibility categories, two factors that according to Rogers (2003) facilitate the diffusion of innovations, appear to be important factors for both adopters and non-adopters. The relative advantage category had the greatest number of citations, 114 for the adopters and 132 for the non-adopters. Both groups have also highlighted requirements for m-learning adoption as a fundamental issue (68 citations for adopters and 69 for non-adopters), thus forming the third common category between the two groups.

Table 2: Interviewees' profile

Category Families	Adopters	Non-Adopters
Enabling Factors	▪ **Relative Advantage** – 114 citations grouped in 20 codes ▪ **Compatibility** – 11 citations grouped in 3 codes ▪ Observability – 12 citations grouped in 2 codes ▪ Trialability – 11 citations grouped in 3 codes ▪ Facilidade de uso – 22 citations grouped in 3 codes ▪ Voluntariness – 12 citations grouped in 2 codes ▪ Result of demonstrability – 12 citations grouped in 2 codes	▪ **Relative Advantage** – 132 citations grouped in 14 codes ▪ **Compatibility** – 22 citations grouped in 4 codes
Hindering Factors	▪ Riskiness – 46 citations grouped in 17 codes	▪ Other barriers to m-learning – 51 citations grouped in 9 codes ▪ Complexity – 20 citations grouped in 5 codes ▪ M-learning disadvantages – 21 citations grouped in 7 codes
In-order-to-adopt requirements	▪ **In-order-to-adopt requirements** – 68 citations grouped in 6 codes	▪ **In-order-to-adopt requirements** – 69 citations grouped in 9 codes

Source: Research data

According to the data, the diffusion of innovations attributes of observability and trialability were not identified within the speech of non-adopters, suggesting that when attributes related to observing and experimenting with can't be perceived, m-learning adoption processes may be hindered. In this case, for the non-adopters group, the whole m-learning introduction and adoption processes are viewed as difficult and unnecessary.

Complexity was pointed out as an inhibitor factor by non-adopters. Because m-learning is a new practice for this group, their perceptions regarding its complexity may be affected by the need to develop new skills. Among adopters, complexity doesn't seem to be a concern. For them introducing m-learning practices was a response to the need to adapt classes to the demands of students highly immersed in a digital world. According to these professors, their learning of m-learning came through intentional search for literature and tutorials, followed by

experimentation balanced by personal and classroom realities. Besides, several interviewees pointed the existence of advantages and compatibilities between m-learning and their previous teaching practices.

Kapoor, Dwivedi e Williams (2014) attributes, which work as complements for Rogers (2003), were present only in adopters' speech, and did not seem to be as significant as they appear to be in Kapoor, Dwivedi e Williams (2014). Ease of operation is the attribute which appears more frequently. Analyzing the speech of adopters, ease of operation seems to be strongly associated with the ease of adaptation of new, compatible educational practices.

Riskiness is an attribute which came to represent the awareness that there will be some obstacles to overcome in order to use m-learning in teaching practices. Adopters have even pointed other essential actors, such as managers, that can contribute to the diffusion of the m-learning in higher education settings. Adopting new ideas, and replacing current practices involves a certain risk and uncertainty (ROGERS, 2003), which could be minimized if managers gave support to the diffusion of these new ideas within their organizations.

Voluntariness and result of demonstrability attributes showed that there is a need to build awareness and disseminate results of m-learning practices among instructors. Results reinforce the positive effect of voluntariness in non-mandatory adoption processes, as voluntariness is directly connected to the professors' personal interest in opening new paths for their teaching practices based on their students' interests.

5.2 Instructors' Attitude

Whereas in the non-adopters group nine professors showed ambivalent attitudes and seven openly unfavorable ones, adopters have showed positive attitudes and intention to use m-learning. Although recognizing an inherent risk in adopting m-learning, these professors showed their enthusiasm with the use of m-learning even before effectively adopting it (Table 3).

Table 3: Citations qualifying m-learning

Interviewee	Citations
13	"So, m-learning for me was a gift!" "M-learning is impressive and engaging."
14	"If it's not w0ith m-learning, it doesn't interest me."
15	"M-learning has no space and time barriers, gives you freedom."
16	"M-learning is fantastic, makes classes full of life, full of action."
17	"M-learning makes things easy, so easy!"
18	"M-learning is the result of a widely accepted practice."

Source: Research data

5.3 M-learning use in Higher Educatio

Broadly speaking, data analysis has identified three fundamental pillars as necessary to support innovative teaching practices: (1) the instructor's interest in innovating and adapting ongoing teaching practices; (2) institutional support; and (3) government support.

Regarding the **instructor's interest in innovating**, we noticed that this subject was brought up by the interviewees both directly and indirectly. Among non-adopters, both the enthusiasm of some and the disinterest of others revealed how important the instructors' engagement with their teaching methods is, regarding content, students and competences. For these professors, m-learning's perceived requirements illustrate the importance of the instructor's interest in adopting new practices. The codes 'need for technological competence', 'need for pedagogical training', and 'need for a new instructor role' represented 48 of the 68 citations related to the 'in-order-to-adopt requirements' category. Such needs assume the instructor's interest as a premise in order to be met. All interviewees indicated that technological competence and pedagogical training are sought when instructors perceive what can be gained from them, thus developing a personal interest in investing in these improvements. The following illustrates how instructor engagement may enhance m-learning use:

> *The smartphone should be tapped by instructors to develop educational activities.* (Interviewee 7:15)

Adopter's opinions make clear that instructor interest is the start of successful m-learning deployment.

> *M-learning appeals to me so that I can take advantage of my downtime.* (Interviewee 18:18)

Data indicate that, for adopters, there is an awareness of the need for new ways to expand teaching beyond the boundaries of the classroom, and that m-learning may help further content learning:

> *I want them to have contact, beyond the forty-minute class. The only way I had, was to place the content into their mobile phones.* (Interviewee 13:12)

As well as with non-adopters, the 'instructor interest' pillar was perceived as a requirement by adopters, and represented in their 'in-order-to-adopt requirements' category. For them, the need to adapt classes to their students' values is the basis to adopt m-learning:

> *There is already interaction with students through Facebook. Anyway, I already use the tools so that to begin using the m-learning is relatively natural.* (Interviewee 17:17)

In addition to these citations from adopters and non-adopters are the studies of Littlejohn, Margaryan and Glasgow (2010), Christensen, Michael e Johnson (2012), and Martin and Ertzberger (2013), whose conclusions strengthen the notion that instructor interest is an important step, and thus one of the pillars, for the deployment of innovative teaching practices in higher education contexts. In the case of m-learning, being it one of these innovative practices, we expect the 'instructor interest' pillar to represent instructors' motivations, facilitating or hindering m-learning adoption in higher education.

Regarding **institutional support**, interviewees highlighted that higher education institutions have an important role in setting an innovative environment. According to the professors interviewed, Higher Education Institutions (HEIs) need to understand the actual role of innovations in the classroom, recognizing its part in more effective teaching-learning processes and encouraging innovative practices. All interviewees indicated that institutional support has the power to provide conditions that give their instructors the necessary freedom, encouragement and commitment to adopt new technologies that enable a more assertive content transfer:

> *Now, such a process must have a much larger infrastructure. The instructor has to know all these tools in addition to knowing the content. So I think the first difficulty might be the institution, or whatever, the group to have this infrastructure to prepare it.* (Interviewee 4:37)

Non-adopters diverge in their opinions about the institutional support needed for m-learning practice, but these divergences seem to complement each other. For them, HEIs are decisive in any innovative technology deployment, providing resources, training, and adequate compensation. These professors recognize the importance of developing new teaching practices and the intense use of mobile devices by their students. However, amidst so many exposed needs, these professors specifically highlight the need for institutional support, represented by the category 'in-order-to-adopt requirements' and by the code 'workload increase'. This code shows the role of the institution as a supporter in the adoption process, but at the same time expresses the professors' fear about what consequences the new practices will have on their already established ones.

> *What can be done in the classroom could be done throughout the week. What is the major problem we have? I teach a subject worth two credits once a week. We only get a weekly meeting. They could interact during the week through the phone, but I cannot keep up with it.* (Interviewee 6:25)

For adopters, HEIs must take the responsibility of disseminating innovations and training instructors, signalizing what can be gained from classroom innovations, especially in the case of m-learning, as it is linked to interests and habits of students. Adopters indicate that education institutions can and should support deployment and provide aid for m-learning, devoting attention to the expressed needs for institutional support, also pointed out by non-adopters, and planning for the development and implementation of m-learning activities:

> *Some universities in the United States for example, have classes directly with mobile devices, so much so that questions are asked to the students and they respond on-line, with the instructor knowing the results of student responses in real time. I think that's a very good idea to try to capture the attention of students, my motivation then, was to make students feel attracted to classes. I have noticed that their attention span in class, from year to year, has been dwindling.* (Interviewee 17:39)

Added to these needs is the degree of risk perceived by the professors, which inhibits m-learning diffusion and adoption. For them, the perception of any risk, which according to Kapoor, Dwivedi e Williams (2014) may affect innovation adoption negatively in many aspects (performance, financial, physical and social), leading instructors to believe in the importance of institutional support in order to minimize these perceived risks. Thus, the HEIs should provide the due background aid to ensure the success of m-learning usage.

> *Abroad [in the US] they gave all the support, structure, there was quite a lot, they gave enough support. (…) Some things were mandatory, for example, you had to use this Blackboard thing there to make interactions with the students, like: Essay delivery has to be via Blackboard. For student interaction there must be at least three discussion forums per semester, you know, there was a couple of rules from the institution.* (Interviewee 14:18)

In both discourses (non-adopters and adopters) some factors that are not directly related to the attributes described by Rogers (2003) and Kapoor, Dwivedi e Williams (2014), represented by category families identified by this study, stand out. These categories suggest contribu-

tions related to the institutional efforts necessary to m-learning adoption processes. Although it has not been investigated in the theoretical background, literature regarding institutional support may endorse the accounts that emerged during interviews. According to Akour (2009), universities must align its strategic objectives with its educational and financial objectives, thus providing the best educational environment and tools for students and instructors. Christensen, Michael and Johnson (2012) suggest that educational institutions should use the right tools to introduce changes.

According to the authors, it is necessary to promote online courses as complement to face meetings, combining subject content with student actual interests, establish an organizational environment that fosters and prepares the institution to implement innovative practices, and not regulate potentially disruptive innovations. In the face of existing theories and the perceptions of the interviewed professors, institutional support emerges as a pillar that should be considered whenever employing m-learning as an aid to teaching practices.

Finally, regarding government support, only adopters have manifested any opinion. Although restricted, this group's statements illustrate the government's participation in the process of adoption of new technologies in higher education settings. For these professors, dissemination of good practices, accompanied by institutional and government incentives, can arouse the interest of instructors in adopting m-learning:

> *The government has to make the technology cheap. As it just happened in India. India sold to students a tablet costing us today around fifty reais [Brazilian currency – about U$ 15,00]. All parents bought. The students then owned the technology and could customize their own devices. (…)* (Interviewee 13:39)

It is general consensus that the reporting of results obtained with m-learning shouldn't be restricted only to educational institutions. Governmental institutions can recognize and promote the best practices and facilitate access to mobile devices, backing m-learning implementation with educational theories and adapting it to the needs of instructors and students. Therefore, it is believed that in addition to the goals it sets for higher education, the government can create mechanisms that make this type of teaching friendlier and more relevant, arousing in the students a greater involvement with learning and in the instructors a desire to innovate their practices. However, according to the professors surveyed, government support cannot occur as a result of a technological fad, as the discourse on digital inclusion has been, but rather as something that is accompanied by a broader project:

> *The former minister [of Education, in Brazil] has distributed tablets in schools. What was his mistake? He should have made a pedagogical project first. It is not technology just for technology's sake. This we cannot agree with, but now we're trying to catch up. Now we're following the UNESCO recommendations. Because there are UNESCO guidelines also for instructor training.* (Interviewee 18:48)

Moreover, there is a fear among instructors that institutionalization could stifle the use of m-learning, thereby limiting the great potential that these technologies can offer to the teaching-learning process:

> *If I say that it is the government's responsibility, I think it implies institutionalizing, and once institutionalized I do not know to what extent it will be good. Why does the mobile work well? Because it is not a novelty among students. You take advantage of something that they have to reach them in some non-*

invasive way (…) In Portugal there are manuals, the book and the CD, there are instructors who choose not to use the CD. It is a matter of choice, it is a matter of methodologies, I think it should effectively be taken by the government, because instructor training also comes from the government. (Interviewee 17:67)

According to Christensen, Michael and Johnson (2012), government support should explore ways to gather political influence in order to convince all involved in the process of adoption of new educational practices to cooperate effectively with initiatives that facilitate the deployment of new technologies. For the authors, the government must inspire and test new school frameworks, incubating schools within schools and supporting institutions so that they kindle the involvement of instructors with curriculum designers, seeking new rules and new interface standards. Therefore, we suggest that the government should focus its efforts in establishing governance tools that promote cooperation so all the parties involved can act in a coordinated manner in order to achieve their proposed objectives. Thus, both the speech of adopters and the considerations of Christensen, Michael and Johnson (2012) serve to strengthen the importance of government support as a pillar for m-learning adoption.

Considering all above, it was possible to identify among the attributes suggested by Rogers (2003) and those gathered from related studies mentioned by Kapoor, Dwivedi e Williams (2014), those attributes that influenced the perception of the interviewed professors about m-learning, and hence, about innovation within HEIs, given the due government support. It is also legitimate to recognize the merit of the three pillars that must be articulated in a process to encourage the acceptance and diffusion of m-learning as a teaching methodology in higher education. If instructors cannot see a solid path to a better teaching performance and an improvement in their students' performance in the results obtained using m-learning, actions taken by institutions and public sectors become less important. More than that, we need to alert and educate academics about the educational and methodological aspects of mobile learning to be explored, taking advantage of proximity and mobile technology's incorporation in people's lives, and not just introducing new technological tools in universities.

6 FINAL REMARKS

In an attempt to find factors that contribute to the attitude of professors regarding m-learning adoption, we have discovered that both adopters and non-adopters show opinions that allow the association of attributes from Rogers (2003) and Kapoor, Dwivedi e Williams (2014) to this adoption process.

Among non-adopters, it was possible to form categories representing the attributes of "Relative Advantage", "Compatibility" and "Complexity", which are defended by Rogers (2003), in addition to categories such as "Disadvantages of M-learning", "Other M-learning Barriers" and "In-Order-to-Adopt Requirements", by grouping complementary codes while respecting the definition of these terms. The formation of these categories had already been mentioned in Kurtz *et al.* (2014). On the other hand, adopters have indicated in their accounts the formation of the categories "Relative Advantage", "Compatibility", "Observability" and "Trialability", after Rogers (2003), and "Degree of Risk", "Ease of Operation", "Result Demonstrability" and "Volun-

teering", after Kapoor, Dwivedi e Williams (2014), while having also indicated the importance of the category named "In-Order-to-Adopt Requirements".

The main contribution of this study was the comparison between adopters' and non-adopters' attitudes. Although the two groups showed differences at times, it was possible to detect that professors from both groups addressed the issue of m-learning adoption around a common axis. Therefore, an additional contribution of this study is the proposal of three fundamental pillars, which have emerged from the interviews, as required to support the introduction of innovative teaching practices such as m-learning: (1) the instructors' interest in innovating and adapting their ongoing teaching practices; (2) institutional support; and (3) government support. Despite limitations such as the number of respondents and the typical constraints of in--depth interviews (indirect information, lack of articulation of respondents) (CRESWELL, 2013), we consider these three proposed pillars particularly important because they arise from the respondents speech and establish a clear relationship with the existing literature.

Exploring the attributes that influence attitude formation regarding m-learning adoption among university professors requires understanding both the instructors and the higher education context. As discussed, the introduction of new practices in this environment is directly related to the attitude of the students, managers and professors, and warrants further investigation to assess, in particular, faculty and administrative staff. Thereby, our results indicate that the rate of adoption of m-learning in higher education can grow as long as the attributes that contribute positively to the attitude formation for this innovation are provided.

Finally, the authors suggest that further investigations should pursue new research models for adoption of mobile learning in other contexts, attempt to understand the effects of the e-learning in the use of m-learning, investigate the role of resistance in the adoption of innovations, suggest new methodologies for the deployment and implementation of m-learning, and apply mixed research approaches and longitudinal analysis to broaden the understanding of this topic. We believe that future studies can foster greater insight into the factors that influence m-learning adoption and capture the different perceptions of different respondents over time.

REFERENCES

AKOUR, H. *Determinants of mobile learning acceptance: an empirical investigation in higher education*. 2009. Ph.D. Dissertation in Industrial Engineering & Management, Oklahoma State University, Oklahoma. p. 1-363, 2009.

BARDIN, L. *Análise de Conteúdo*. 1. ed. Lisboa: Edições 70, São Paulo, 2011.

BOWEN, G. Naturalistic inquiry and the saturation concept: a research note. *Qualitative Research*, Thousand Oaks, v. 8, n. 1, p.137-152, 2008.

CAPRETZ, L.; ALRASHEEDI, M. A Meta-Analysis of Critical Success Factors Affecting Mobile learning. *In*: 2013 IEEE INTERNATIONAL CONFERENCE ON TEACHING, ASSESSMENT AND LEARNING FOR ENGINEERING (TALE), Bali. *Anais* [...]. Bali, 2013. p. 262.

CRESWELL, J. *Research Design*: Qualitative, Quantitative, and Mixed Methods Approaches. 4th Edition. London: SAGE Publications, 2013.

CHRISTENSEN, C.; MICHAEL, B.; JOHNSON, C. *Disrupting Class*: How Disruptive Innovation Will Change the Way the World Learns. 1st. ed. New York: McGraw-Hill, 2012.

FERREIRA, J. B. *et al.* Mobile Learning: Definition, Uses and Challenges. In: WANKEL, Laura A.; BLESSINGER, Patrick (eds.). *Increasing Student Engagement and Retention Using Mobile Applications*: Smartphones, Skype and Texting Technologies (Cutting-edge Technologies in Higher Education). Bingley: Emerald Group Publishing Limited, 2013. v. 6, p. 47-82.

FREITAS, A. S.; BANDEIRA-DE-MELLO, R. Managerial action and sensemaking in e- implementation in Brazilian business schools. *Computers & Education*, Amsterdam, v. 59, n. 4, p. 1286-1299, 2012.

GLASER, B.; STRAUSS, A. *The discovery of Grounded Theory*: Strategies For qualitative research. New Brunswick and London: Aldine Transaction, 1967.

IBGE. *Pesquisa Nacional por Amostra de Domincílios*. Instituto Brasileiro de Geografia e Estatística, 2015. Available in http://www.ibge.gov.br/home/estatistica/pesquisas/pesquisa_resultados.php?id_pesquisa=40. Retrieved Oct 15th, 2015.

KAPOOR, K.; DWIVEDI, Y.; WILLIAMS, M. Innovation adoption attributes: a review and synthesis of research findings. *European Journal of Innovation Management*, Bingley, v. 17, n. 3, p.327-348, 2014.

KEARNEY, M.; BURDEN, K.; RAI, T. Investigating instructors' adoption of signature mobile pedagogies. *Computers & Education*, Amsterdam, v. 80, Issue C, p. 48-57, 2015.

KOC, M. Student instructors' conceptions of technology: A metaphor analysis. *Computers & Education*, Amsterdam, v. 68, p.1-8, Oct. 2013.

KUKULSKA-HULME, A. *et al.* The genesis and development of mobile learning in Europe. In: D. Parsons (Ed.). *Combining E-learning and M-learning*: New Applications of Blended Educational Resources. Hershey: IGI Global, 2011. p.151-177.

KURTZ, R. *et al.* Adoção de m-learning por professores no ensino superior: uma investigação sobre aspectos favoráveis e possíveis barreiras. *In*: XXXVIII ENCONTRO DA ANPAD, 2014, Rio de Janeiro. *Anais do XXXVIII Encontro da ANPAD*, 2014.

LEFOE, G. *et al.* Faculty development for new technologies: Putting mobile learning in the hands of the instructors. *Faculty of Education-Papers*, Wollongong, 77, 2009.

LITTLEJOHN, A.; MARGARYAN, A.; GLASGOW, G. Exploring students' use of ICT and expectations of learning methods. *Electronic Journal of e-learning*, Reading, v. 8, n. 1, p. 13-20, 2010.

MARTIN, F.; ERTZBERGER. J. Here and now mobile learning: An experimental study on the use of mobile technology. *Computers & Education*, Amsterdam, v. 68, p.76-85, Oct. 2013.

MARTIN-DORTA, N.; SAORIN, J.; CONTERO, M. Web-based Spatial Training Using Handheld Touch Screen Devices. *Educational Technology & Society*, Doulin City, v. 14, n. 3, p.163–177, 2011.

MERHI, M. Factors influencing higher education students to adopt podcast: An empirical study. *Computers & Education*, Amsterdam, v. 83, p.32-43, Apr. 2015.

NICKERSON, R.; AUSTREICH, M.; ENG, J. Mobile Technology and Smartphone Apps: A Diffusion of Innovations Analysis. *In*: 20TH AMERICAS CONFERENCE ON INFORMATION SYSTEMS, 2014, Savannah. *Anais* [...]. Savannah, 2014.

NIELSEN HOLDING N. (BRASIL). *Release – contato assessoria de imprensa*. São Paulo. Agosto, 2014.

PÜSCHEL, J.; MAZZON, J.; HERNANDEZ, J. Mobile banking: proposition of an integrated adoption intention framework. *International Journal of Bank Marketing*, Bingley, v. 28, n. 5, p. 389-409, 2010.

ROGERS, E. *Diffusion of innovations*. 5th ed. New York: The Free Press, 2003.

SHARPLES, M. The Design of Personal Mobile Technologies for Lifelong Learning. *Computers & Education*, Amsterdam, v. 34, n. 3-4, p. 177-193, 2000.

SHARPLES, M.; TAYLOR, J.; VAVOULA, G. A Theory of Learning for the Mobile Age. In: Andrews, R.; Haythornthwaite, C. (eds.). *The Sage Handbook of Elearning Research*. London: Sage, 2007. p. 221-47.

SHUIB, L.; SHAMSHIRBAND, S.; ISMAIL, M. A review of mobile pervasive learning: Applications and issues. *Computers in Human Behavior*, Amsterdam, v. 46, ed. c, p. 239-244, 2015.

Fernanda Pina, Renata Kurtz, Jorge Brantes Ferreira,
Angilberto Sabino de Freitas e Fernanda Leão Ramos

TRAXLER, J. Defining, Discussing, and Evaluating Mobile learning. *International Review of Research in Open and Distance Learning*, Athabasca, v. 8, n. 2, 2007.

UNESCO. *O Futuro da aprendizagem móvel*: implicações para planejadores e gestores de políticas. Brasília: UNESCO, 2014. 64 p.

WENGROWICZ, N. Teachers pedagogical change mechanism – Pattern of structural relations between instructors' pedagogical characteristics and instructors' perceptions of transactional distance (TTD) in different teaching environments. *Computers & Education*, Amsterdam, v. 76, p. 190-198, July 2014.

WINTERS, N. What is mobile learning. *In*: Sharples, M. (ed.). *Big issues in mobile learning*. Report. University of Nottingham, 2007. Available in http://www.lsri.nottingham.ac.uk/Publications_PDFs/BIG_ISSUES_REPORT_PUBLISHED.pdf. Retrieved July 27, 2010.

WONG, L.; LOOI, C. What seams do we remove in mobile-assisted seamless learning? A critical review of the literature. *Computers & Education, Amsterdam*, v. 57, n. 4, p. 2364-2381, 2011.