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Haaga-Helia
University of Applied Sciences

MOBILE LEARNING AND FRUGAL INNOVATION
for emerging markets

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Foreword

'Frugal innovation' is not only a new concept; it is a megatrend with potential to affect all companies and their networks. As income levels in many less-developed countries are rising, there is an increasing demand for smart but affordable new solutions for everyday needs. These needs often relate to the fundamentals of how food, water or energy are distributed, how people travel and are connected with each other, how they handle health-related issues or access education and other basic services in contexts where critical infrastructures still may be underdeveloped.

Frugal innovations promise to offer smart and affordable solutions to real needs through more purposefully engineered innovations and business models. Therefore, they challenge current engineering and management thinking that is often geared towards developing highly advanced and complex products and services polished to perfection. Finland has excelled in this type of thinking for many years, and it has served us well. However, in the future, the biggest winners will be those who can also offer smart and affordable solutions for emerging markets in rapidly developing countries where societal challenges and needs often are greatest.

The SCALA project focuses on frugal innovation related to mobile learning in the context of Brazil as an example of opportunities and challenges that companies and their partners face when entering emerging markets. Business Finland is also actively supporting companies in accessing such markets, among other things, through services and programs such as the Business with Impact (BEAM) program that is implemented jointly with the Ministry for Foreign Affairs.

This book reports and discusses the findings of the SCALA project. It provides many insights and learnings about frugal innovation that are of high relevance to companies, policy stakeholders and researchers alike. We thank the project group for their good work, and hope that the book will stimulate discussion and also challenge current engineering and management thinking, so that Finland can both benefit from the frugal innovation megatrend and better address societal challenges and needs that the world is currently grappling with.

Christopher Palmberg
Program Development Manager
Business Finland

Introduction

This publication focuses on mobile learning (m-learning), frugal innovation, business development and emerging markets, especially that of Brazil. M-learning is a rapidly developing area, and when entering emerging markets, frugal innovation thinking is an essential skill. The publication presents ways in which m-learning can be developed and solutions for it implemented in collaboration with users and other stakeholders. The publication is directed at anyone interested in these issues, either in companies, educational organizations, funding organizations or academia. The publication's style is rather practice-oriented. The work described in the publication has been conducted in a project entitled "Scalable mobile learning services for emerging markets" (SCALA). The project was implemented by Haaga-Helia University of Applied Sciences (coordinator) and Lappeenranta University of Technology, LUT Lahti.

Why mobile learning?

Mobile devices are transforming the way in which we communicate, live and learn. M-learning offers modern ways to support learning processes through mobile devices, such as handheld and tablet computers, MP3 players, smartphones and mobile phones. We must ensure that this digital revolution also becomes a revolution in terms of educational settings, promoting inclusive and better learning everywhere. As noted by Aarreniemi-Jokipelto and Goulart in their chapter (Mobile learning in global education: Analysing different circumstances and cultures), mobile devices can deliver learning to people, communities and countries with previously poor or no access. Naturally, there are also challenges involved, and those will be focused on in several chapters.

Why Brazil?

Brazil is the 5th largest higher education market in the world and the largest in Latin America. Brazil has 57 million students in basic

education, out of which 11.1 million are in secondary education and 7.3 million are in the higher education sector. Brazilians are turning into heavy consumers of mobile-formatted content, and m-learning is expected to become a big part of what is consumed on these screens, as explained, by Isacsson, Suhonen and Wickström in their chapter (Identifying market potential and buyer profiles for Finnish mobile learning services in Brazil). The most downloaded apps in Brazil are related to learning and educational games. In August 2016, the Minister of Foreign Affairs of the Federative Republic of Brazil, José Serra, and the Minister of Foreign Affairs of the Republic of Finland, Timo Soini, agreed to adapt a "List of Priorities for the Cooperation between Brazil and Finland" involving cooperation in educational matters. There is thus a solid basis for collaboration. The interest in Finnish education, innovations, learning methods and learning content is high in Brazil.

Why frugal innovation?

There is a wealth of various innovation concepts being discussed nowadays, and the understanding concerning innovation has widened considerably from the times when it was mainly seen as an outcome produced by one or few "heroic innovators". Frugal innovation is yet another new concept, but one that is very useful in terms of emphasizing the innovation process as a social process that focuses on meeting users' needs and on the design of suitable solutions. Frugal innovation thus involves rethinking entire production processes and business models, as discussed by Hyypiä and Melkas (The essence of frugal innovation in the development of mobile learning: A case study of two Finnish SMEs). An example of this is in the development of solutions together with students, as in the upcoming case presented by Isacsson, Hyypiä, Goulart, Harmaala and Uronen (Waste management collaboration between Brazilian and Finnish students in the SCALA project) and in another case presented by Rainio (Developing mobile learning applications with students for emerging markets). In technology development, the starting point is typically the technology itself, but companies should consider that the fastest-growing markets are in emerging markets with a high demand for frugal products and services and, therefore, major business opportunities are available for skilled frugal innovators.

Why SCALA?

The SCALA project (2016–2018) was designed to focus both on research and testing content and applications in educational institutions in Brazil, in the São Paulo area. The project was funded by Business Finland (BEAM) and the Ministry for Foreign Affairs. Three Finnish companies were also involved in the project, providing their learning content for testing and development. The University of São Caetano do Sul in Brazil played a significant role both in the research and testing aspects. SCALA has provided new knowledge, networks and skills, in line with its objectives.

We wish to thank – on behalf of the whole project – the funders of the project, the participating companies (Viope Oy, Finpeda Oy and Promentor Oy) and the project's steering group, as well as all the stakeholders who participated in, for example, the various pilots in Brazil. Many students, teachers, schools and other organizations were involved in one way or another, so we are indebted to many people for their participation and assistance. Without them, it would not have been possible for the project group to test, develop and study m-learning and frugal innovation. Moreover, we wish to thank Nina Finell and Pirjo Aura at Haaga-Helia for proofreading.

This publication is also available as an electronic version at Haaga-Helia UAS webshop (shop.haaga-helia.com).

Helsinki and Lahti, February 2018
Annica Isacsson and Helinä Melkas

Introduction from the Brazilian point of view

Introduction

Science is the art of overcoming challenges through knowledge, methods, techniques and, especially, by being daring. Sometimes challenges are faced on their own, others require some people and others need, besides people, much will and determination.

The SCALA project started with an idea, a conversation and a willingness to undertake a joint effort to study the phenomenon of m-learning. The international call for joint technological research projects between Brazil and Finland arose and provided the opportunity for a joint effort with a common desire to expand knowledge in the area.

Outside of the project itself, the greatest collaboration was between people, where the gap narrowed between different visions and cultures, as did the approximation and learning of a collaborative construction, albeit with its own difficulties and limitations.

The project ended with its goals achieved and shows that challenges feed the human soul. The project highlighted that when competent and determined people come together, positive results are achievable, and it is only a matter of time for these results to actualize.

Introdução

A ciência é a arte de superar desafios por meio do conhecimento, de métodos, técnicas e, especialmente, de ousadia. Por vezes, enfrenta-se um desafio sozinho, outros maiores requerem algumas pessoas e outros precisam, além das pessoas, muita vontade e determinação.

O projeto SCALA teve início com uma ideia, uma conversa, e uma vontade de juntar esforços para se estudar o fenômeno da aprendizagem móvel. A chamada internacional entre Brasil e Finlândia para projetos de

pesquisa tecnológica conjunta surgiu e deu a oportunidade para união de esforços e o desejo comum de ampliar conhecimentos na área.

A despeito do projeto em si, a colaboração maior foi entre pessoas, o estreitamento de visões e culturas diferentes, a aproximação e a aprendizagem de uma construção colaborativa, ainda que com suas próprias dificuldades e limitações.

O projeto termina com seus objetivos alcançados e mostra que os desafios alimentam a alma humana. O projeto mostrou que quando pessoas competentes e determinadas se unem, os resultados são apenas uma questão de tempo.

Elias E. Goulart

1

Mobile learning in global education: Analysing different circumstances and cultures

Päivi Aarreniemi-Jokipelto and Elias E. Goulart

Abstract

Mobile devices can offer learning to people, communities and countries where other educational inventions have been too expensive, difficult, dangerous or demanding. The objective of the present study was to test if existing e-learning solutions could be localized to enable mobile learning (m-learning) in Brazil. Another aim of the study was to develop an m-learning taxonomy defining the criteria for localizing m-learning within global education and to tailor it to different circumstances and cultures.

Introduction

Mobile devices have overtaken personal computers for accessing both the Internet and learning resources in classrooms. The main issue involved is the presence everywhere of mobile devices in students' hands, even in places where there are lower socioeconomic conditions, and more importantly, these devices have the capability of changing educational processes. According to ComScore (ComScore, 2017), mobile devices dominate total minutes spent online worldwide, exceeding 90% in Indonesia; thus, mobile technology is becoming our primary tool in our digital lives. Additionally, from the same research, 7 out of 10 Brazilian Internet users access data via their mobile phones.

Mobile learning (m-learning) is traditionally defined as the educational process by which learning is mediated via mobile devices such as

smartphones and tablets (Schuler, Winters, & West, 2012). However, mobility does not merely involve devices, but also learners and learning itself (Pegrum, 2014). Mobility for learners implies that they are on the move, outside of school, accessing content, interacting and studying through electronic devices; in other words, learning mobility means that the learning situation itself can be mobile. Learners can participate in learning situations by using mobile devices to access the required information, to create content or to share content (e.g., making an audio or video recording, taking a picture). Mobile technology offers personalized learning experiences at preferred moments and a device is needed for learning to take place. Furthermore, as Pegrum (2014) points out, there are several conditions where mobility is used in the wider society and where it can promote learning processes. However, it is not easy to separate the mobility of the devices, the learners, the learning, society and the new era. The study discussed in this paper focuses on the mobility of devices and examines a context in which m-learning solutions were used in classrooms, aided or substituted by mobile devices. However, we assume that in the near future, the learning solutions illustrated in this paper will be further developed for learning situations where the learners themselves are mobile.

Mobile devices are excellent educational assets, but they have also caused distraction in schools. In today's technological world, it is important that students learn the necessary skills and competencies to enable them to keep up in the digitalized world. According to Redecker et al. (2011), technology-enabled learning is a future trend that will require citizens to gain new competencies. Therefore, technological awareness and the willingness to learn to use new technologies are important competencies, not just from the personal point of view, but also from the societal viewpoint.

Students and teachers are using mobile devices to access educational resources, to converse, to share and construct information with peers, to elicit support from other students and teachers, and to facilitate communication (Pisa & Goulart, 2017). M-learning can deliver learning to people, communities and countries where other educational inventions have been too expensive, difficult, dangerous or demanding (Traxler & Kukulska-Hulme, 2016). The United Nations Educational, Scientific and Cultural Organization (UNESCO, 2013) suggests that mobile technologies can provide an excellent medium for extending educational

opportunities to learners who may not have access to high-quality schooling.

Methods

Design science research was the approach applied in the study. A design scientist attempts to engineer innovative educational environments while simultaneously conducting experimental studies on those innovations (Brown, 1992). This study's aim was to understand how existing mathematics, English and Java learning resources could be used in learning situations through mobile devices in another culture and under circumstances that they were not originally designed for. Design science research consists of two basic activities: building and evaluation (Järvinen, 2001). Building refers to the process employed to construct an innovation, artefact or a model for a specific purpose. In this study, building refers to the process of tailoring existing e-learning solutions to m-learning solutions and developing m-learning taxonomies for localizing m-learning solutions within global education. Evaluation refers to determining how well the innovation, artefact or model is performing. In evaluating m-learning solutions, the question arises as to whether they are, in some sense, superior to the teaching and learning methods used previously in the same situations. The main condition for construction validity is that it solves the problems in question (Kasanen, Lukka, & Siitonen, 1993).

The constructive approach, which is widely used in technical and design sciences, is used to develop m-learning taxonomies to assist in the design of m-learning solutions for global markets. The constructive approach is typically a practical problem-solving process and constructions refer to entities that produce solutions to explicit problems. It is common that the usability of the solution is demonstrated through the implementation of the solution, which is the reason why pilot studies are crucial for the taxonomic construction approach.

Another important aspect of using digital technologies in education concerns ease of use. Usability, therefore, can be analysed from the pedagogical perspective of needs. The relevant points to consider are noted by Nielsen (1990): ease of learning, absorption of knowledge over time, agility in completing the task, error rate and user satisfaction.

In fact, through usability studies, guidelines can be developed for the construction of educational technological artefacts, as well as enabling

the analysis of the adequacy of the available artefacts or their degree of adequacy: "the factor that ensures that the products are easy to use, efficient and pleasant, from the perspective of the student" (Preece, Rogers, & Sharp, 2015).

In this study, we used an instrument called the Systems Usability Scale (SUS) (Brooke, 2013). This instrument uses ten questions on the Likert scale and provides a relative analysis of the usability of the "object" (device or software) in focus; that is, it tells us if the obtained score fits the bands, as outlined in Figure 1.

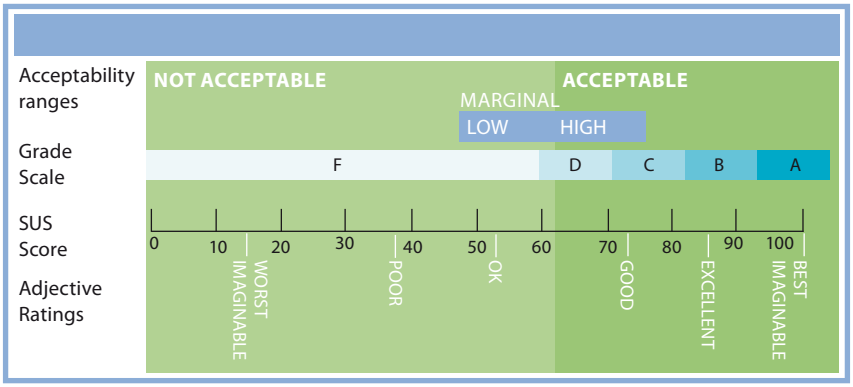

Figure 1. Information about the SUS score (Brooke, 2013).

The main research question was as follows: What are the criteria for localizing m-learning solutions within global education under different circumstances and in different cultures?

The following questions were the secondary questions:

1. Is it possible to localize existing e-learning solutions in mathematics, Java programming and English to ensure that they are effective for teaching Brazilian students through mobile devices?
2. Are m-learning solutions able to bring added value to learners?
3. Is it possible to use the "bring your own device" (BYOD) concept in Brazilian schools?
4. How easy is it to use m-learning?

Study

The study was conducted as part of the "Scalable mobile learning for global markets" (SCALA) international research project. Figure 2 illustrates the conceptual model of the study.

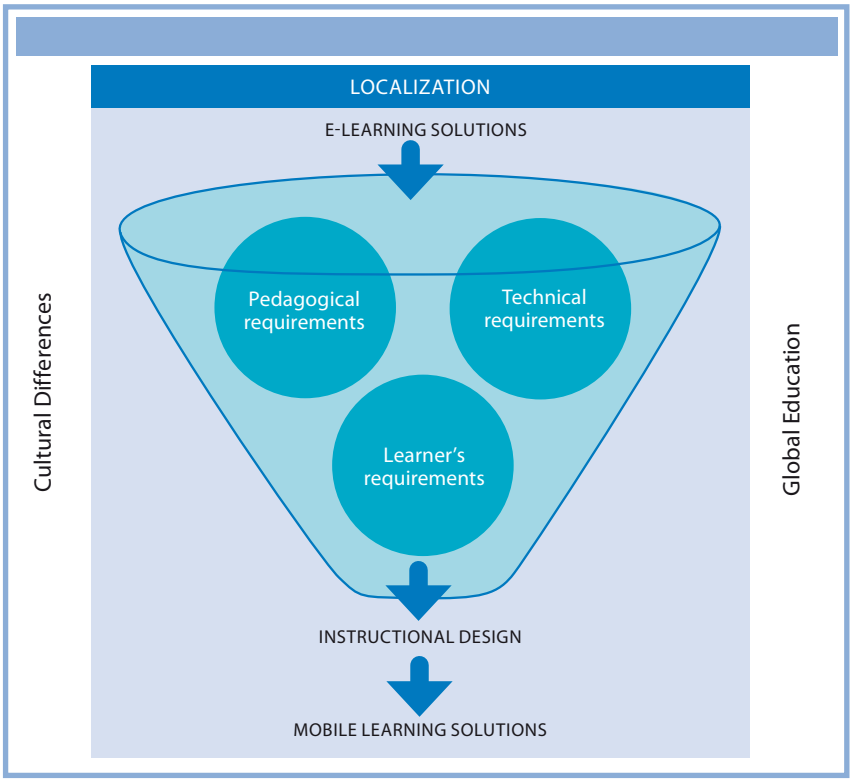

Figure 2. Conceptual model for the development and design of localized m-learning solutions (adapted from Aarreniemi-Jokipelto, 2006 and Aarreniemi-Jokipelto & Goulart, 2017).

In the first study we utilized the e-learning solutions from two Finnish companies: Viope (viope.com) and Promentor (promentor.fi/en). The existing e-learning solutions are utilized in Finnish institutions and the companies have taken steps to expand into global markets. They were interested in knowing if their learning solutions could be applied through mobile devices in emerging markets. Owing to its high mobile penetration and increasing Internet use through mobile devices, Brazil was chosen as the test environment. However, the main objective was to create a localized model for global markets.

There are cultural differences between the Latin American and the Nordic countries; therefore, there was a need to localize the learning services according to the circumstances in Brazil. The pedagogical, technical and learner requirements of the conceptual model were adopted from an existing T-learning (interactive digital TV learning) model (Aarreniemi-Jokipelto, 2006) to form a basis for categorizing localized m-learning criteria to enable the analysis of the results of the tests carried

out in Brazil. Ultimately, the defined localized m-learning criteria will serve as a tool for the instructional design and development of m-learning services in global markets. This paper describes the criteria for localized m-learning services and makes suggestions for the companies to cater to the local circumstances and needs in global education.

First Brazilian pilot study in March 2017

The study included two experimental studies: a first pilot study in March 2017 and a second pilot study in October 2017. From the pilot studies, we were able to determine the necessary actions for the next phases of the development process and to infer the taxonomies for localizing m-learning solutions within different cultures and under different circumstances.

Four schools/universities participated in the first pilot study. Table 1 illustrates the age and number of students in each pilot school/university and the tested applications. Students were from bachelor programs in pharmacology and computer science at USCS, from fundamental courses at Brisabella, from secondary level courses at the FSA college, from mathematics and languages bachelor programs at the FSA university, and from fundamental and secondary (technical) levels at Alcina. The learning material and platforms were originally in English, but when necessary, they were translated from English to Portuguese.

SCHOOL	AGE	NUMBER	APPLICATION
Escola Estadual Professora Brisabella de Almeida Nobre (Brisabella)	12–13 15–16	36 26	Promentor English Viope Math
Colégio da Fundação Santo André (FSA Univ)	18–46 19–27	29 46	Viope Math Promentor English
EME Profª Alcina Dantas Feijão (Alcina)	13–14 18–26 18–26	16 19 8	Viope Math Viope Java Program Promentor English
Municipal University of São Caetano do Sul (USCS)	20–34	27	Viope Java Program
Total		207	

Table 1. Description of the tests in March 2017.

At the beginning of the study, students filled in a questionnaire. There were 11 questions aimed at obtaining the following information: (1) gender, (2) age, (3) type of media used for studying, (4) types of sites used

for studying, (5) number of teachers who allow the use of mobile phones in the classroom, (6) comments about the test or suggestions to contribute to the project, (7) main apps used for studying, (8) main sites used for studying, (9) suggestions for the use of mobile devices in learning, (10) suggested content or subjects, and (11) the use of social media as a tool for learning and how it can be used.

As the tested learning solutions had not yet been optimized for mobile-device usage, students tested them primarily on smartphones, but via a browser. Additionally, some student groups combined smartphones and personal computers (PCs) in the learning situations. The most common operating system on the students' smartphones was Android and the phones varied from expensive smartphones to cheaper ones.

Results from the first study

While analysing the received feedback and observation notes, it became evident that most of the feedback was related to technological issues. The most typical feedback resulted from the use of browser-based solutions, which were not favoured by the students. The most typical feedback concerned scaling challenges. When a mobile device was in a horizontal position, the keyboard covered almost half of the screen, making it difficult to see the learning content. In addition, there were situations where some of the content was obscured in the horizontal position. When the phone was in a vertical position, the content scaled better on the screen and consequently, the user experience was better. There were also challenges depending on the operating system, browser or device; some students using a different phone model or operating system did not encounter the same challenges as other students did. Therefore, it is important that the solutions be adaptable to different operating systems and devices. There were also challenges related to infrastructure. The number of classrooms equipped with a Wi-Fi connection was typically very limited. It was common for a school to have two classrooms with Wi-Fi connectivity. In addition, the number of sockets in classrooms was very limited, which made it difficult to charge the mobile-device batteries. To solve infrastructure-related challenges, offline solutions, which do not require Internet access for studying, would be indispensable. It would then be possible for users to download learning solutions on their mobile devices beforehand and study whenever they wished to, regardless of the availability of Internet access. It would also allow for the solutions to be

used outside the classroom such as while travelling to school or when going home (Aarreniemi-Jokipelto & Goulart, 2017).

Second Brazilian pilot study in October 2017

Design science is a process whereby we gradually look for more comprehensive answers to our research questions. The results of the first pilot study were used to define the next phases of the study. The main feedback from the first test had been that instead of browser-based solutions, mobile solutions should be smartphone applications and they should be available when offline. Thus, business information technology students from Haaga-Helia University of Applied Sciences developed eight mobile-application prototypes (see Picture 1) for the second pilot study. There had also been usability challenges in the first pilot study, therefore, usability was planned to be explored more in the second pilot study while using the developed apps. In addition, the feedback on pedagogical categories had been limited in the first pilot study, thus, mobile pedagogy was named as a special research area in the second study. There was also a need to locate more information on the necessity of the BYOD concept in Brazil.

Picture 1. Mobile-application prototypes tested in the second study.

The research data was gathered via the questionnaire and via observing the testing situations. Table 2 illustrates the participators and the schools in the test that was organized for October 2017. The schools were involved in basic education (elementary and high school levels) and in adult

vocational education. ETEC is a technical school (secondary level) called Escola Técnica Estadual do Centro Paula Souza in Mauá city.

SCHOOL	AGE	NUMBER	APPLICATION
FSA Univ	19–46	24	Viope Math
FSA	14–15	25	Promentor English, Viope Math
Brisabella	14–15 14–15	26 27	Promentor English Viope Math
Alcina	13–14 16–41	12 7	Viope Math Promentor English
ETEC	18–52	23	Viope Math
Total		144	

Table 2. Description of the tests in phase 2.

The Brazilian students tested the mobile applications through smartphones and tablets. The same students who were involved in the March trial also participated in the testing sessions, but in addition to them, we involved two additional schools.

Results of the second test

The feedback from the second test was generally more positive than for the first one. The usability of the mobile solutions improved from March 2017, when the browser-based solutions were used instead of applications. The application prototypes were experienced as learnable and easy to use, and the navigation as intuitive. The most successful app among the students was an app with which the students were able to practice English pronunciation. Overall, students prefer using more gamified and audio-based apps in Brazil. The applications and developed offline solutions met the main requirements, but there were also challenges that were recognized: navigation (few), visualization (colour and font size) and a lack of user instructions.

Additionally, having a personal mobile device does not mean that students solve assignments alone in Brazil. It was very common to solve assignments in small groups. Beforehand, we assumed students would solve their assignments totally via their mobile devices, but some students combined a traditional pen-and-paper strategy with the use of their mobile devices. There was also a strategy when mathematical equations were first written down on paper or on their hand, and afterwards, the answers were written on the app. Some students also used

Google Translate to check words for their English assignments. Mainly, the content chosen for the application prototypes fitted the Brazilian curricula. However, one school used a phenomenon-based approach where the students, via calculations, were aiming to learn wider subjects or phenomena, not just calculations. They needed a wider phenomenon-type description for their assignments. There are also differences in the mathematical symbols between Finland and Brazil, thus, it is important to be familiar with the utilized symbols when localizing mathematical solutions within other cultures. In addition, to define the correct school level for the applications, it is crucial to cooperate with Brazilian teachers who have curricula competences.

The feedback and user experiences from the tests were shared with the students of Haaga-Helia immediately after the trip. The Finnish students were eager to see how their apps had been accepted and tested in the Brazilian schools. Next, the Finnish students developed their application prototypes further based on the given feedback. The final solutions and applications were presented to the companies and to the research team in December 2017. The companies are currently deciding if they will use the applications in the future.

Results gained from the questionnaires

Questionnaires provide interesting findings about how mobile devices are used by students. Table 3 shows the time Brazilian students indicated that they spent on the Internet and on social networks, and it should be noted that females seem to spend more time online, but males are more interested in social networks. In terms of media choice (see Table 4), in general, students prefer videos, as discussed by Khan and Nassem (2015), among other researchers; however, girls tend to choose text content more than boys do.

	INTERNET	SOCIAL NETWORKS
All	7.25	4.65
Female	7.57	4.57
Male	7.23	4.69

Table 3. Questionnaire findings on Brazilian students' daily hours spent online.

	ALL	FEMALE	MALE
Text	30	57.1	15.4
Video	60	47.2	69.2
Image	0	-	-
Audio	5	-	7.7
Game	5	-	7.7

Table 4. Questionnaire findings on the preferred media use (%) of Brazilian students.

Table 5 shows male students change mobile devices more frequently than females do, while almost all female students think that social networks can be used for studying. It should be noted that we are looking at averages and it will be necessary to study distributions in order to say that the perceived differences are statistically meaningful.

	PHONE AGE (MONTHS)	STUDY USAGE (%)	SOCIAL NETWORK** (%)
All	9.9	60	90
Female	10.4	71.4	100
Male	9.6	53.8	84.3

Table 5. Questionnaire findings on other information usage (average) by Brazilian students. ** Yes, it can be used for studying.

In terms of accessibility and the usability of mobile applications, one challenge is to enable access for inexperienced users, and at the same time, to respond to the requests of accustomed users or technological natives; this becomes a complex task and requires designers and programmers to redouble their efforts to effectively reach the entire public domain without restrictions. Many aspects of usability are being debated today because the associated theory has still not been applied in practice, which can be observed in several applications, web portals and electronic devices with graphic interfaces, among others, whether due to technical inability or simply due to commercial disinterest (Machado & Olibário, 2013).

In educational terms, teachers and experts involved with digital technologies have realized the numerous benefits brought about through the use of usability principles. The ease of use of software, or an application, or even a mobile device is essential for this technology to be useful as a resource to support education. In pedagogical terms, other aspects can be considered important and should be considered when creating or applying digital technology in education. Items such as

the degree of difficulty of installation, the size of letters and images, the quality of the colours, demands on the device's computational resources (memory, processing etc.), among others, may limit use by professors of teaching and learning.

The collected data, once adjusted and evaluated, was summarized and is presented in Table 6. For the analysis of this table, it is necessary to take into account Figure 1 where it was observed that the male students gave good appraisals of the applications on the threshold of acceptance, while the female students were more critical about the usability characteristics, pointing to the marginal quality of the products. The overall result of 70.4% indicates, in broad terms, that comparatively, the applications were better than 70% of all similar interfaces that were evaluated.

	SCORE (%)
All	70.4
Female	63.6
Male	74.0

Table 6. Usability measured by the SUS.

Conclusion

As a general result, it can be stated that the localization of learning services must be analysed in broad terms by including technical-, pedagogical- and learner-related issues, which are all affected by culture. The following table (Table 7) illustrates the m-learning taxonomies where the dimensions and values are based on the pilot studies. The taxonomies are defined in the conceptual model of the study, which is an adaptation of the T-learning model (Aarreniemi-Jokipelto, 2006), and the first version of the taxonomies (Aarreniemi-Jokipelto & Goulart, 2017) was published previously, but has now been modified according to the results from the second pilot study. The objective of the m-learning taxonomies is to categorize criteria that should be considered when m-learning solutions are planned for localization under other circumstances or in different cultures to those in which the solutions were developed.

TAXONOMY OF	DIMENSION	DESCRIPTION OF VALUES
Technology	Technical solution	Application, browser-based solution
	Internet connection	Online, offline
	Connection	Wi-Fi, mobile connection
	Device	Mobile phone, smartphone, tablet; names of the devices
	Operating system	Android, Apple iOS, Blackberry OS, Windows OS etc.
	Usability	Types of presentation and navigation
	Ownership of devices	Student, school
Pedagogy	Role of m-learning	Supplementary, partial, substitute
	Easiness for studying	Intuitive, study instructions needed
	Learning situation	Search for information, make calculations, exchange content, use specific apps, collaborate during activities, develop projects, games
	Learning strategy	Individual, collaborative
	Learning resources: ▪ Purpose ▪ Form ▪ Type ▪ Language, translations ▪ Navigation	 ▪ Designed for learning purposes, designed for other purposes ▪ Learning material, instructions, assignments, games ▪ Text, picture, video, audio ▪ Consistent, inconsistent ▪ Intuitive, not intuitive
Learner	Accessibility	Regional, technical
	Motivation	High, medium, low

Table 7. M-learning taxonomies for localizing m-learning solutions.

In terms of the technical aspects, it is important to be aware of the technology, which means technical solutions, types of devices, operating systems, available memory, usability and especially Internet access.

In terms of the learning resources' pedagogical aspects, it is essential to be aware of correct language translations, the symbols used and their meanings, curriculum specifications for the educational system and pedagogical strategies when the learning resources are aimed at global markets. According to the questionnaire, if mobile devices are used in learning, students mostly use apps and other solutions that are designed for purposes other than for learning. However, in the pilot studies, the learning resources and solutions that were used were designed specifically for learning purposes. Additionally, mobile devices have different roles in learning: as a supplement, playing a partial role in learning or as a substitute. The supplementary role of m-learning refers to the situation

when m-learning is used to provide additional, extra learning resources. Second, the partial role of m-learning refers to the use of mobile devices as one form of media use that enables learning. In this case, the role of m-learning is planned and is partially required for learning. Third, mobile devices can replace other media altogether, and the entire learning solution is provided only via mobile devices. In the first pilot study, mobile devices had a partial role, but due to the browser-based solutions, it was also possible to use PCs. In the second pilot study, m-learning had a substitute role and it was not possible to study without a mobile device. According to the questionnaires, if teachers do allow for the use of mobile devices in Brazilian classes, the devices are used in a supplementary role, for example, to search for additional information. Users with different backgrounds and experience use mobile solutions, therefore, we cannot rely on the intuitiveness of the solutions – on the contrary, we should provide study instructions. Especially in the first field study, there was a request for video instructions to make it easier to study. There were also requests to make the content and study instructions visual by adding videos and pictures.

In terms of the learner-related aspects, motivation and accessibility are important aspects when designing mobile solutions for global markets. The students involved in the pilot studies had very high levels of motivation in terms of using mobile devices for their learning. As one participant commented, "This is the way that we want to study." However, as we only observed each group on two occasions, the question arises as to whether this influenced the feedback that we received. We cannot state with certainty if we would have received the same comments if the students had used the devices for three months or more.

When analysing the challenges regarding learners' personal criteria, the main concern appeared to relate to accessibility. The type of mobile device affected the accessibility of the learning solution. When the concept of BYOD has spread further in educational settings, students' devices should be able to be used for the designed learning situations. The other option would be for schools to provide the devices for use in learning situations. According to the Horizon report (Freeman, Adams Becker & Hall, 2015), future trends in higher education in Brazil included the BYOD concept and the use of mobile apps, which was set to be rolled out by 2017. In the pilot study, students used their own mobile devices, thereby utilizing the BYOD concept. However, whether students are able

to adopt the BYOD concept across Brazil remains unclear. After the first pilot week, there was an opportunity to observe m-learning use in the State of Piauí, a northern region, which is one of the poorest states in Brazil. Some students used their own devices in class, but the school had also bought mobile devices for classroom use. This was because students had been afraid to bring their own devices to school as they feared that their devices would be robbed from them during their journey to school or back home. Regardless of the Horizon report's estimation of the BYOD trend spreading throughout Brazil by 2017, it does not look likely, at least not yet. There are teachers and schools utilizing the concept, but to date, it cannot be called a trend in Brazil. Furthermore, in the second pilot study, the students mainly preferred working in small groups, not individually. This raises a question: Is there any need for BYOD in Brazilian education? One key cultural aspect is that Brazilians have close contact with their peers and collaboration is automatically integrated into educational activities, thus, there may not be the same need for the BYOD concept as in other countries.

Future activities

The next phase of the research will be to apply the developed m-learning taxonomies for localizing m-learning solutions in global markets in countries other than Brazil. An excellent opportunity for this will be in the export of the educational activities that Haaga-Helia UAS is providing.

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2

The essence of frugal innovation in the development of mobile learning: A case study of two Finnish SMEs

Mirva Hyypiä and Helinä Melkas

Abstract

Despite rising global interest, frugal innovation has so far attracted little research or business interest in the Finnish context, and Finnish companies have yet to develop skills and strategies in frugal innovation. Moreover, the link between high-technology solutions and frugal innovation in business activities and strategies needs to be clarified, as it might seem contradictory to some. Through a qualitative approach based on a case study, we investigate how to develop and integrate mobile learning (m-learning) and content for an emerging market, and what practices and skills are needed to involve users in frugal innovation activities and to develop frugal innovation in Finnish small- and medium-sized enterprises (SMEs). The main contribution of this chapter is related to the application of frugal innovation processes in practice. This study also contributes to the empirical evidence on the relevance of Brazilian user experience and knowledge in terms of Finnish companies.

Introduction[1]

Frugal innovation provides an interesting avenue for companies developing innovative solutions for (or in) lower-income emerging markets where the prime concern is to solve the problems of poor consumers. Frugal innovation is much more than low-cost innovation; it strives to use less instead of more by cleverly employing technology (Eagar, van Oene, Boulton, Roos, & Dekeyser, 2011). All frugal solutions are characterized by affordability, robustness, user-friendliness, scalability and an attractive value proposition (Tiwari & Herstatt, 2012). Despite rising global interest, frugal innovation has so far attracted little research and business interest in the Finnish context. Consequently, Finnish companies have yet to develop competences and strategies in frugal innovation.

This chapter focuses on the implementation of Finnish mobile learning (m-learning) solutions in Brazil to increase access to learning and facilitate the transformation of pedagogical methods. M-learning has been successfully applied in various settings and modes in advanced economies, and the affordability and widespread use of smartphones in emerging markets make them a potential equality-increasing learning vehicle. In technology development, however, the starting point is typically the technology itself, and the contrast between high-tech solutions, such as m-learning applications, and the characteristics of frugal innovation may seem highly conflicting. In this m-learning development context, we need to return to the essential elements of frugal innovation such as user-friendliness. In general, Western SMEs should consider that the fastest-growing markets are in developing economies with a high demand for frugal products and services, for example, in m-learning and, therefore, major business opportunities exist for Western frugal innovators (Bound & Thornton, 2012; Khan, 2017).

This empirical, transdisciplinary, frugal innovation study applies the firm and cross-national lenses of high-tech entry into an emerging-market country. It is a case study of two Finnish small- and medium-sized enterprises (SMEs) providing different kinds of m-learning applications and services for the Brazilian market. This study investigates

1 This chapter is a revised and abridged version of a journal article that is under review (Hyypiä & Melkas, forthcoming).

how to develop and integrate m-learning and content into an emerging market, what the good practices are in terms of involving users in frugal innovation activities, and what company competences are needed to develop frugal innovation. Companies with frugal innovation competences can enhance the user experience to support learning, but, as this study shows, they need a clear focus and strategy to do so. In the Brazilian context, m-learning is either absent or present only in the initial stages in many vocational and higher education institutions. This context provides an intriguing environment for study.

Frugal innovation in emerging markets

Generally, frugal innovation is viewed as synonymous with low-cost innovation, but it, in fact, is much more than that. Frugal innovations are considered to be potentially disruptive and transformational in both emerging and developed markets (Immelt, Govindarajan, & Trimble, 2009). Such innovations are strongly oriented towards users who increasingly desire, for instance, good functionality (Herstatt & Tiwari, 2015). In this new research stream, Weyrauch and Herstatt (2016) define three criteria: substantial cost reductions, concentrating on core functionalities and optimizing performance levels. There is nothing new about companies adapting their products to emerging-market consumers, but frugal innovation, it is claimed, forces us to rethink the very nature of innovation (see, e.g., *The Economist*, 2010). Frugal innovation uses existing technology in imaginative new ways, applies the concept of simplification or strives to use less instead of more through inventive analogies transferring solutions among industries (Tiwari, Kalogerakis, & Herstatt, 2014).

Process-oriented definitions of frugal innovation capture its design and delivery dimensions. It is seen as a design innovation process which puts the needs and circumstances of citizens in developing countries first to develop appropriate, adaptable, affordable, accessible services and products for emerging markets (Basu, Banerjee, & Sweeny, 2013). Frugal innovation involves rethinking entire production processes and business models; it is more a mind-set than a particular type of innovation (Soni & Krishnan, 2014) and it focuses on meeting citizens' needs and designing suitable solutions (Basu et al., 2013). The process-oriented definition is at the core of this chapter, and it comes close to user-driven innovation

thinking, at its "be" and "test" levels (see Figure 1; Nordic Innovation Centre, 2007).

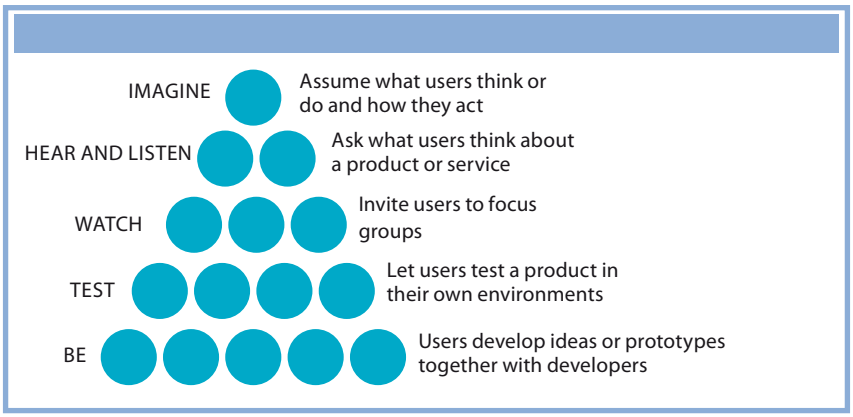


Figure 1. Degrees of user involvement (adapted from Nordic Innovation Centre, 2007).

The starting point for technology development is typically the technology itself and speculation about what users need (see Figure 1, the "imagine" level). The contrast between high-tech solutions such as m-learning applications and the characteristics of frugal innovation may seem highly conflicting. However, user-centeredness has been found to be central to technology development and use. End-user participation in development activities is a basic principle of user-centred methods. Early and ongoing user involvement and participatory methods are recognized as principles that are especially important in information technology (Cresswell & Sheikh, 2013; Martikainen, Korpela, & Tiihonen, 2014). Users have a crucial role in the implementation of disruptive technologies, as the selection of new technologies and innovative practices requires more than mere adoption; users also have to integrate novelties into their practices, organizations and routines (Geels, 2002).

The pilots in Brazil

This case study concerns m-learning research and frugal innovation development and research that was conducted in Brazil for subsequent use by SMEs. Two pilots were implemented in the "Scalable mobile learning services for emerging markets" (SCALA) project. The Finnish case organizations were small companies operating nationally and internationally in the online learning industry. They provided learning

solutions in, for example, Java programming, mathematics and language skills. One aim of the SCALA project was to build up the companies' knowledge and skills to address user needs and frugal innovation in emerging markets.

As a research strategy, case studies are often used to contribute to knowledge on individual, group, organizational, social and similar phenomena (Yin, 2009). A case study is an in-depth empirical inquiry into a contemporary phenomenon within its real-life context, especially when the boundaries between the phenomenon and the context are not clear (Yin, 2009). Despite popular misconceptions linking qualitative research and the case-study approach, case studies can be based on any mix of quantitative and qualitative methods and data sources such as questionnaires, interviews, interactions, meetings, survey data and observations (Gummesson, 2000; Yin, 2009), as in this study.

Most of the research data was collected during two pilot studies that tested Finnish products and were conducted in the São Paulo area, Brazil, in 2017. In March, 180 students aged from 12–46 years, and in October, 144 students aged from 13–53 years in basic education, higher education and adult vocational schools, as well as 17 professors and teachers participated in the pilot tests (see Table 1). The first pilot study tested online learning solutions and the second pilot study tested mobile-application prototypes.

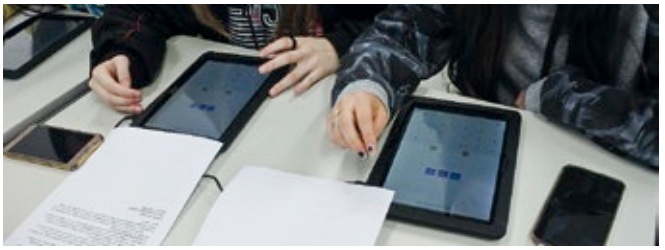
TIMEFRAME	TESTING CONTENT	DATA	DOCUMEN-TATION	PARTICIPANTS
March 2017	Online learning solutions in Java, mathematics and English	6 schools 6 student groups	Notes, photographs and a questionnaire	180 students 9 professors/ teachers 2 researchers
October 2017	M-learning apps: 4 mathematical apps 4 English apps	6 schools 8 student groups	Notes, photographs, video recordings and a questionnaire	144 students 8 professors/ teachers 2 researchers
November 2017	Eight newly developed m-learning apps (mathematics & English)	Workshop	Notes, photographs and co-created written materials	33 students 2 company representatives 4 teachers 2 researchers

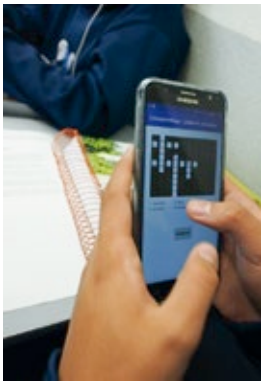
Table 1. Outline of the primary data collection.

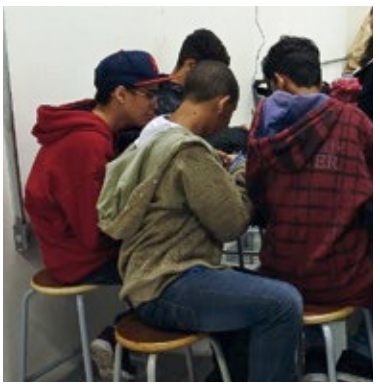
In March 2017, Java programming, mathematics and English e-learning content formed the core of the first pilot study. These learning solutions were not yet optimized for mobile-device use, but the students tested them primarily via smartphones (mostly Android devices). Some student groups used both their own smartphones and personal computers (PCs). For younger students, teachers incorporated testing into the coursework or led the test using a laptop projected onto a screen for the whole class to see (Picture 1).

To meet Brazilian students' m-learning needs, business information technology students from Finland, Brazilian teachers and the Finnish case companies co-created eight mobile-application prototypes for the second pilot study in October (Picture 2). Four applications aided learning mathematical skills and four were for learning English.

Picture 1. Testing online learning solutions in March 2017 (photos: Mirva Hyypiä).







Picture 2. Testing mobile learning apps in October 2017 (photos: Mirva Hyypiä).

In November 2017, after the second pilot study, a workshop with 33 students, representatives from each case company, four teachers and two researchers were organized at Haaga-Helia University of Applied Sciences (UAS) in Finland. During the workshop, the Finnish students had the opportunity to see and hear how the Brazilian students received the app development and what improvements had been suggested.

Outcomes of the pilot studies in Brazil

Many shortcomings were identified in the pilot tests from the frugal innovation perspective. In addition to the various technological pitfalls connected to appliances, services or the infrastructure (e.g., the quality and availability of Internet connections and offline-mode possibilities), many pitfalls were related to culture in a broad sense, educational culture and pedagogical skills in general, and linguistic differences and the distance between home and school. In particular, the Brazilian participants strongly recommended changing the emphasis from written instructions to audio-visual materials to guide and support the use of Finnish m-learning solutions.

The Finnish solutions were evaluated as interesting by the students and teachers who eagerly participated in the pilot studies. Across ages and courses, students used the learning solutions in hugely different ways. Mobile devices were not sufficiently utilized in teaching, but there was significant interest among the participants. There were vast differences across schools. Several future needs were expressed by the participants such as HTML5 and the responsiveness of webpages. The online versions, instructions and news had shortcomings. Understanding the announcements and the content of the tasks sometimes required knowledge of Finnish while the students were in the middle of an activity. More audio-visual elements were desired in the instructions, as well as numbering to show which stage the students had reached (e.g., 12 tasks completed out of 20).

Most of the online learning systems required continuous Internet access that was sometimes not possible in Brazil due, for instance, to long distances between the home and school. M-learning applications with both offline solutions and online platforms were a critical need. In addition, the infrastructure of Brazilian school buildings was not designed for m-learning devices. For example, not all classrooms and buildings had facilities to re-charge batteries (e.g., not enough plugs).

Additionally, Brazilians frequently used many different apps such as social media services, thus the memory capacity to enable several m-learning apps to run on one smartphone could be a complicated issue. Despite the shortcomings in the layout and other aspects of the applications, the students eagerly tested all the tasks and considered the mobile versions to be useful for their studies. The students used a wide range of mobile phones and Android versions. The applications had flaws in terms of navigation and Brazilian Portuguese grammar, in addition to the instructions. More tasks were requested, along with combining different applications. Pedagogically, it would be desirable for the students to complete 5–10 tasks at one time before seeing their results (e.g., the number of correct answers and mistakes). Learners could benefit from returning to a task and thinking about how to do it correctly.

The Finnish case companies were quite small and had very limited capabilities in terms of allocating resources to developing m-learning apps within the timeframe of the project. Consequently, Finnish students of Haaga-Helia were involved after the first pilot study to allow the product and service development to continue. The researchers shared the feedback

and video-recorded user experiences of the Brazilian participants with the Finnish students immediately after the second pilot study in November 2017. The Finnish students were eager to see how their apps had been received and tested in the Brazilian schools. They improved and refined their application prototypes based on the feedback that was given. For instance, four individual mathematical apps were combined into one solution. Collaboration between educational institutions and companies can thus provide interesting avenues for product development, but it is also necessary for companies to build up their skills to address user needs and innovate frugally on their own.

Based on the written feedback, the Brazilian students wished to use m-learning apps more in their studies, group work or for small-scale research. They also much valued increased interaction with teachers via mobile solutions. The most popular app among the Brazilian students was a language app to practice English pronunciation. Generally, there was much room for improvement in the features of speech-recognition technology for dialects and pronunciation. Overall, the students wanted to use more gamified and audio-based apps in Brazil. Companies developing solutions for emerging markets could pay more attention to cultural factors related to differences in educational systems and teaching and learning practices, but instead, they appear to mostly focus on immediate opportunities for business deals. As a staff member at the Brazilian university involved in organizing the pilot studies emphasized: "The real problem is not about products or services, the applications as such (there are plenty of available ones). It is more about the service and solutions. The companies should instead provide integrated and personalized solutions for us here in Brazil. Particularly, develop[ing] apps with certain schools, acknowledging their specific curricula, would be more valuable [for both the companies and the schools]."

Discussion and conclusions

In this chapter, we focused on the essence of frugal innovation in m-learning such as user-friendliness and putting the needs and circumstances of those in the emerging market first to develop appropriate, adaptable, affordable, accessible services and products for them. Instead of asking schools to remotely test and give feedback on learning solutions, two researchers participated in the testing sessions

in Brazil. The pilot studies enhanced user involvement in the product and service development and, importantly, gave valuable insights into the differences between Brazil and Finland, particularly in terms of the educational systems, school infrastructure and Internet access. Cultural and social differences related to pedagogical skills and approaches cannot be bridged solely by offering Portuguese-language options in learning solutions.

To understand students' and teachers' user needs in m-learning in Brazil in practice, interviews and questionnaires were not enough. Instead, involving and meeting the users, sharing their experiments and discussing, observing and listening to them were vital in obtaining a deeper understanding (see also Figure 1) and also fostering collaboration and learning through community engagement, as emphasized by Pisoni, Michelini and Martignoni (2017) and Basu et al. (2013). From a long-term perspective, companies should focus on more than mere adoption and help users integrate novelties into their practices, organizations and routines, as was also highlighted by Geels (2002).

While it is understandable that SMEs may not be able to handle all these types of innovation, it is largely their attitude that counts, particularly in terms of them having an interest in and willingness to learn user-driven frugal innovation thinking and to form and enter relevant networks including actors from emerging and advanced economies and various sectors. The prospects for m-learning in Brazil have been recognized, and there is stiff competition for business opportunities. Companies that provide comprehensive solutions and integrate them with Brazilian partners instead of merely offering Western products and services increase their likelihood of success. From the frugal innovation perspective, the possibilities for scalability in the Brazilian markets should be considered from a bottom-up perspective, starting with the experiences and future demands of users (students and teachers) and combining them with valuable feedback from decision makers in school management at the municipal and government levels. This approach could decrease or, preferably, completely avoid unwanted methods, devices and irrelevant high-tech investments at different educational levels.

Frugal innovation thinking has important potential for high-tech development and related activities, but it needs to be properly understood, put into practice and managed. It seems obvious that every company, especially in the high-tech field, needs to find its own frugal innovation

pathway, but certain general skill characteristics may also be shared, as suggested. Brazilian pedagogical and individual skills should be developed in a comprehensive inclusive manner. In addition to single solutions and technology hype, a multi-faceted, human-oriented vision and a very clear aim for using m-learning applications and services in an emerging market are essential.

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3

Developing mobile learning applications with students for emerging markets

Ohto Rainio

Abstract

In autumn 2017, 42 software engineering students from Finland started a school project to build mobile learning (m-learning) applications for two Finnish education technology companies: Viope and Promentor Solutions. The goal was to help the organizations expand their operations in Brazil and possibly in other developing countries. The students built eight applications which were used for teaching mathematics and English. The applications were successfully tested in five Brazilian schools. The students used the lean start-up methodology to support the creation of many experimental solutions, thus maximizing the learning within the unknown market. The students were able to build solutions that enabled successful m-learning in Brazil and gave the client organizations good insights into entering the Brazilian market.

Defining mobile learning and its benefits

Mobile learning (m-learning) holds much potential for changing the ways in which the learning experience is organized. Some of the benefits of m-learning are:

1. It can be free of the restrictions of time and place.
2. It can reach students and schools that cannot afford or access other learning material.
3. It can be personalized to give students more targeted feedback and help them when needed.

4. It can enable instant data collection and thus give the instructor a real-life picture of how the students are doing.
5. It is a source of motivation for mobile-savvy students.

(McQuiggan, Sabourin, McQuiggan, & Kosturko, 2015.)

Based on the definition by McQuiggan et al. (2015), m-learning is something that gives the student access to instantly available on-demand learning resources. These resources are used for creating a personalized learning experience to increase the student's knowledge. In their definition, they clearly stipulate that physical mobile devices are mere enablers for on-demand, on-the-go personalized usage. However, in real-life m-learning, the capability of the device plays an important role. This capability can put students in an unequal position based on the device they have access to. On-demand usage also requires a functioning and cheap Internet connection, which can be a real hurdle for m-learning, especially in poorer and less developed countries or regions. Furthermore, the instructor should plan the m-learning sessions so that the unique possibilities of mobile devices are being utilized. These possibilities can mean, for example, personalized feedback, multimedia content or gamified exercises. Just handing out the devices and putting existing content on mobile devices does not constitute well-designed m-learning. Finally, McQuiggan et al. (2015) emphasize the responsibility of the application designers. The designers should understand the educational content and figure out how to present it in an appropriate and interactive way (McQuiggan et al., 2015).

Mobile technology is fairly cheap to build and deliver when compared to traditional communication infrastructure. M-learning can happen even in places with no extensive electricity power grid, nor does it require expensive computer rooms (Traxler & Kukulska-Hulme, 2005). This makes m-learning a compelling option, especially in developing countries. The market potential in countries like China (with 717 million smartphones), India (with 300 million smartphones) or Brazil (with 79.5 million smartphones) is significant (Newzoo, 2017).

Building Android applications for mobile learning

At Haaga-Helia University, we run several software project courses, where software engineering students build software for real clients. In autumn 2017, we started a school project to build m-learning applications for two Finnish education technology companies: Viope and Promentor Solutions. The goal was to help them expand their operations in Brazil and possibly in other developing countries. Viope and Promentor had web-based systems for teaching mathematics and foreign languages, which had been tested in Brazil in spring 2017. These testing sessions in four educational institutions revealed the technical realities in Brazil; most institutions lacked the infrastructure that is taken for granted in Europe. Access to a working Internet connection, or even electricity, was very limited. Yet most students owned a smartphone. The phones ranged from very small-screen and low-cost models to more expensive and high-resolution models. The students were able to test Viope's and Promentor's web-based systems with their smartphones with poorly working Internet connections to some extent. Our testing personnel reported real enthusiasm among the students when using any kind of learning content with mobile devices. However, it became evident that this market would require a more tailored m-learning experience. Most importantly, the m-learning solutions would have to address these issues:

1. The learning content would have to scale to different screen sizes.
2. The workflow should support long periods of offline usage. This would probably mean loading the learning content near an Internet hotspot and then using it offline for the actual learning session.
3. The content should be localized to Brazilian Portuguese.

(Aarreniemi-Jokipelto, 2017.)

To sum up the results from these tests: The Brazilian students could definitely make use of the advantages of m-learning solutions as described by McQuiggan et al. (2015). However, many of the challenges for m-learning, as described by McQuiggan et al. (2015), are also present in the Brazilian market.

Thanks to the testing sessions in Brazil, our software engineering students in Finland had some idea of the requirements and technical limitations of the m-learning application project. However, it was clear

that the software engineering students were starting their project with many unknown factors:

1. There was no strong vision of what kinds of applications would motivate the students in Brazil and what kinds of applications would fit the needs of the Brazilian schools.
2. The learning sessions where the applications would be used were not defined.
3. The starting level of the Brazilian students was not clear.
4. There was no plan or vision regarding how the existing learning content of Viope and Promentor would fit to a mobile environment.

Building the mobile learning applications

For the m-learning application project to succeed, the students would have to learn as much as possible about the unknown factors during the project. Thus, we started forming the methodology around the principles of lean start-ups. The lean start-up methodology places a strong emphasis on experimentation, end-user feedback and iterative design. The development work starts with a minimum hypothesis, which should rapidly be made tangible and testable. This is achieved by minimizing the product to an absolute minimum. In the lean start-up terminology, the minimized version is called a minimum viable product (MVP) (Ries, 2011).

To address the first and fourth problem about the lack of vision and of market knowledge, we wanted to support the creation of many experimental solutions in the spirit of a lean start-up. The 42 software engineering students were divided into eight smaller application teams. Four teams were dedicated to each of the two client organizations: Viope and Promentor. Each team was to build a small application for m-learning. Dividing the software engineering students into small application teams also supported the learning of our students, as they would get clear ownership of their own product.

The software engineering students started by defining the relevant content for their applications. This was done in cooperation with the clients and the Brazilian teachers. First, we sent an email questionnaire to the Brazilian teachers who would be running the testing sessions in Brazil. We asked them about the starting level of their students and the preferred exercise content. Involving the potential teachers in Brazil from

the outset would address challenges one, two and three. It would also build up the teachers' engagement in testing the applications as they had had the chance to contribute in designing them. Interviewing the clients, Viope and Promentor, helped the students in understanding what kind of content might be most relevant for the clients' business, especially when considering the clients had much existing quality content designed for web environments. The students selected "mathematics" (for Viope) and "English" (for Promentor) as the general subjects. These would be further split into more detailed themes. The resulting four application themes, planned together with the Brazilian teachers and the clients, are listed in Table 1.

APPLICATION THEMES FOR VIOPE AND MATHEMATICS	APPLICATION THEMES FOR PROMENTOR AND TEACHING ENGLISH
1. Square roots and fractions	1. Time-related English
2. Equations. (Figure 1 shows a screenshot of this application.)	2. Pronunciation
3. Mathematical economics	3. Irregular verbs
4. Basic formulas (e.g., related to geometry)	4. Basic translations

Table 1. Selected application themes for Viope and Promentor.

The testing sessions in Brazil were scheduled in the middle of our project course. This meant that the software engineering students would only have 6 weeks to finish the first application versions. Then the applications would be tested on real Android devices in five Brazilian schools. Our students had no previous experience of developing Android applications or of developing for mobile devices. However, they had the capability to learn the required technologies during the project. They had taken one previous software project course where they had developed a small web application. They were to work on the project for about 10 hours per week. Especially when considering this small 10-hour workload and the inexperience of our students, coming up with an MVP was essential. It would ensure that at least something would be testable in Brazil. We agreed that the first versions of the applications could have only one type of exercise, that the exercises would be locally stored on the mobile device, that the applications would only give feedback on whether the solutions were correct or not and that the user interface would be very rough. The students were able to present these first MVPs for the clients in Finland

after only 3 weeks. Based on the client feedback and on their improved understanding of developing for the Android platform, the student teams planned the next version of their applications. This version could have features such as several types of exercise, several steps for doing the exercises, the ability to show some feedback and progress to the students, a more finished user interface or simulating the hotspot-use case in Brazil. However, we agreed that the exercises would be locally stored and that the answers would not be sent anywhere. The applications would have to be translated into Brazilian Portuguese. These would be the versions to be tested in Brazil.

Testing the first versions in Brazil

The applications were tested in Brazil as planned half way during the software project course. All eight applications were tested and the tests consisted of nine sessions in five schools. Generally speaking, the Brazilian students were excited about the applications and were engaged in using them despite the obvious shortcomings in the content and visual appearance. Each application team received specific feedback related to their application. Apparently, planning the applications together with the Brazilian teachers worked out well. The applications received surprisingly little negative feedback about the content or the exercises, except that there should have been more content. Most of the improvement feedback could be categorized as minor usability issues. The most popular by far of the eight applications was the application teaching pronunciation. In this sense, learning about the unknown world by splitting the work into many smaller experiments proved to be a good choice. The pronunciation application would be a good horse to bet on for Promentor, if trying to make a market entry into Brazil. It was also typical for the students to use the applications together in smaller learning groups, especially when learning mathematics. Designing a mobile application around group learning could be a novel strategy when entering the m-learning market in Brazil. A group learning application would strip down the costs for m-learning even further and thus make it a conceivable option even in the poorest regions (Aarreniemi-Jokipelto, 2017).

Finishing the applications

After the testing sessions in Brazil, the software engineering students finished their applications based on the feedback. They were able to pick up the best working features, navigation structures and other user-interface elements based on the feedback from all eight applications, thus successfully utilizing their learning enabled by the lean start-up methodology. They also made it technically possible to update the content in the applications by building a simple server-side component where the applications could download the latest content. This would enable the client organizations to start adding and distributing their own content through the applications as they saw fit. The applications were built to support the hotspot-use case; you can download the content and submit your answers when there is an Internet connection available. The mathematics applications were combined into one application.

Conclusion

You could argue that this m-learning application project was a success in many regards. Table 2 summarizes our project achievements compared to the five benefits of m-learning, as described by McQuiggan et al. (2015).

MOBILE LEARNING BENEFITS AS DESCRIBED BY MCQUIGGAN ET AL. (2015)	ANALYSIS OF OUR PROJECT RESULTS IN RELATION TO THE BENEFITS OF MOBILE LEARNING
1. It can be free of the restrictions of time and place.	1. The applications were tested in a classroom environment, but in principle, they could support learning without the restrictions of time and place. However, the applications could be specifically designed and tested to better support them being free of time and place learning.
2. It can reach students and schools that cannot afford or access other learning material.	2. The applications can reach any student with a very low-cost Android device and limited Internet access.
3. It can be personalized to give students more targeted feedback and help where needed.	3. The applications give the student immediate personalized feedback.
4. It can enable instant data collection and thus give the instructor a real-life picture of how the students are doing.	4. The applications have the technical capability of data collection, but currently, the instructor does not get a real-life picture of the students' progress.
5. It is a source of motivation for mobile-savvy students.	5. Our software engineering students were able to build m-learning applications that were a great source of motivation for mobile-savvy students in Brazil.

Table 2. Summary of our achievements in the mobile learning project compared to the five benefits of mobile learning, as described by McQuiggan et al. (2015).

For our software engineering students this was a challenging real-life case which taught them professional designing and engineering skills:

1. They learned about designing a new application together with the end users and client organizations.
2. They learned about minimizing the requirements to an MVP that they could realistically build.
3. They learned about collecting feedback and making improvements based on the feedback.
4. They learned about organizing and splitting work in a software team.
5. They learned how to build an Android application.

The student feedback from the course also verified that the students were satisfied as 27 students out of 42 answered the course feedback queries. They gave the course an overall grade of 4.4 out of 5.

The client organizations learned about entering the Brazilian market. They learned what kind of content would fit the Brazilian schools. I

believe they have a more realistic picture about what it takes to build mobile applications and integrate them into their existing systems. Promentor gained new knowledge mostly related to tailoring their content to the Brazilian market and the existing devices there. The project also produced new innovations for presenting their existing content in a gamified way (Pietikäinen, 2018). The clients might have gotten even more out of the project had we included their business model more clearly during the project. This could have meant, for example, negotiating some preliminary deals with the Brazilian schools during the project and designing the applications to support these aspects. However, this would have been hard to fit within the scope of the software project course. When thinking about the freemium business model that we see in many mobile applications, you might think that giving out most of the student content for free and then charging for the teacher tools could be one business model to start experimenting with.

The applications can be found on Google Play Store by searching with the keyword "Viope" or "Promentor", respectively.

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4

Waste management collaboration between Brazilian and Finnish students in the SCALA project

Annica Isacsson, Mirva Hyypiä, Elias E. Goulart, Minna-Maari Harmaala and Satu Uronen

Abstract

All the participating "Scalable mobile learning services for emerging markets" (SCALA) Finnish companies' learning solutions were tested in Brazil, developed further in Finland and piloted in Brazil. The Finpeda FSV virtual learning environment, however, needed content for further testing/piloting. As part of the SCALA project, Haaga-Helia students produced a report on the Brazilian market and concluded in their analysis that the Brazilian government considers environmental education as one of the important factors that has significantly influenced the development of the country. Hence, a Haaga-Helia course on waste management was embedded in the FSV learning environment and a joint Finnish/Brazilian waste management learning module was co-created. This chapter aims at elaborating on the pedagogical need for a virtual environment, the need for waste management content and the need for a mutual learning module including both Finnish and Brazilian students. It is an anticipatory process description of the Finpeda pilot study.

Introduction

There is a need in today's education for new learning in virtual flexible environments. Mattila, Arhippainen and Ryymin (2013) argue that there is a need to develop socio-technically engaging learning environments.

According to Mattila and Silander (2015), inclusive virtual 3D learning and educational environments enable ubiquitous learning and distance education that enriches projects across boundaries.

Furthermore, Mattila and Silander (2015) state that the strength of technology is supporting social interaction and is making it possible to see, experience and learn things that would not otherwise be possible in education. Such environments make it possible to conduct interesting joint modules between countries. Imagine yourself as a teacher in the midst of a classroom, wishing that you could change the learning environment simply by clicking your fingers to better demonstrate the issue to be learned. In a virtual environment, this is already possible, that is, the learning situation can be changed very quickly from a rainforest into a desert, and further into the pyramids of Egypt or space, according to Mattila (2015). A virtual learning environment supports formal teaching, but it also enables informal and non-formal ways of learning. In a virtual environment, you can learn with peer learners from anywhere in the world.

In 3D learning environments such as in Finpeda, users can customize their avatars to look exactly as they want them to. This makes it possible to try out different roles such as those of gender or nationality. In addition to roles, simulations and role-playing games can be operated in environments that suit different themes. Generally speaking, an avatar is the embodiment of a person or idea. However, in the computer world, an avatar specifically refers to a character that represents an online user. Avatars are commonly used in multiplayer gaming, online communities and web forums (Christensson, 2009).

Picture 1. Photo of the FSV environment.

As part of the "Scalable mobile learning services for emerging markets" (SCALA) project, Haaga-Helia students (Soronkis, Huynh, Ten, & Barbosa 2017) produced a report on the Brazilian market, and concluded in their analysis that the Brazilian government considers environmental education as a priority. Creating content related to environmental education could hence be a strategy for Finpeda to enter the local market. However, as the Brazilian Ministry of Environment has already conducted several courses on environmental e-learning, perhaps the SCALA/ Finpeda focus should be on content and learning environments that will bring added value to the existing courses. Recycling oil waste to soap and organic farming/communal food production are currently integrated in the Brazilian basic and higher education levels.

Inspired by experts in Brazil and Finland, waste management content was integrated into the Finpeda 3D FSV virtual environment for the SCALA pilot study. The content was produced by the principal lecturer responsible for sustainable development at Haaga-Helia. The course consists of four themes and topics. The description of the content can be found in the table below (Table 1).

TOPIC	CONTENT	OBJECTIVES
Recycling and reuse of waste	▪ The recycling business (recycling centres, second-hand shops) ▪ The possibilities for reuse ▪ Producer responsibility	▪ Recognize the significance of recycling and reuse ▪ Identify the business potential of recycling and reuse ▪ Describe the principle and operations of producer responsibility
Utilization of waste as material and energy	▪ Industrial utilization of waste ▪ Utilization of construction and demolition waste ▪ Utilization of organic waste ▪ Utilization of recycled fuels ▪ Utilization of waste in energy production ▪ Production of new goods using recycled materials	▪ List the material and energy utilization potential of different types of waste ▪ Describe the waste management and sorting process ▪ Explain the basic principles of waste material recovery and utilization ▪ List examples of commonly used waste utilization methods
Final disposal of waste	▪ Final disposal sites: principles, structures and operating procedures ▪ The future of final disposal sites	▪ Describe the structures and operating procedures of final disposal sites ▪ Explain the order of priority for waste and the place of final disposal ▪ Estimate the future importance of final disposal ▪ Present ways of reducing the need for the final disposal of waste
From waste to resources	▪ Future prospects in the world ▪ Utilization of landfill waste (landfill mining) ▪ End-of-waste success stories	▪ Recognize the value of waste as a resource ▪ Recognize the growth and significance of the waste management business in the future ▪ Recognize the need for new innovations

Table 1. Waste management course content.

The pilot survey

The upcoming Finpeda pilot involves a Finnish vocational business school, a teacher and 16 students, 3 Brazilian upper secondary institutes, 6 teachers and 6 students per school. Each school will design their own avatar. The implementation of the joint learning module is planned to take place over 6 weeks during February and March 2018, and the plan

is to arrange six FSV video conferences, one each week. One avatar per group from all the different schools will participate in the weekly meetings. Generally speaking, an avatar is the embodiment of a person or idea. However, in the computer world, an avatar specifically refers to a character that represents an online user. Avatars are commonly used in multiplayer gaming, online communities and web forums. In this case, the school-specific avatars represent the Brazilian and Finnish school groups.

The pilot will involve a survey phase during which the Finnish/Brazilian students will get acquainted with the learning environment, each other and the waste management content. In the next phase, the students will observe their own daily waste management practices, compare and document what they see and learn through pictures, audio-visual and written material. The third phase will involve sharing and demonstrations in the Finpeda FSV waste management learning space.

The SCALA pilot results from 2017 in Brazil recognized some challenges that the upcoming pilot has to deal with. First of all, most online learning systems require continuous Internet access, which is not always available in Brazil as readily as it is in Finland. In addition, the infrastructure of Brazilian school buildings is not designed for m-learning devices. For example, the possibility of recharging batteries cannot always be guaranteed as there is a shortage of sockets in the classrooms. Furthermore, the virtual learning environment is not optimized for smartphone use. Students' own smartphones were previously used, as the availability of tablets or laptops in different schools was/is rather limited. It was also noted that a Portuguese-language option is needed in the initial learning solutions and the manuals. Especially, video-based instructions for different solutions were highly recommended. Moreover, the pedagogical skills and education systems differ between Finland and Brazil; for example, in the Nordic region, problem-based learning methods or self-directed group work is commonly used in various disciplines and at many levels of education.

The SCALA project is interested in studying how waste management and m-learning as well as collaboration in the virtual environment takes place between Brazilian and Finnish education. Additionally, the information and experiences of users are of crucial importance in order to develop the virtual learning environment further as well as to approach emerging markets.

Digital communication and information technologies have brought people together around the world, making the interactions and sharing of knowledge and experiences effective. Cultural differences can enrich dynamic exchanges, especially among children and young people who are motivated to be in touch with each other. In educational terms, international contacts can motivate learning processes such as by opening new horizons up for learners. The project aims to integrate Brazilian and Finnish students into a cooperative educational action, as well as explore the use of a virtual environment supporting educational activities based on the Second Life model.

The main challenges are the cultural differences, the necessary temporal synchronization of the joint activities and the technological infrastructure to support the project, especially in the case of Brazilian schools.

As a basic subject for analysis and discussion by the students, material recycling was chosen because it has global importance with impacts and studies in all centres of research and in terms of the dissemination of knowledge, as well as for national governments. The greatest learning benefit will be to study and analyse data on the management of recyclable materials in the two countries and compare the results.

Finnish lecturer's expectations of the joint Finnish/Brazilian project

I'm a teacher in a vocational college in Vantaa Finland, and I was offered a chance to take part in this project – SCALAble mobile learning services for global markets. I was introduced to a new learning interface, FSV, and my aim is to teach sustainable development to our 2nd-grade students by exploiting the FSV interface. In this chapter, the 3 D virtual learning space has previously been referred to as the Finpeda FSV environment.

Sustainable development concerns all countries, all nations and all of us, people. That's why I find it very important to study and research all the sectors of sustainable development with my students. Our three main topics are sustainable development and climate change, material efficiency and product lifecycle, and waste management.

During this project, we will learn how to use the FSV 3D interface in order to study our sustainable development topics. We will utilize the virtual environment to explore different rooms, which contain learning materials, tests, videos and other material. We will also produce material of our own that will be downloaded to the FSV. We will share information, learning material and new ideas about sustainable development that can be put into practice.

We want to communicate with other participants of this project. Our students will observe, undertake analyses and make conclusions regarding their own consuming habits, and share the results with the students in other colleges. We will talk about the results and sustainable development topics in general with other students online in the FSV.

I think it's very important for our students to share thoughts and visions of the future of our planet. Hopefully, we will get productive conversations between students and new ideas into our everyday life to make sustainable decisions for our planet Earth.

Objectives stated by our Brazilian research director

The project aims to integrate Brazilian and Finnish students into cooperative educational action, as well as exploring the use of a virtual environment supporting educational activities based on the Second Life model. The main challenges are the cultural differences, the necessary temporal synchronization of the joint activities and the technological infrastructure to support the project, especially in the case of Brazilian schools.

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studies in all centres of research and in terms of the dissemination of knowledge, as well as for national governments. The greatest learning benefit will be to study and analyse data on the management of recyclable materials in the two countries and compare the results (Figure 1).

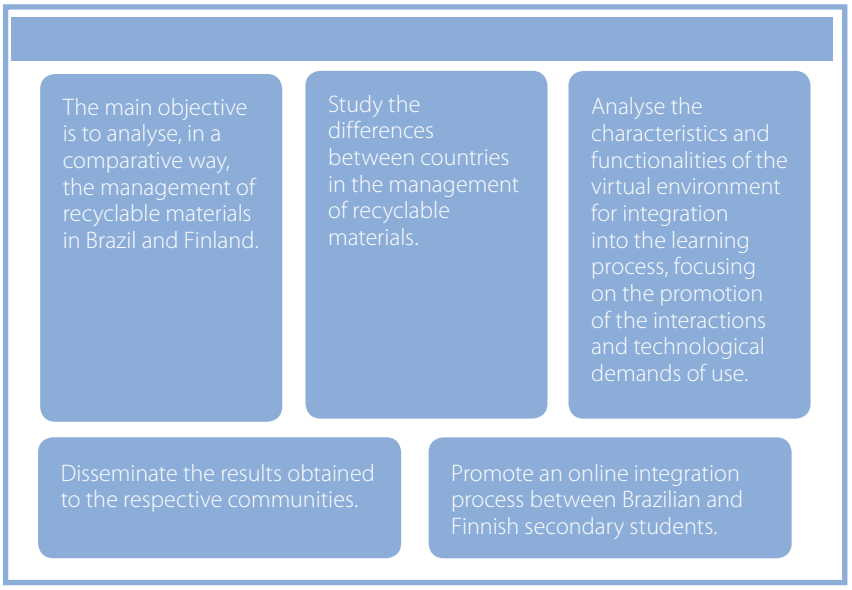

Figure 1. Objectives of the joint project.

Methodological steps

The project will contain three phases: organization, execution and presentation. The organization phase aims to prepare the students for the joint activity, defining common basic knowledge, work planning and goals to achieve. The execution phase will basically consist of the collection of data from the school community. The presentation phase should encompass data analysis and the construction of presentation forms, thus finalizing the project. In this phase, there will be an evaluation of the project.

Participating schools should allocate a group of high school students supervised by a teacher. Each group will have an avatar in the virtual space for online meetings, which will take place in the English language. The documents related to the project will be made available in the Meshmoon virtual environment. An additional communication channel (Google Hangout) is anticipated in the event of technical or operational non-availability.

The project is expected to be carried out over 6 consecutive weeks from 19 February to 30 March 2018, according to the schedule presented in Table 2, with 2 weeks allocated for each phase.

PROJECT PHASES:

Organization: (weeks of 19 February to 2 March)
- Definition of groups and profiles
- Definition of the object of study
- Basic reading: standardizing concepts and nomenclature
- Video on plastic island
- Define common goals
- Virtual meeting: student contact, base knowledge discussion

Execution: (weeks of 5 March to 16 March)
- Data collection: questionnaire, interviews, photos (portfolio)
- Specific reading
- Virtual meeting: show/comment on the data collection process

Conclusion: (weeks of 19 March to 30 March)
- Analyse data
- Produce presentation
- Virtual meeting: show results
- Publicizing at school: events and/or social media (video)

NOTES:
- Execution places: computer lab in schools
- Meetings on Fridays: 16 February, 2 March, 16 March and 30 March.
- One-hour meeting: 9AM Brazil and 3PM Finland

STUDENT ONLINE PROFILE:
From knowledge in the e-learning area, it is important to create "contact points" among online students, so they can start conversations about common life and create a sense of belonging.

In this way, each group of students shall elaborate an MS Power Point presentation where each student will insert his/her own information as follows:

Name: Photo: Age: Preferred Hobby: Preferred Sport: Preferred Music/Singer: Preferred Movie:

Do They Have a Pet?: Number of Brothers/Sisters

Table 2. The project process.

Discussion

There is much potential in an online 3D environment. In the best case, it brings added value to learning, collaboration, knowledge production and international activities. The environment can easily be designed to fit the needs of a project, study unit, learning environment etc. It seems perfect for the purpose of the SCALA project as it will be designed with waste management décor. Avatars will be designed to fit student profiles. Collaboration and documentation, videos and content will be found and

uploaded, as well as presented and discussed in the environment. The students will learn about their own waste management practices and have the possibility of comparing them with Finnish strategies and daily activities. Dialogue and collaboration will take place in a novel way. The expectations of the different partners are high, and everybody is excited and has confidence when it comes to the learning outcomes, collaboration and motivation. The results will be communicated via multiple channels once the pilot is completed.

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5

Identifying market potential and buyer profiles for Finnish mobile learning services in Brazil

Annica Isacsson, Marja Suhonen and Jarkko Wickström

Abstract

Today's learners, the so-called native digital learners or the "millenniums", have more or less grown up with the Internet, mobile devices and in a digitized society. Consequently, they demand up-to-date working methods and learning environments. These learners are equipped with mobile devices, which they use to manage their daily lives, not only for learning, but also during their leisure time. In essence, they are digital citizens in a global society. They have grown up presuming that most information is available online, including content, knowledge and services. Mobile technology has changed the way we live and it is beginning to change the way we learn. This chapter will discuss and describe the challenges and possibilities from a Finnish perspective when entering the mobile learning (m-learning) market in Brazil with content and applications. It will present some options and organizations for market entrance, an overview of the market and some recommendations. It seems that there are possibilities for English learning and mathematical applications in addition to games, as well as innovative learning environments both in the private and public sectors. The "Scalable mobile learning for global markets" (SCALA) project pilots and research have mainly been conducted in the public sector.

Introduction

More than 52 million smartphones were sold in Brazil in 2014, and now over 95% of the phones in Brazil are smartphones. Tablet sales have increased dramatically (by over 70%) since 2013 and will continue to grow in the future. Currently, Brazil is producing the largest revenues for mobile learning (m-learning) in Latin America, with the growth rate being around 25.7%. About 38% of the users access web sites via their mobile devices. M-learning products and services are expected to exceed 1 billion USD in 2019 in Brazil, and the Brazilian government is giving tax incentives for mobile and tablet producers who want to set factories up in the country (Adkins, 2015).

Moreover, the Brazilian government has launched a program in 2015 called Broadband for All in an attempt to connect most of the population to the web by 2018. Furthermore, the Brazilian government announced a set of measurements in 2014 that will be implemented up until 2024 in order to boost the educational system's performance. This program, the *Plano Nacional de Educação* (PNE), is composed of 21 measures and aims, among others, to increase the number of mandatory education years, the percentage of Brazilians going to schools and universities and to provide the means for teachers to improve their qualifications and skills. To reach the targets established by the PNE, the government will have to nearly double its investment in education.

According to to Rosa and Azenha's research at Columbia University's Centre for Brazilian studies (Rosa & Azenha, 2015), the vast majority of Brazilian teachers affirm that they do have a lot of electronic equipment at home, including notebooks, tablets, desktop computers and, especially, mobile phones with Internet access. This result is in line with the ICT Education (TIC Educação, 2013) survey, which shows that 98% of the teachers in Brazil have a computer at home, including laptops (82%), desktop computers (70%) and tablets (33%). However, when explored in more depth, they are not satisfied with the skills they have in applying them, and many of them rate their knowledge as basic, only being able to handle an email account and instinctively navigate social networks or sites of interest. There are, however, huge differences and variety among teachers in the study. Opportunities are hence arising for teacher trainers, and for suppliers of mobile (m)- and electronic (e)-learning content, hardware, software, education and services. Governments are handing out

laptops to students; private schools are asking their students to bring in their own computers, tablets or other devices, and corporations are rolling out e-learning platforms for employees to improve their skills. Hence, there is growth, potential and investments being made by the Brazilian government in the field of m-learning, but there are also challenges involved.

The most downloaded apps in Brazil are related to learning and educational games. Brazilians are turning into heavy consumers of m-formatted content, and m-learning is expected to become a big part of what is consumed on these screens. According to Ambient Insight (Adkins, 2015), the products bought are m-learning apps and educational games (28%), m-learning value-added services (23%) and collaboration-based learning products (7%). Furthermore, consumers are the biggest buyers (almost 30%), whereas the state/municipal government account for 20%, higher education for almost 20%, corporations and businesses for more than 15%, with pre-K12 and academic sales at 5%. The primary catalyst driving the m-learning market in Brazil is content, as we can see from Figure 1.

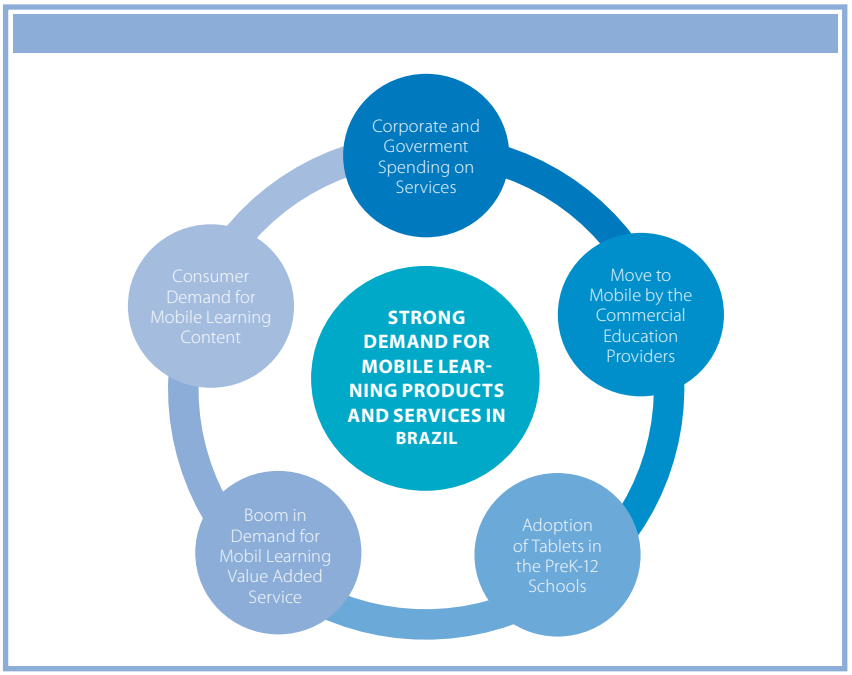

Figure 1. Primary catalysts driving the 2014–2019 mobile learning market in Brazil (Adkins, 2015).

Moreover, Brazil has the highest revenues for digital English language-learning products in Latin America. The growth rate is 15.5% and revenues will more than double to 161.5 million USD by 2018, up from the 78.4 million USD reached in 2013.

The time seems right for Finnish learning and digital learning solutions

According to the Finnish Minister of Education and Culture, Ms Grahn-Laasonen, education, without a doubt, is of huge interest in Brazil. The quality of education was on the agenda in all of the Minister's meetings during her visit to Brazil in spring 2016 (Grahn-Laasonen, 2016). The Brazilians wanted to know the secret of Finnish excellence in education. There is no secret, she said. The Finnish educational system is built on motivated, competent and highly educated professionals/teachers who plan their own work. How to build and shape quality teacher education is of the utmost interest in Brazil, as is Finnish pedagogy. Another topic on the agenda during the Finnish Minister's visit was related to the digitalization of education. Clearly, it is not enough to invest in technology if you do not know how to apply it. Hence, digital pedagogy and Finnish digital learning content was discussed, and according to the Finnish Minister, there is a demand both for Finnish teacher education on all levels, pedagogical solutions, learning methods and services in Brazil.

The Trade Commissioner, Matti Landin at Business Finland (personal communication, January 23, 2018) stated that Finland has a good reputation in Brazil. Mr Landin has 10 years of experience in enhancing Finnish business in Brazil, hence he is an expert in this regard. The Brazilian economy faced a recession in 2015–2016 and investments were scarce. In 2017, however, it all turned around. The Brazilian GNP showed 1% growth in 2017, and the expected growth rate for 2018 is 2–3%. Furthermore, Mr Landin stated that was not true that the big international actors were taking over the Brazilian educational market, as the locals are strong, and Finns, on the other hand, are considered reliable, highly professional and trustworthy to partner with. Finnish education combined with technology and digital learning solutions is both attractive and in demand, he stated. However, there are many things to consider when entering the Brazilian market.

Recommendations to consider when entering the Brazilian market

1. The Portuguese language, as Brazilians wish to communicate in their own language.
2. Presence, as Brazilians prefer to discuss business in their own time zone.
3. Social interaction, as Brazilians prefer face-to-face encounters.

There is hence a need for a local partner and/or presence.

(M. Landin, personal communication, January 23, 2018.)

Another thing to consider is whether to partner with the private or public sector, and also whether to aim for the secondary or tertiary sector.

Finnish educational potential in the private and public sectors

As the "Scalable mobile learning services for global markets" (SCALA) project has successfully tested, developed and localized m-learning solutions within the VET (vocational education and training) sector and secondary education within the Brazilian market, it only seems natural to pursue negotiations in this field. Especially since there seems to be potential, the references are there, and because upper secondary education enrolment in Brazil is expected to continue to increase.

The question is how to continue? A Finnish gamification platform called Seppo has been published on NOVA ESCOLA, an Internet portal, in 2017. NOVA ESCOLA is a non-profit organization and portal that reaches 2.5 million Brazilian teachers each month. It provides teachers with tools, study plans and support for teaching. It is founded by the Lemann Foundation and their company cooperates with Google.org. NOVA ESCOLA is one possibility. Another possibility is offered through SENAI and SENAC, as Trade Commissioner Landin also recommended and mentioned as a possible channel for further collaboration.

The Finnish gamification platform has also been tested in the SESI/SENAI-PR (National Industrial Apprenticeships Association, Paraná State's unit) schools. SESI-Paraná has a network of 55 secondary schools (Colégio SESI) and 7 primary schools. Throughout Brazil, SENAI has a network of over 700 non-profit vocational schools and SESI has 1250 schools and mobile units. It is funded by the Confederation of Industry. Another entity under the Confederation of Industry is the Brazilian Industrial Social Services (SESI), which delivers, among others, basic education to industrial workers' families. SENAI offers basic education and formal training for specific industries. The Seppo pilot has been

successful and SESI has shown interest in expanding the use of the platform (Seppo reaches 2.5 million teachers in Brazil, 2018).

VET in Brazil
VET in Brazil is provided by public and private institutions, with [an] increasing presence of private institutions such as SENAI (National Service for Industrial Training) and SENAC (National Service for Commercial Training).
(OECD, 2015)

At every price point, think about value for money

In the private sector, on the other hand, according to Landin, three questions are of most relevance:

Recommendations to consider when entering the private market
- Is the solution cost-effective, i.e. can it reduce educational school expenditures?
- Does the educational solution have an impact on student retention?
- Does it have an impact on the school image or differentiation?

(M. Landin, personal communication, January 23, 2018.)

According to the Education Policy Outlook (OECD, 2015), the public sector still has more than 80% of the students, and the number of students enrolled in private schools increased by 14% from 2010 to 2013. There are several reasons that justify the movement towards private institutions. One of them is that the rising living standards of the lower classes has provided many families with the possibility of ensuring their children a better education at private schools. Other reasons concern the fact that public schools still suffer from a lack of teachers, overcrowded classrooms, a lack of security and general issues with infrastructure. Last but not least, the controversial law which allows students in public institutions to be promoted to the next grade, even if they fail, generates further scepticism regarding the effectiveness of public-school learning.

The private sector is more than interesting, as there is a thriving 30 billion USD private education market in Brazil. Brazil's for-profit higher education segment was an early adopter of distance learning and now e-learning is common in for-profit universities. These companies are now building up their digital catalogues with m-learning content. The commercial private education providers and the major educational publishers in Brazil are now moving rapidly towards digital formats.

Online classes, digital courses and digital reference-ware are now an integral part of their product catalogues. In the context of the booming smart-device market and with the rapid adoption of mobile devices in schools, these commercial suppliers have begun to port courses and content to mobile formats.

Santillana is the largest education publisher in Latin America: 35% of their global revenues are generated in Brazil. In August 2011, Santillana launched their tablet-based product via subscription called Sistema UNO (System One) in Brazil. Sistema UNO targets private schools and includes content from Santillana and Discovery Education preloaded on tablets. "The program aims to improve the quality and relevance of education by providing tools that improve teaching practices and promote English-language learning." (Adkins, 2011.)

The language-learning chains in Brazil are expanding their digital catalogues with mobile content. English language-learning apps are the best revenue opportunity. By the end of 2014, over 2.8 million people (from children to adults) were taking English lessons in Brazil. Private English-language learning is a 3.1 billion USD industry according to the Brazilian Franchising Association. Brazil had over 70 brands and 6215 branches of private English-language schools by the end of 2014 (Adkins, 2015).

Whether it is better to sell a bundle of services or single applications probably depends on the buyer – in any case, it is important to have the product/service wrapped up in a concise way, and something too large or comprehensive might not get through if it is not easily understandable. The seller should have "packages" to sell and should not necessarily wait for the Brazilians to identify all their needs first in order to then develop an offering based only on those needs.

Use of mobile phones in teaching?

Several studies have indicated that while many teachers in Latin America have developed the skills to use new technologies, they have not yet translated these skills into innovative practices in the classroom (Cuban, 2001; Law, Pelgrum, & Plomp, 2008; Trucano, 2005). This may be due in part to the fact that most schools in Latin America have computers installed in labs rather than in individual classrooms, making it more difficult to integrate ICT into regular lessons and activities.

The use of mobile phones in education has the potential to make learning more accessible, collaborative and relevant. As a low-cost substitute for computers, mobile phones can increase access to the Internet and digital educational content, and because the devices are portable, they can facilitate learning outside as well as inside schools. The proliferation of social media has also created new opportunities for collaboration through mobile technologies, which can be leveraged for educational purposes. Finally, because so many people currently own mobile devices, encouraging students to use them for learning could make education more relevant, especially in an age where the ability to access and make sense of information is an increasingly vital life skill. Though still in the early stages of development, m-learning has begun to spread in Latin America, and a number of m-learning projects have been launched in recent years (UNESCO, 2012).

Mobile devices and the digitized world are changing when and how we learn. Mobile content, for example, English-learning apps and educational games are in demand among consumers. The Brazilian government is spending on mobile devices, on teacher training and on educational quality. The government has also launched a program in 2015 called Broadband for All. The implementation, however, is still in process, in particular, in rural areas. Hence, m-learning content is needed as well as more training on how to apply mobile devices in teaching and in different environments in Brazil.

The SCALA project has piloted mathematical and English-learning content and developed localized applications for the Brazilian market in

Source: Shutterstock

the São Paulo area mainly in the vocational/secondary educational sector. The Brazilian government is taking decisions in the tertiary educational sector, but our recommendation would be for Finnish m-learning companies to partner up with local companies and enter the market through the private sector with integrated service solutions, for example, through educational publishers such as Santillana, or through vocational training institutions such as SENAI or SENAC with short-term vocational courses, or through an Internet portal called NOVA ESCOLA.

Even if the public sector is huge, it is often also described (M. Landin, personal communication, January 23, 2018) as more difficult to enter, more complex, bureaucratic and slow, whereas the private sector is perceived as more dynamic, flexible and easier to enter. Both sectors have issues with quality. Direct purchase of Finnish-learning content through the Ministry of Education or municipal or municipal/state committees is very unlikely in the current Brazilian economy. The private sector is more flexible; they have money and the possibility of making purchase decisions.

The Brazilian federal government and the state- and municipal-level public decision makers are important because they have the power to decide on the strategies in the education sector, which affect not only the public-school system, but also the private sector. Therefore, it is important to know where the country is heading with its educational policy. Nevertheless, the federal education ministry, state-level education ministries and municipal education secretariats are more bureaucratic and complex, and to develop direct education export action with them is very challenging and time-consuming. In addition, the budgetary situation of the public sector has been largely affected by Brazil's economic difficulties during recent years.

Events such as EduTech and the EDEB, BETT, ICEF and Hackathon fairs are also possibilities for entrance, as consultants can help with surveys and contacts, Business Finland with contracts and taxes, and FINEP, FAPESP and CONFAP with funding.

However, local partners, presence, social interaction, language, in addition to an understanding of the educational policies and private sector's values and interests (costs, student retention, school image) seem to be at the fore when entering the Brazilian market. Furthermore, educational platforms and networks can be of help when entering the market.

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MOBILE LEARNING AND FRUGAL INNOVATION
for emerging markets

This publication focuses on mobile learning (m-learning), frugal innovation, business development and emerging markets, especially that of Brazil.

M-learning is a rapidly developing area, and when entering emerging markets, frugal innovation thinking is an essential skill. The publication presents ways in which m-learning can be developed and solutions for it implemented in collaboration with users and other stakeholders.

The publication is directed at anyone interested in these issues, either in companies, educational organizations, funding organizations or academia.

The work described in the publication has been conducted in a project entitled "Scalable mobile learning services for emerging markets" (SCALA). The project was implemented by Haaga-Helia University of Applied Sciences (coordinator) and Lappeenranta University of Technology, LUT Lahti. It was part of "Business with Impact" (BEAM) program of Business Finland, implemented jointly with the Ministry for Foreign Affairs.

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