The challenges in the development of technological research projects in generational gap contexts

Rui Rodrigues[1,2], Ana Melro[1]

Abstract. The generational differences that exist in a society or community are not only evidence that one cannot be escape, but a plus for its development. Furthermore, this allows an existence of a connection to the past and as a way of continuity for the future. However, and to increase this importance, the analysis of generational gaps is considered as an aspect that allows development, innovation and creativity, considering the specific context of the research project LOCUS - playfuL cOnneCted rUral territorieS. The article aims to contextualize the generational gaps in Amiais, Sever do Vouga, Portugal and is part of the LOCUS project. The LOCUS project has as main goal to carry out a survey of cultural heritage of the village, with the purpose of developing and apply an Internet of Things (IoT) system for use by residents, stakeholders and visitors. The methodology described in the article is the analysis of the ethnographic research results, namely interviews with privileged informants and informal conversations with residents. Based on these results, it is intended to outline the challenges that are expected to be found in the technological development of the project and the way as it is expected to outcome them.

Keywords: Digital competences, Rural, Generational gap, Cultural heritage, Co-design.

1 Introduction

The development of research projects that involve, on the one hand, the use of technology (tools or knowledge to use them) and, on the other hand, desertified rural

1 DigiMedia Research Centre, DeCA – Department of Communication and Art, University of Aveiro 3810-193, Aveiro, Portugal

2 ISMT – Miguel Torga Institute of Higher Education, Coimbra 3000-132, Portugal

geographical areas are always a challenge. To include these two dimensions - which inevitably involve other dimensions such as population aging, territorial availability and technological personal skills – it is should be considered that the initial challenge will be related to the way the resident population (population of a Portuguese rural area, deserted and aged between 60 and 95 years old) appropriates the technology. Therefore, it must also include the initial acceptance by the population, as well as the ease with which these actors will be involved in the project and its objectives in the future (A. N. de Almeida, Alves, & Delicado, 2011; Carroll & Reich, 2017; European Comission, 2006; Mahardika, Thomas, Ewing, & Japutra, 2019).

All of these factors – elderly population; rurality and desertification – are of great importance in the context of LOCUS project and can influence the way in which the tasks that follow ethnographic research are developed and how the population participates in them (more actively or passively). Thus, these challenges should be seen more as opportunities. In other words, they will be challenges that will promote the implementation of more interactive and participative co-design techniques. This way of carrying out the planned co-design sessions, will be an excellent contribution to the possibility of the LOCUS project team getting closer to the Amiais' population, and therefore, getting closer to their cultural heritage and knowledge. In additon, it will be a way for the population to feel closer to the project and to contribute more actively to its development.

The article analyzes the expected challenges that will be implicitly present in the technological development of the LOCUS research project, considering the dimensions identified in the previous paragraphs by an audience whose participation in the project is expected to be high.

The aims of the article are: 1) to identify, explain and contextualize in the LOCUS project those dimensions/challenges - population aging, rurality and desertification of the geographical context, low availability of technological means, low technological utilization and literacy by the audience of the project; 2) to identify solutions to match the challenges encountered; 3) to understand generational gaps as opportunities in the development of technological projects; 4) to discuss the role of technology in the development of digital competences; and 5) to present the methodology applied in the LOCUS project that allows its development and, consequently, the intergenerationally and the development of digital competences.

Finally, the article aims to answer the questions: 1) How do digital competences influence the development of projects with a strong technological and intervention dimension in the territory? 2) Which methodologies to apply in a situation where a generational gap regarding digital competences exists and has a strong influence in technological research projects?

These questions guide a large part of the work to be carried out throughout the project, since it will be the answer to them that will ensure that the different tasks are fulfilled as planned in the original work plan.

2 LOCUS project and the generational gap challenge

LOCUS - playfuL cOnneCted rUral territorieS: The Internet of Things in the intergenerational creative production of cultural georeferenced contents is a project with a time horizon of 36 months (running from July 2018 to July 2021). It is being developed in Amiais village, which is predominantly rural, with just over 15 residents (some of whom have only temporary housing there), belonging to the parish of Couto de Esteves and the municipality of Sever do Vouga. It is in the centre of the Portugal, more specifically in the Aveiro district.

The project has 11 tasks, as listed on Table 1.

Table 1 LOCUS project tasks.

Task nr.	Task designation	Duration in months
1	Project Management and Internal Communication	36
2	LOCUS' social outreach	36
3	Dissemination and promotion of knowledge and scientific culture	36
4	Literature Review	6
5	Ethnographic research	6
6	Data analysis, interpretation, discussion and consolidation	13
7	Prototyping the IoT infrastructure, wearable device and mobile App	9
8	Agile Participatory Design & Development of the IoT system prototype	7
9	Large-scale test and evaluation of the IoT system prototype	6
10	Development of a fully functional IoT system	4
11	Design sustainability and strategy migrability models	5

The LOCUS project has as its main purpose the characterization and recognition of the cultural heritage of Amiais. It is expected that the characterization and recognition of cultural heritage will allow the integration of a technological layer (through sensors and the use of a mobile application) with relevant information intended to be passed on to Amiais visitors. To this end, the researchers have been deeply immersed in this village through ethnographic research techniques, namely: 1) the participant observation of cultural, religious and social activities; 2) privileged informants' (agents of change with an important intervention in the community – stakeholders); 3) and informal conversations with residents and visitors. These tasks were carried out over six months and, in addition to characterizing and

recognizing the cultural heritage of Amiais, they also intend to prepare the following project tasks (focus groups and creative co-design sessions), having as main focus the implementation and development of a technology system based on Internet of Things (IoT) and Augmented Reality (AR).

In the LOCUS project, the ethnographic research (task 5) has an important role for prototyping the IoT infrastructure (and the collected data analysis and interpretation). With the ethnographic research, the team will be able to understand which are the risks, the difficulties and the opportunities in each conceived IoT scenario. Thus, for each risk and difficulty, the team can think and develop an appropriate solution.

Relevant for the aim of this article (and for the project in general) is the task of "Agile Participatory Design & Development of the IoT system prototype" (task 8), which is carried out with the participation of Amiais residents, stakeholders and visitors. For this task, ethnographic research (task 5) gives important insights such as the availability or absence of infrastructures capable of supporting the technological requirements, as well as the competences that the target audience has for the use of necessary technology for its development. In this task (task 8), the answer to the question "How do digital competences influence the development of projects with a strong technological and intervention dimension in the territory?" will gain great relevance, since it will be its answer that allows the choice of specific methods and techniques in the application of co-design sessions (for example, be more or less participative or include more or less technology in these sessions). These choices are the answer to the question "Which methodologies to apply in a situation where a generational gap regarding digital competences exists (and has a strong influence) in technological research projects?".

LOCUS also has an associated particularity: the development of the IoT system will be carried out using gamification techniques. It is intended that through playful game tools, the involvement of participants from different generations in the project (residents, visitors and stakeholders of Amiais) is guaranteed, both in the definition of the IoT system (upstream) and in its use and enjoyment (downstream). For these factors, the project must ensure that the involvement occurs taking into account the intergenerationality of the participants and that the definition of the IoT system considers these characteristics. This happens because the population resident in the Amiais is mostly between 60 and 95 years old, contrasting with the age of its potential visitors. This will bring different intergenerational digital competences relevant to the design and development of the IoT infrastructure.

All those goals and tasks previously listed converge towards the preservation of the cultural heritage. A mobile application also will be developed using co-design techniques implemented in creative sessions in which residents, visitors and stakeholders will be involved. This mobile application is based on the tangible and

intangible cultural heritage of Amiais and the playful dimension as a form of involvement, exploration and learning about that cultural heritage.

Being the phenomenon of country rural and inland areas desertification a reality (Almeida, 2018; Branco, Oliveira, Ferreira, & Póvoa, 2010) and, as a consequence, the loss of cultural heritage a concern, the tools, methods and techniques described previously are intended to be implemented in various areas of the country, considering that LOCUS project has a very high possibility of replication and even of great national interest. It is a dynamic process that involves the stakeholders and contributes to the preservation of an important dimension of any society - the cultural heritage - in an innovative way, using technological means and collaborative development techniques (co-design and participatory design).

Thus, in an ethnographic research carried out in this project, it was possible to conduct interviews with two presidents of cultural and social associations (Couto de Esteves League of Friends and Naturals Association (LANCE) and Couto de Esteves Cultural and Social Association (ACSCE)) and presidents of public services (Sever do Vouga City Council and Couto de Esteves Parish Council). The main goal of these interviews was to deepen the knowledge of the territory, using contact with those who have a more direct intervention in that territory.

Additionally, it was also possible to participate and observe various activities and festivities: 1) the religious festivities in honor of 'São Francisco de Assis' and 'Nossa Senhora do Amparo' (in Amiais, April 2019); 2) the religious festivities in Couto de Esteves, 'Festa do Senhor' (July 2019); 3) the photography exhibition 'Watermills' and the 'Balconies in Flower contest', where the inhabitants participate by placing flowering vases in their balconies, both events organized by LANCE (July 2019); 4) the 'Moonlight Serenade' at Amiais' communitarian threshing floor, organized by LANCE (August 2019); 5) and the 'Traditional Leafless' at Amiais' communitarian threshing floor, organized by ACSCE (September 2019).

Finally, and still related to ethnographic research (task 5), several trips were made to Amiais with the specific purpose of contacting, interacting and listening to the residents and visitors of Amiais. These visits resulted in many hours of informal conversations about the practices, uses and customs of that village, with different generational perspectives.

The participation and presence in all the events mentioned were important for the residents to start perceiving LOCUS team members as individuals who cares about the territory, mainly for the maintenance and sustainability of their cultural heritage. This objective was fully accomplished since in the 2 co-design sessions held so far, at least 10 Amiais residents participated.

After completing the ethnographic research (task 5), we proceeded to the analysis and interpretation of the collected information (task 6). This task will make it easier the realization of focus groups with those three groups of people - residents, visitors

and stakeholders. These focus groups will be important for the development of the IoT system prototype, more specifically the mobile application and the bracelet design. It will be in focus groups that will be discussed, characterized and explored the dimensions of cultural heritage that are intended to be reflected in the mobile application. Once again, the aspect of playfulness must be considered and always respecting the participants' digital competences, which will inevitably be different.

Then, a more immersive creative co-design sessions will be held with the same groups. In these sessions, the goal will be to discuss the mobile application and the bracelet design, which will include the decisions of the aspects of tangible and intangible cultural heritage that should be part of the IoT system.

The LOCUS project also has a large-scale testing and evaluation task for the IoT system prototype (task 9) and, finally, the development of a fully functional IoT system and strategies for sustainability and migration models (task 10 and task 11). This is the main goal of the project, since it will be through this migration that the maintenance and sustainability of cultural heritage is guaranteed.

In this article we present the analyses and characterization of what were the LOCUS tasks performed so far (mainly related to the task 5 – ethnographic research) and the impact that this research had or will have on the project development. The conclusions about the generational digital competences that were possible to perceive up to this moment will also be analyzed. These dimensions will be reflected in the next section.

3 Amiais and its generational gap context

One of the big challenges that stood out from the ethnographic research was the generational gap in the village of Amiais. As can be seen from the following table, the differences in age distribution of the resident population are significant. Although, the table considers all the people who have residence in Amiais, this may in some cases be a weekend home or a residence for some months of the year.

Table 2 Amiais' residents / houses characterization.

Sex	Age	Residence type	Connection to Amiais
M	87	Permanent	Marriage
F	85	Permanent	Amiais as a place of birth
M	80	Permanent	Amiais as a place of birth
F	78	Permanent	Marriage
M	65	Permanent	Amiais as a place of birth
F	69	Permanent	Amiais as a place of birth
F	40	Permanent	Marriage
F	42	Permanent	Amiais as a place of birth
M	42	Permanent	Amiais as a place of birth
F	40	Permanent	Amiais as a place of birth
F	3	Permanent	Amiais as a place of birth
F	8	Permanent	Amiais as a place of birth
F	62	Permanent	Marriage
F	66	Permanent	Amiais as a place of birth
F	7	Permanent	Amiais as a place of birth
M	42	Holiday home	Amiais as a place of birth
F	20	Holiday home	Amiais as a place of birth
M	40	Holiday home	Amiais as a place of birth
M	52	Holiday home	Amiais as a place of birth
F	50	Holiday home	Marriage
M	72	Holiday home	Met in tourism
F	49	Holiday home	Amiais as a place of birth
M	50	Holiday home	Marriage
M	18	Holiday home	Parents were born in Amiais
M	20	Holiday home	Parents were born in Amiais
M	50	Weekend home	Amiais as a place of birth
F	51	Weekend home	Marriage
M	72	Weekend home	Amiais as a place of birth
F	73	Weekend home	Amiais as a place of birth
M	40	Weekend home	Met in tourism
M	70	Weekend home	Amiais as a place of birth
M	50	Weekend home	Parents were born in Amiais
F	50	Weekend home	Marriage
M	50	Weekend home	Parents were born in Amiais
F	50	Weekend home	Marriage

There are fifteen (15) people who have a house in Amiais and use it as a permanent residence. The age of these individuals is between 3 and 87 years. Only three (3) people are over 10 years old; four (4) are between 40 and 42 years old and eight (8) people are over 60 years old. It should also be noted that of all individuals with permanent residence eleven (11) are women.

Another group of people are those who, not having their permanent residence in Amiais, still have a home there, either because they rebuilt a family home, or because they discovered the place. In this second case, they felt a connection, bought a house and did rebuilding it.

The distinction in the previous table between holiday home and weekend home is directly related with another important factor, the emigration. Everyone who keeps the house in Amiais only as a holiday home means that emigrated to other countries (for example France or Switzerland). The situation "met in tourism" is an immigrant, who liked the village and decided to buy and rebuild a home, spending only a few months a year in Amiais. In this group of people, the age range is between 18 and 50 years old (with the only exception being the immigrant). Of the 10 people, seven (7) are men.

Finally, Amiais are still a weekend-only housing. There are ten (10) people in this situation, aged between 40 and 73. Most of these people are over 50 years old, where 6 are men.

To conclude this analysis, the total of 45 people living in the village of Amiais have an average age of 49.8 years. However, if we distinguish by type of residence, with permanent housing have the average age of 51.6 years; in holiday homes of 41.3 years old and in weekend homes the average age of 55.6 years old.

It should also be noted that most people are connected to Amiais because they were born there and maintained that connection over the years, with the interest of rebuilding a family home. This is a characteristic that is true for people who have a permanent, holiday or weekend housing in Amiais. At the same time, there is a marriage connection, people who, although being from other locations, especially parishes or neighbouring villages, eventually married with a resident of Amiais and moved their residence there. In fact, this aspect has greater relevance, since most men found their wives in the Amiais when they were young, especially at local folk dances.

As mentioned before, the generational gap is perceived by the LOCUS team as a challenge. But it is also this generational which is expected to be of enormous potential, for several reasons already identified. Older people are the guardians of the cultural heritage (Dimitropoulos et al., 2018; McDowell, 2016), of the memories, the stories and objects. It will be these actors that will allow the LOCUS project achieve its goals, both as a project that aims to recognize the local cultural heritage as a project that intends to contribute to its maintenance and sustainability through technology.

It is also this generational gap that will allow the LOCUS team to perceive and distinguish the different games and traditions of the Amiais population. Through

ethnographic research, it was possible to talk to people of different ages from Amiais, who explored the different ways of playing and occupying their free time, differences that still exist today. At the same time, it was possible to identify similarities in the playful traditions that have been kept over the years and have passed from generation to generation. It is important that this part will be reflected in the IoT System.

Additionally, the generational gap is an opportunity for the development of technological projects similar to LOCUS, as it allows to take into account the different existing digital competences. And here it is not only in generational terms. The age is not the only relevant concern for the analysis of digital competences, but it can be one of the variables, along with gender, education levels, the use or not of technology devices, the contexts of their use, or even with its mood to use it. This is seen in the different perspectives of other studies (Blayone, Mykhailenko, VanOostveen, & Barber, 2018; De Pablos Pons, 2010; Porat, Blau, & Barak, 2018).

Lasty, it is also important to mention that the difficulty in reconciling the digital literacy of the inhabitants with the digital literacy required for pilot implementation will be, perhaps, one of the biggest challenges of the LOCUS project (along with the lack of local technology infrastructures). In this particular case, as will be seen below, training sessions will be planned in parallel to the implementation of the co-design sessions. However, these sessions will be complementary, i.e., at no point should the inhabitants feel uncomfortable considering what is being designed. Proximity will be ensured by what the team considers the main aspect that brings people closer to the project: the maintenance of the Amiais' cultural heritage.

4 Challenge to overcome: the generational gap

It may seem contradictory, or redundant, when discussing the role of technology in the development of digital competences. What is at stake here is how technology itself, and its use, contribute to influence, and even create the need for the development of digital competences. As already Ilharco (2007) refered, technological artifacts, especially hardware, are possessed things that fit into the sphere of appropriation before they become components of the comprehensive sphere (Ilharco, 2007, p. 62).

Thus, one of the goals of the LOCUS project will not only be to discuss Amiais' cultural heritage with its residents, stakeholders and visitors, but also to collaboratively find ways to maintain and sustain this cultural heritage. For that, the LOCUS will use as a distinctive factor the use of technological. This component will only be useful if it is understandable by these three groups, before it is even tested for integration with cultural heritage and territory.

The challenge here, as already discussed, is that of the generational gap, especially of Amiais' residents. In terms of competences for using digital media, studies

show that the digital natives' generation still has the greatest availability at all levels (Coelho, Costa, & Mattar Neto, 2018; Juliani, 2016). The generation born between the 90's and 2000's and thereafter are the ones that use the most advanced technological artifacts to accomplish any task (study, socialize, make appointments, work, watch movies, catch up on news, etc.) and this competence makes all the difference in the ease that is created with an increasingly and more frequent use.

On the opposite side we have the generation born in the 1940s or 1950s, whose closest connection to technological artifacts is to television or radio, with the Internet only entering their homes when they were about 40 or 50 years old. This is something that makes all the difference when LOCUS project includes concepts such as IoT, AR or wearable devices. Despite all these aspects, it has been reported in informal conversations throughout the ethnographic research made (task 5) that there is already some diffusion of technology, such as online chat tools in order to keep in touch with their families who emigrated. Moreover, the telephone devices used by the population are mostly smartphones, something that will allow to overcome the barrier of mistrust of technology.

However, it is expected that exist some resistance from residents to perform certain exercises, especially due to lack of knowledge, or even resistance in terms of making suggestions for the development of the IoT system. As it is not intended to exclude their participation, on the contrary, the exercise will ensure that this lack of knowledge is overcome, but as conveniently as possible for the participants. It is anticipated that at the same time as the technology is introduced, a brief familiarization will be made using parallel and agile training techniques.

There are two limitations that are intended to be overcome with these techniques: 1) structuring and applying too rigid and traditionally formative training sessions could contribute to a sense of detachment from technology; 2) the time required to apply too structured and rigid training and even at different times. The limitation here is that the project does not have unlimited time for its completion and the people who will participate in the project also do not have unlimited time. So, the training to be applied aims to bring participants closer to technology, contributing to their familiarization in the most natural way possible.

Another challenge, somewhat related indirectly to generational issues, is the (un) availability of infrastructures capable of supporting network requirements for the IoT system development. Amiais is a rural, sparsely populated territory located in the heart of central Portugal. The mobile phone network is weak or even non-existent in some places. These are two realities that, as much as one tries not to relate, end up being linked, this idea was already defended by Whitacre (2010). The author considered that the most relocated rural areas are unprofitable for business investment in terms of connecting networks, because they have few business, industrial, educational centers, etc. This lack of interest consequently results in a lack of use, which eventually leads to a vicious cycle in the same direction (Whitacre, 2010, p. 1284).

So, how do digital competences influence the development of projects with a strong technological and intervention dimension in the territory? The answer is expected to be (at the end of the LOCUS project) that existing digital competences are a major element in the development of projects with a strong technological dimension, but even more importantly, to have the opportunity to contribute to the development of their own competences, not only to contribute to territorial development.

The way to do this is using agile methodologies, approaching these same people and the elements with which they relate. Flexible methodologies should be used, adapting to the requirements of existing (un)knowledge, so as not to contribute to widening the competences gap. The methodologies should be also inclusive, accompanying the natural challenges of those who are relating to an artifact or system for the first time, but not in an infantile way. Finally, these methodologies must include the participants themselves in the solution to be found, since they will also be the object of the study and the main users of the project solution.

5 Conclusions

If, on the one hand, heterogeneity translates into richness and added value for the development of scientific research projects, on the other hand, dealing with this heterogeneity is always a challenge in any scientific area. In technological projects, with a strong technological component and in which study participants and technology (digital media) will have to be in constant interaction, the heterogeneity in terms of competences and frequencies of use translate into an even higher challenge.

Nonetheless, it is precisely this challenge that often leads to new processes, new methodologies and new perspectives on the problem. In the LOCUS project it is expected to contribute to the reversal of what has been identified by Whitacre (2010) as a problem: contribute to increasing the use and interest in what digital media can do for territory and cultural heritage and, as a result, demonstrate the relevance of a priori infrastructure for such use.

The challenges of the LOCUS project with regard to the existing generational gap and how inhabitants access and use technologies are various: (1 digital competences held; 2) the interest in acquiring these digital competences; 3) the technological infrastructures existing in the territory; 4) existing local support for promoting the development of these technologies; 5) and the added value perceived in the use of technologies.

The way these challenges will be addressed will have to be holistic in order to address the different variables that are at stake here. Creative co-design sessions will be one of the tools that will bring participants closer together, while using flexible and agile participation methodologies will allow one to follow the project development more closely, as well as how participants are feeling about it.

Thus, one of the main conclusions drawn until the moment of implementation of the LOCUS project is related to the understanding that it has already been possible to deal with the generational gap, as it allows access to different realities and build different IoT scenarios, considering the different possibilities participants report. It also enables digital competences to be developed as they will always be present both during creative co-design sessions and during application of participatory and agile methodologies.

The ultimate goal, which is to ensure the sustainability and maintenance of cultural heritage, will be (as it has been) always present throughout the application of these techniques, and this answers the question as to how such projects can contribute to intervention in the territory.

References

Almeida, A. N. de, Alves, N. de A., & Delicado, A. (2011). As Crianças e a Internet em Portugal. Perfis de uso. *Sociologia, Problemas e Práticas*, (65), 9–30. Retrieved from https://repositorio.iscte-iul.pt/bitstream/10071/2950/1/n65a1.pdf

Almeida, M. A. P. de. (2018). Fighting depopulation in Portugal: Local and central government policies in times of crisis. *Portuguese Journal of Social Science*, *17*(3), 289–309. https://doi.org/10.1386/pjss.17.3.289_1

Blayone, T. J. B., Mykhailenko, O., VanOostveen, R., & Barber, W. (2018). Ready for digital learning? A mixed-methods exploration of surveyed technology competencies and authentic performance activity. *Education and Information Technologies*, *23*(3), 1377–1402. https://doi.org/10.1007/s10639-017-9662-6

Branco, J., Oliveira, M., Ferreira, R., & Póvoa, O. (2010). Desertificação em Portugal: causas, consequências e possíveis soluções. *II Seminário de I&DT - Consolidar o Conhecimento, Perspectivar o Futuro*. Retrieved from https://comum.rcaap.pt/handle/10400.26/2049

Carroll, J., & Reich, B. H. (2017). Technology Portfolios: How Individuals Manage Multiple Digital Technologies. *SIGMIS Database*, *48*(1), 75–92. https://doi.org/10.1145/3051473.3051478

Coelho, P. M. F., Costa, M. R. M., & Mattar Neto, J. A. (2018). Saber Digital e suas Urgências: reflexões sobre imigrantes e nativos digitais / Digital Knowledge and its Urgencies: reflections on digital immigrants and digital natives. *Educação & Realidade*, *43*(3), 1077–1094. https://doi.org/10.1590/2175-623674528

De Pablos Pons, J. (2010). Higher Education and the Knowledge Society. Information and Digital Competencies. *RUSC. Universities and Knowledge Society Journal*, *7*(2). https://doi.org/10.7238/rusc.v7i2.977

Dimitropoulos, K., Tsalakanidou, F., Nikolopoulos, S., Kompatsiaris, I., Grammalidis, N., Manitsaris, S., … Manitsaris, A. (2018). A Multimodal Approach for the Safeguarding and Transmission of Intangible Cultural Heritage: The Case of i-Treasures. *IEEE Intelligent Systems, Intelligent Systems, IEEE, IEEE Intell. Syst.*, *33*(6), 3–16. https://doi.org/10.1109/MIS.2018.111144858

European Comission. (2006). *Mediappro: A European Research Project: The Appropriation of New Media by Youth*. Retrieved from https://www.researchgate.net/publication/282975388_Mediappro_The_Appropriation_of_New_Media_by_Youth

Ilharco, F. (2007). Where are you? A Heideggerian analysis of the mobile phone. *Comunicação & Cultura*, (3), 59–76.

Juliani, T. (2016). A Geração Z e a Tecnoloogia na Aprendizagem. *Revista CPB Educacional*. Retrieved from https://educacional.cpb.com.br/conteudos/universo-educacao/a-geracao-z-e-a-tecnologia-na-aprendizagem/

Mahardika, H., Thomas, D., Ewing, M. T., & Japutra, A. (2019). Experience and facilitating conditions as impediments to consumers' new technology adoption. *The International Review of Retail, Distribution and Consumer Research*, *29*(1), 79–98. https://doi.org/10.1080/09593969.2018.1556181

McDowell, S. (2016). Heritage, Memory and Identity. In B. Graham & P. Howard (Eds.), *The Ashgate research companion to heritage and identity* (pp. 37–54). London: Routledge.

Porat, E., Blau, I., & Barak, A. (2018). Measuring digital literacies: Junior high-school students' perceived competencies versus actual performance. *Computers & Education*, *126*, 23–36. https://doi.org/10.1016/J.COMPEDU.2018.06.030

Whitacre, B. (2010). The Diffusion of Internet Technologies to Rural Communities: A Portrait of Broadband Supply and Demand. *American Behavioral Scientist*, *53*(9), 1283–1303.