

# Teachers and peer teacher students' perceptions on ICT tools usage in peer learning projects

## Findings from a multiple case study

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**Abstract** — Preparing learners for the demands of 21<sup>st</sup> century society requires a comprehensive approach that integrates the development of cognitive and interpersonal skills as well as the choice for innovative pedagogical strategies that assign teachers and learners new roles and give room for the integration of technology enhanced learning. Peer learning promotes collaboration and interaction between peers and can be used by teachers as a powerful strategy to foster students' cognitive, affective and social skills. The inclusion of ICT tools in peer learning programs has become more and more relevant based on their potential to foster learners' autonomy, collaboration, and communication skills as well as on the pervasiveness of mobile and social media tools. The present multiple case study focuses on analyzing the role of ICT tools in five peer learning projects implemented in five Portuguese educational institutions through the perceptions of teachers and peer teacher students who integrated them. A semi-structured interview and a survey by questionnaire were the tools used and the data collected were treated under content analysis and descriptive statistics. Findings from this study are expected to add insight into the state of the art of ICT tools usage and role in promoting effective learning in peer learning projects.

**Keywords** – peer learning projects; ICT tools; teachers; peer teacher students.

### I. INTRODUCTION

According to the 2020 World Economic Forum's conclusions on 'society and the future of work', by 2030 more than a billion people "need to reskill", as a consequence of the transformation operated on jobs "by the technologies of the Fourth Industrial Revolution" [1], and besides "high-tech skills", there will be a high demand for "human attributes like creativity, critical thinking, persuasion and negotiation", as mentioned by Bernadette Wightman, one of the invited agenda contributors [1]. These principles were also soon advocated by the European Union in the Reference Framework on key competences for lifelong learning [2].

Education paves the way to "the future re-skilling" [3], and so is the urge for educational systems to "maximize learning" [4, p.2] and, according to Reigeluth [4], assign new roles to its main actors, namely the teacher, to be perceived, according to the author, as a "designer, facilitator, and mentor" [4, p.11]; the student, a "worker, self-directed learner, and teacher" [4, p.11]; and technology, to be used for "record keeping", "planning",

"instruction", and "assessment" [4, p.12-13]. Interaction is at the core of relationship building between teachers and students and students and their peers, and so is the need to "better address the strong emotional basis of learning" and "foster social and emotional development" [4, p.15]. In line with social constructivism principles [5, 6], peer learning encourages collaborative work and knowledge sharing between peers as well as learners' autonomy, creativity, and responsibility for the learning process [7, 8, 9] and when supported by digital technologies, in particular mobile and social media tools, may have significant impact on learners' motivation, engagement, social interaction and academic performance [10, 11, 12, 13].

This paper describes a multiple case study involving five peer learning projects, implemented in five Portuguese basic and/or secondary and higher education institutions and integrates the preliminary research stage of a project developed under Educational Design Research. Teachers who were responsible for the projects and former/current peer teaching students (PTS) were inquired and invited to reflect on the projects' purpose, organizational variables as well as on its impact on the educational community and on their own teaching and learning practice. This paper focuses on a specific part of the data collected with the purpose of identifying teachers and PTSs' perceptions on ICT tools usage in these projects, and promoting teachers and learners' reflection on ICT tools' impact on supporting collaboration and communication between teachers and students and students and their peers. It is expected that findings from this study bring insight into the issue summarized in the following question: *What was the role of ICT tools all over the implementation of the selected peer learning projects based on the perceptions of the teachers and of the peer teacher students inquired?*

### II. PEER LEARNING IN THE DIGITAL AGE

#### A. Peer learning programs and the 21<sup>st</sup> century curricula demands

Peer learning is one of the practices that provides learners with the opportunity to connect and collaborate with each other and benefit from that interaction for longer in history as it has been used for educational purposes since Ancient Greece [14]. Renowned theorists of Education such as Johann Pestalozzi, Lev Vygotsky, and Jean Piaget studied the principles of peer-to-peer teaching and learning [7], and Hoover [15, p. 422] highlighted

its twofold effect on peer teacher students (PTS), for the impact of knowledge sharing on expertise consolidation, and on peer learners (PL), for the effect of comfort and informality on these learners' motivation and engagement levels. Due to its potential, new trends of peer learning have been established and various terms are used to name them according to the context, the status, and the role of the actors involved [8]. Topping [8] emphasizes the evolution operated over the last decades, especially due to the attention given to the organizational variables of peer learning delivery, which according to the author can vary in thirteen dimensions.

Evidence of the benefits of peer learning have particularly been found under the cognitive, affective and social dimensions [16, 5, 7, 17, 8] in distinct areas and educational contexts, such as Health [16, 14], Computer Science [18, 9], or Physics [19, 20]. Peer learning is currently adopted worldwide, either as a learning strategy in class, or as an extra-curricular option, but more significantly in the USA, and the UK, predominantly in introductory courses and in cross level programs [17].

#### *B. Technological innovation and peer learning: strengths and challenges*

The connection between information technology and peer learning has been reinforced over the years [8]. Based on recent studies, authors like Harju, Koskinen & Pehkonen [11], Narayan, Herrington & Cochrane [12] or Aguayo, Cochrane & Narayan [10] advocate the potential of mobile and social media tools, among other things, for promoting greater visibility of learners' work with their peers and teachers, working as a trigger of high cognitive processes in their learning, and generating a "motivational competition" [12, p.219] that promotes learner engagement and empowerment. Harju, Koskinen & Pehkonen [11, p.15] also emphasize that the use of digital devices increases learners' ability to "engage in critical analysis", also for favoring opinion expression. Sharples [13, p.340] is clear when he states that current learners are used to sharing knowledge through social media and that "success in digital education comes from social-networked learning". All these features play a significant role in improving connection between peers, favoring the creation of learner-communities and collaborative learning opportunities [12, 13], and as mentioned by Cochrane & Antonczak [26, p.3], triggering learners' creativity by "pushing them beyond their comfort zones", which according to the same authors is highly valued by students and might have an impact on improving learners' engagement and sense of fulfillment [27, 26]. Recent studies converge in that mobile learning and digital tools not only allow new forms of social learning [10, 12, 22, 23, 24], but also contribute to pedagogical changes including the reorganization of learning spaces as well as the adoption of new learning strategies and ontological shifts [21, 26, 12].

Notwithstanding, according to Cochrane & Antonczak [26, p.2], moving from "teacher-directed pedagogy towards student-directed heutagogy" demands a lot more than simply redesigning activities using technologies teachers are comfortable with, which is in line with Traxler's [28] considerations upon the dangerous use of mobile devices with the support of traditional approaches.

### III. METHODOLOGY

This multiple case study is part of a project designed under the methodological framework of Educational Design Research (EDR), chosen for integrating research, development and the search for solutions for educational problems, whose answers will have an impact on educational practice [29, 30].

Five peer learning projects incorporate this multiple case study, and their selection process was based on purposeful sampling due to matching the following criteria: i) current/recent implementation in Portuguese educational institutions; ii) involving cross level peer learning programs; iii) voluntary participation of PTS; iv) expertise regarding the organisational dimensions of the projects; and v) consolidated findings on the outcomes of the project to the learners involved and the educational community. Three of these projects were selected based on news articles published about their positive impact on the schools they were held and the other two were previously known by the researchers. Four of these projects were held in basic and/or secondary institutions and one in a higher education institution. Only one of the schools is private. One of the institutions is in the district of Vila Nova de Gaia, two in the district of Aveiro, one in the district of Santarém, and another in the district of Leiria in Portugal. Four of these projects involve PTS attending secondary education, in the case of projects A, B, D and E, and one of them relates to former students of the curricular unit of a university degree course, in the case of project C. PL attend basic education in four of the projects, out of which two belong to the first cycle and the other two to the third cycle. In the project held at university, PL are students of the curricular unit "Multimedia Laboratory 4", which is part of the curriculum of the fourth semester of New Communication Technologies bachelor's degree course. PTSs' age ranges from fourteen to eighteen years old, in the case of projects A, B, D, and E, and nineteen to twenty-six years old in project C. The sample includes thirty-six female and twenty-seven male PTS in a total of sixty-three PTS. TABLE I lists the total number of teachers and PTS per project.

TABLE I. SAMPLE IDENTIFICATION

| Peer learning projects | Participants in the case study |                                 |
|------------------------|--------------------------------|---------------------------------|
|                        | Number of teachers             | Number of peer teacher students |
| A                      | $n = 2$ [T1 and T2]            | $n = 6$                         |
| B                      | $n = 2$ [T3 and T4]            | $n = 10$                        |
| C                      | $n = 1$ [T5]                   | $n = 20$                        |
| D                      | $n = 1$ [T6]                   | $n = 13$                        |
| E                      | $n = 2$ [T7 and T8]            | $n = 14$                        |

Before the selection process was complete, school Directors were contacted and formally invited to integrate the study, and all agreed on participating in it, having connected the researchers with the teachers in charge of the peer learning projects. These teachers were key elements in the process of preparation and implementation of the case study and strongly contributed to the effectiveness of data collection with PTS. In order to enforce the applicable law regarding participants' confidentiality and anonymity, teachers and PTS signed a declaration of informed consent, which in the case of students under eighteen was done

by their legal representatives. Data were collected from December 2018 to January 2019 in the educational institutions the projects belong to and online.

### A. Purpose of the study

The goal of this case study was to get to know the selected peer learning projects in detail regarding their purpose, human and organisational variables, and results. Moreover, gaining insight into PTSs' motivation to voluntarily join and participate in the projects as well as to their perceptions of this experience was also considered for its relevance. In order to do that, a mixed methods analysis was held based on qualitative and quantitative data, collected with the support of two data collection tools, created and validated for this purpose: a semi-structured interview, to be applied to the teachers who were directly involved in designing and/or implementing the peer learning projects; and a survey by questionnaire, to be answered online by former or current PTS who used to participate in the projects. This paper reflects on a specific part of the data collected in this case study, summarised in the following question: *What was the role of ICT tools all over the implementation of the selected peer learning projects based on the perceptions of the teachers and of the peer teacher students inquired?* These perceptions would focus on the role of ICT tools in specific stages of the projects, on the interaction between the actors involved, and on their impact on PTSs' collaboration and communication skills as well as on digital fluency.

### B. Data collection tools

The semi-structured interview was created with the purpose of gaining in-depth knowledge of the selected projects regarding their purpose, the human and organizational variables involved, and fostering reflection among the teachers interviewed on the impact of the projects on PTSs' learning outcomes. Overall, eight teachers were individually interviewed, as listed in TABLE I. Teachers were chosen for their active and leading role in creating and/or implementing the projects. The interviews were held face-to-face, from December 2018 to January 2019, in the schools the projects were developed, and they were recorded and subsequently transcribed.

The interview was structured into four distinct parts, namely the introduction, the purpose of the project, the human and organizational variables, and the results. The script of the interview was validated by four experts as recommended in literature [32]. The questions related to ICT tools usage in the projects were included in the section devoted to the human and organizational variables and are listed in TABLE II, where these can be compared with the questions addressed to PTS on the same topic in the survey by questionnaire.

The survey by questionnaire was created on *Google Forms* and answered online. The purpose of this online survey was to identify the profile of the PTS involved, get to know their initial motivations to voluntarily join the projects as well as those to have continued in the projects over time, and finally understand what their perceptions of the whole experience were (under the cognitive, affective, and social dimensions). The questionnaire was divided into four sections, namely the introduction, socio-demographic data, initial motivation and participation in the project. The online survey includes fifteen closed questions and eight open questions. The questions related to ICT tools usage

belong to the final part of the survey, devoted to PTSs' perceptions on their participation in the project, as listed in TABLE II and paired with the questions asked the teachers interviewed on similar/complementary items of the topic. The questions connected to assessing attitudes and perceptions were formulated in affirmative instead of interrogative sentences as suggested in literature [31, 32]. Questions 1, 2 and 3 require a mutually exclusive nominal scale [31] and questions 4 and 5 were created with Likert scales, respectively related to variables "level of agreement", and "level of evolution".

TABLE II. ICT TOOLS USAGE – QUESTIONS ADDRESSING THE TOPIC

| Interview and survey by questionnaire question pairing on ICT tools usage   |   |
|---|---|
| Questions from the semi-structured interview to teachers  | Questions from the survey by questionnaire applied to peer teacher students   |
| a) Have you ever used ICT tools to communicate/collaborate with peer teacher students?  | 1) When preparing for the peer learning sessions, I used ICT tools. (Yes / No)  |
| b) Do you know if PTS have ever used ICT tools to communicate with each other and/or with PL either in peer learning sessions or in other moments all over the project? | 2) I used ICT tools (e.g., social networks, synchronous communication tools) to deliver the peer learning sessions. (Yes / No)<br>3) I used ICT tools to communicate with PL in other moments out of the sessions all over the project. (Yes / No)  |
| c) Do you know if PTS still communicate and interact with PL out of the project?  | 4) ICT tools promoted collaboration and communication with PL. (Choose between <i>totally disagree/disagree/agree/totally agree / not answered or applicable</i> )<br>5) My fluency using ICT tools (Choose between <i>really improved/improved / hasn't changed/decreased / not answered or applicable</i> ) |

a. Own source

### C. Data analysis

The qualitative data collected from the interview were treated under content analysis with the support of qualitative data analysis software WebQDA. The content of the answers that address teachers' perceptions on ICT tools usage in the projects was categorized as "ICT tools usage", under which the following subcategories were determined: "teachers/PTSs' communication"; "peer learning sessions' promotion"; "research work"; "PTS/PL's communication"; and "peer learning sessions".

The quantitative data collected from the survey by questionnaire was analyzed with the support of software SPSS (v. 25) by means of descriptive statistics.

## IV. RESULTS

### A. Interview results

As regards question a), "Have you ever used ICT tools to communicate/collaborate with PTS?", three teachers, belonging to projects B and D, replied affirmatively and referred to having created a group on *Facebook* for that purpose. Only two teachers

from one of the projects answered negatively to the question (project A). The following excerpts show that *Facebook* had a significant role, not only in promoting communication between teachers and PTS, but also in publicizing the project or any events related to it or on delivering information on the project. "... *Facebook is very important in disseminating it. There is a very interesting work regarding creating events on Facebook, advertising them, creating enigmas and mystery about what is going to happen*" (T5); "*Everything is publicized on Facebook ...*" (T6). "*Some aspects are displayed on the school page, on Facebook, ...*" (T7). ICT tools like the E-mail and collaborative editing tools like *Google Drive* and *Padlet*, instant-messaging platform *Slack*, SMS and mobile/smartphones were referred to once by different teachers. The teacher from project C added that ICT tools are used in different dimensions all over the project and, above all, according to an open source approach so that everyone can access all files shared, especially on *Google Drive*. Participation and comments from all members are therefore welcomed. Besides that, the teacher also uses *Slack* as a privileged tool to communicate with PTS, where different channels can be created based on the purpose and the elements involved in different conversations. In the case of this project, the teacher added that the E-mail is never used in order to prevent private exchange of information. "*So, the fact that PTS work with me based on an open source approach is one of the key points.*" (T5)

Regarding question b), "Do you know if PTS have ever used ICT tools to communicate with each other and/or with PL either in peer learning sessions or in other moments all over the project?", the teachers belonging to projects B and D mentioned no ICT tools were used between PTS and PL. Coincidentally, in both cases PL were children attending the first cycle of basic education. In the case of the remaining projects, social media (e.g., *Instagram* and *Facebook messenger*) and SMS were the ICT tools teachers referred to for being used more often by PTS to communicate with each other as well as with PL. Mobile phones were mentioned by two teachers and instant messaging and calling platform *WhatsApp* was mentioned by one. Based on the following excerpts from teachers' answers, it becomes clear that for these students, using mobile phones to make calls is something considered outdated, and although exchanging phone numbers between PTS and PL is a common procedure in projects A, C and E, the way they use them is mostly for sending/receiving SMS or communicating through *WhatsApp* or social media. According to the same answers, most of these students consider using social media a lot cooler, instant and valuable, especially for the social recognition associated with the fact of becoming friends/following older peers on *Facebook / Instagram* and the effects on self-esteem and social status connected to it. "... *the first thing they have to do is exchange contacts and I find it really amusing because they always say: 'teacher, the phone is old-fashioned', and then they become friends on social media, which is really fun, because afterwards they start communicating through Instagram, Facebook, Messenger, and they do it often, not only on the first session...*" (T2). "*It may happen that they use Facebook to share information on the project. Sometimes they have class groups there and find instant ways of communicating with each other...*" (T6). Another thing mentioned by some teachers is the empathy established between PTS and PL and the role of

constant communication through social media and mobile phones in promoting the quality of this relationship, e.g. in the support older students give their younger peers when they have exams or even when making arrangements to be together in breaks at school every time PTS feel PL might feel insecure. "*When empathy is created, they regularly communicate, not only about the good school results PL are proud of informing their older peers about, but also to ask: 'So, are you here today? Are you coming for lunch?', in the case from PTS to PL...*" (T2). "*Sometimes they have exams and communicate with each other to get to know or to tell about whether it worked well or not.*" (T7). One of the teachers also mentioned students use other multimedia tools such as interactive games or film excerpts to work with each other in some peer learning sessions. One of the teachers from project B also added that PTS used to do some research work to prepare for peer learning sessions on *Youtube*, on *Facebook* and by simply accessing a browser to search for specific information.

In the case of question c), "Do you know if PTS still communicate and interact with PL out of the project?", most teachers mentioned they do not have enough information on that, even though they think it does not generally happen.

#### B. Survey by questionnaire results

The initial three questions answered by PTS on ICT tools usage all over the projects are all mutually exclusive and require a "yes", "no" or "not answered/applicable" answer. Question 1 refers to ICT tools usage in peer learning session preparation, question 2 refers to ICT tools usage while delivering peer learning sessions, and question 3 relates to PTSs' usage of ICT tools to communicate with PL in other moments apart from peer learning sessions. Based on PTSs' answers to question 1, the majority (57%) assumed they use ICT tools when preparing for peer learning sessions, contrary to a lower but still considerate percentage of students (34,9%) who declared not to use ICT tools in the same situation. 7,9% of the students did not answer/consider this question. Surprisingly, as regards the use of ICT tools when delivering peer learning sessions (question 2), a more significant percentage of PTS (63,5%) assumed they do not use ICT tools in that case as opposed to 28,6% of their peers, who mentioned they use ICT tools in that context. The same percentage of students from question 1 (7,9%) did not answer/consider this question. In the case of question 3, a significant percentage of PTS (61,9%) assumed they did not use ICT tools to communicate with PL out of peer learning sessions, contrary to 25,4% of their peers, who said they used to do it. A slightly higher percentage of PTS (12,7%) did not answer/consider this question.

Results from the three questions were paired and shown on Fig.1. Based on this, it is evident that among this study sample, ICT tools were more significantly used by PTS when preparing for peer learning sessions, and a lot less when delivering these sessions or out of them for possible communication with PL.

The remaining two questions of the survey by questionnaire relate to assessing PTSs' perceptions on ICT tools usage and focus, first, on variable "level of agreement" (question 4), more specifically, characterizing the potential of ICT tools to promote collaboration and communication between PTS and PL (Fig.2). According to PTSs' answers to question 4 (Fig.2), for the

majority (65%), ICT tools promote collaboration and communication between them and PL, out of which 30% “totally agree” and 35% “agree” on it. The percentage of PTS that disagree with that is substantially lower, corresponding to 16%, out of which 6% “totally disagree” and 10% “disagree”. 12% of the PTS chose not to answer/consider this question. Regarding the content of question 5 (Fig.3), related to variable “level of impact”, in this case of PTSs’ participation in the project on their digital literacy and fluency (Fig.3), the majority of the PTS (57%) assumed their digital literacy and fluency has not changed after having participated in the project as opposed to 27%, who noticed some improvement, in particular 17%, considering their digital fluency “improved”, and 10% mentioning it has “really improved”. Only 2% of the PTS declared their digital skills have “regressed”, and 14% of the students did not answer/consider this question. Based on this, it can be inferred that the majority of the PTS who integrated the sample perceived themselves as digital literate and that participation in the project did not alter their level of digital proficiency.

Figure 3. PTSs’ opinion on the impact of their participation in the project on their digital fluency (survey by questionnaire)

## V. DISCUSSION AND CONCLUSIONS

When considering the question addressed in this study, more specifically, *What was the role of ICT tools all over the implementation of the selected peer learning projects based on the perceptions of the teachers and of the peer teacher students inquired?*, it is clear that most teachers had similar perceptions to the majority of the PTS inquired, regarding the distinguishing role of ICT tools in promoting communication, collaboration and information exchange (between teachers and PTS and between PTS and PL) all over the projects, due to their ubiquity as well as the immediacy they promote and their contribution to the reinforcement of affective bonds between PTS and PL. Teachers from two of the projects highlighted the effective role of ICT tools in sharing information about the projects. Every teacher interviewed mentioned at least an ICT tool used by them to communicate and/or share information with PTS and all of them agreed on the fact that these tools were organic elements of PTSs’ communication with each other and, in a few cases, with these and PL as well, which substantiates the position of several authors previously mentioned [12, 13, 22, 23, 24, 25, 28]. However, only one of the teachers (from project C) reports a strategic integration of different ICT tools in the preparation for peer learning sessions and its decisive role in promoting open source communication and collaboration between the teacher and PTS as well as among them. This low uptake of ICT tools as an integrative part of most projects may substantiate the position of authors [26, 28] who advocate limitations of technology usage based on the integration of traditional pedagogical approaches. In the case of most of these projects, further investigation should be implemented to ascertain the possible reasons for this low integration level of ICT tools in the projects.

As regards ICT tools usage either in peer learning sessions or out of them, PTSs’ perceptions complement the teachers’ more generic views on this subject, as most students clearly assume ICT tools were not significantly present in peer learning sessions or out of them. Although three out of five teachers referred to at least an ICT tool as being used in peer learning sessions, the vast majority of PTS assumed they did not use ICT tools in those sessions. It may indicate that ICT tools’ role in the peer learning projects selected for this study was not significantly relevant for the implementation of peer learning sessions. Teachers also mentioned several examples of ICT tools they supposed PTS used to communicate with each other and with PL (out of which social media and SMS were the more referred to) all over the projects, which substantiates the position of authors who advocate the potential of mobile and social media tools in promoting social visibility, learner engagement and motivation [10, 11, 12, 13, 26]. However, a significant percentage of PTS assumed they did not use ICT tools in other moments out of peer learning sessions, which may indicate ICT tools were not the privileged vehicle for communication among PTS and between these and PL or that interaction between both happened mostly in peer learning sessions and not out of them.

Based on most PTSs’ perceptions, PTSs’ participation in the projects did not have significant impact on their digital literacy

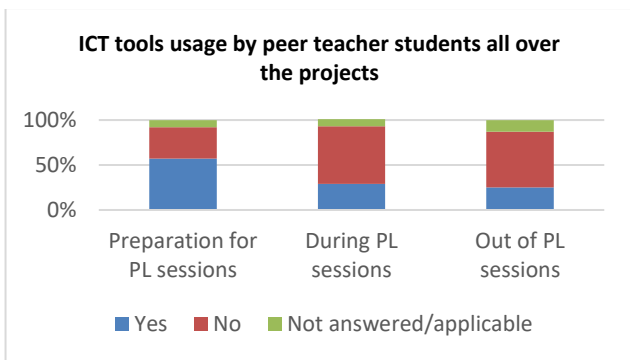


Figure 1. Peer teacher students’ answer pairing of questions 1, 2 and 3 (survey by questionnaire)

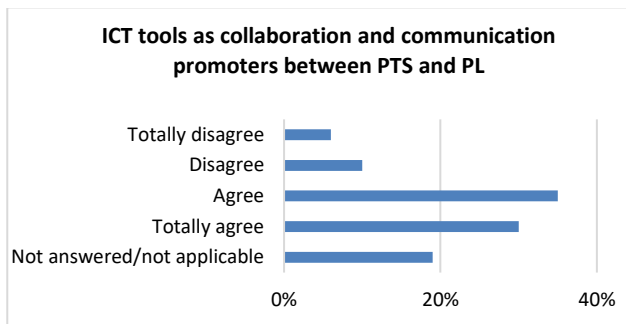
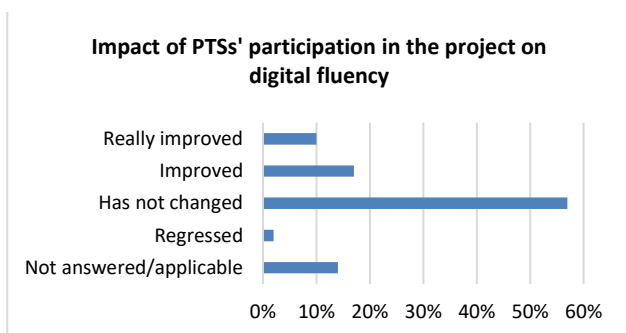


Figure 2. PTSs’ opinion on ICT tools potential to facilitate collaboration and communication between them and PL (survey by questionnaire)



and fluency, which may be indicative of these students' digital mastery and may reinforce Istifci's [25] position on 21<sup>st</sup> century learners' digital competence.

Possible limitations of the study are directly connected to the fact that the findings deriving from it cannot be generalized as they stem from a case study. The fact that the study presented in this paper integrates a multiple case study whose goals are broader than those connected to getting to know teachers and PTs' perceptions on ICT tools usage may have conditioned further investigation on the topic.

It would therefore be important to promote studies with larger samples, whose findings could be generalizable and add a comprehensive insight on current issues that may still prevent the integration of ICT tools in peer learning projects as well as assess their impact on facilitating the peer learning experience and on PTS and/or PLs' academic performance.

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