Knowledge Transfer in Doctoral Education During the Pandemic Time: An Exploratory Study of the PhD Students' Experiences

Rocco Agrifoglio[1,], Paola Briganti[1], Maria Ferrara[1], Maria Luisa Iavarone[1], Rocco Reina[2], Luisa Varriale[1] and Anna Maria Melina[2]
[1] University of Naples Parthenope, Naples, Italy
[2.]Magna Graecia University of Catanzaro, Catanzaro, Italy
rocco.agrifoglio@uniparthenope.it

Abstract. The research aims to explore how PhD students interacted with professors and peers and transferred knowledge during pandemic time. We firstly aim to provide an overview of communication media used by students, as well as to classify them for different kinds, social presence, and media richness. Furthermore, our research also aims to explore how doctoral students took their courses by interacting with professors and with peers, in terms of learning (KT) and social exchange relations (LMX, TMX, POS), through online learning platforms and communication media. We conducted exploratory research on 25 PhD students from 5 Italian PhD Programs in 'economic and statistical sciences' area. Data was collected through (a) the focus group interview with PhD students for collecting their opinions and experiences on the usage of media for communicating with professors and peers and (b) an online questionnaire aimed to measure their experiences or perceptions on technology usage and social relations. Results shown that PhD students used e-learning platform for communicating with peers and professors, so developing good social relations -even at a distance- which have encouraged knowledge transfer among them.

1. Introduction

The Covid-19 pandemic has created numerous problems in doctoral education, and above all for face-to-face PhD courses, encouraging the adoption of online learning platforms to enable students to take course remotely. It has also profoundly limited the social interactions between students and professors and between students (peers), pushing them to experience new ways of communication and sharing of knowledge through using communication media.

Although previous research based on social perspective to investigate KT in education, still little attention was paid to the links between social relations, communication media, and KT when the pandemic occurred.

The research aims to explore how PhD students interacted with professors and peers and transferred knowledge during pandemic time. We firstly aim to provide an overview of communication media used by students, as well as to classify them for different kinds, social presence, and media richness. Furthermore, our research also aims to explore how doctoral students took their courses by interacting with professors and with peers, in terms of learning (KT) and social exchange relations (LMX, TMX, POS), through online learning platforms and communication media.

We used a mixed method to explore the PhD students' experiences. We conducted exploratory research on 25 PhD students from 5 Italian PhD Programs in 'economic and statistical sciences' area. In particular, data was collected through (a) the focus group interview with PhD students for collecting their opinions and experiences on the usage of media for communicating with professors and peers and (b) an online questionnaire aimed to measure their experiences or perceptions on technology usage and social relations.

Results provided useful insights for research on KT in doctoral education and for PhD programs' coordinators involved in definition of teaching methods and training programs that are more suitable for sharing knowledge through social relations' improvement and technology usage.

2. Literature review

We reviewed the literature on media richness, social presence, and social exchange dimensions, such as Perceived Organizational Support (POS), Leader-Member Exchange Theory (MX) and Team-Member Exchange Theory (TMX).

Media richness theory describes how various communication media carry the intended information and the symbolic information with respect to the intended message and the sender: features of a communication media, such as the capacity to allow quick feedback, provide multiple cues, use language variety, and the perception of personal focus, determine the richness of the media (Shepherd & Martz, 2006; Daft et al., 1987).

Face-to-face is the richest form of communication media, reducing equivocality more efficiently than telephone, instant messaging, written, addressed documents (email, memo, letter), unaddressed documents (fliers, bulletins, and reports), progressively lower in social presence and media richness scales (Daft et al., 1987).

Face-to-face communication can transmit facial expressions, body language, gestures, proximity, and non-verbal cues and is therefore the highest in social presence and media richness: all other communication media are compared to face-to-face, and in many ways are adapted or designed to be more like face-to-face communication to find ways to make up for the medium's lack of richness.

Specifically, media richness theory was developed in the 1980s by organizational scholars with the use of electronic communication media, such as email (Daft, Lengel, & Trevino, 1987; Daft & Lengel, 1986, 1984). The theory identifies the matching between the richness of a medium and the equivocality of task as the main source of successful use of a communication channel or medium: the effective information processing in organizations is significantly related to uncertainty and equivocality reduction, respectively thanks to adequate quantity or amount of information to reduce uncertainty, and appropriate quality or richness of information to reduce the confusion or the lack of understanding (equivocality). For instance, using a media communication technology tool such as email, the technological medium can transfer a large amount of information to reduce uncertainty, but equivocality reduction could be a problem, because of the lack of nonverbal cues featuring mediated communications.

Media richness theory describes the "richness" of a communication channel based on the presence of four criteria: immediate feedback, multiple cues, language variety, and personal focus. Basing on this theory, face-to-face represents the richest medium, followed by phone, written addressed document (e.g., letter, email, and text chat), and unaddressed document (e.g., flyer). Effective manager selects medium with higher richness features, such as face-to-face, in presence of higher levels of equivocality of the task, and lower rich medium, such as lean unaddressed documents, for unskilled tasks.

Media richness theory has been applied in interpersonal, educational, and organizational contexts (Ishii et al., 2019).

In the interpersonal context, mobile devices have changed communication in the development of friendship relationships. The increase of channel options (webcam, instant messaging, texting and social media, face-to-face communication tools) is giving pressure to users on what way to transmit a message to another individual is morally or socially appropriate (Pettegrew & Day, 2015). Duration of the interaction causes positive effect of happiness just using face-to-face; testing, phoning, emailing people reported no relationship between duration of interaction and happiness (Vlahovic, Roberts, & Dunbar, 2012). However, referring to voice chat, Kwak (2012) highlights the role of communicator media use: theoretically voice chat is a richer channel than text-based chat, because let communicator to actively reduce equivocal communication of information, but if the answers don't give immediate feedback, the richness of the medium decrease and uncertainty and equivocality risk to damage the relationship.

Liu and Yang (2016) stated that mobile phones use, that would expect immediate responses, facilitate immediate communication in close friendships, more than social networking sites, and also instant messaging services on these sites, used for less intimate relationships. On the other hand, specifically the adolescents perceive instant messaging relatively rich, despite media richness theory, and they like more asynchronous channels to apply advanced tool of "presentation control", which should transfer the portray of a desirable image, by filtering or regulating information in messages, pictures, and videos: the use of a theoretically lower rich medium could better control the quality of communication, and, consequently, the quality of friendship relation (Sheer, 2010).

Furthermore, mobile learning is an important, growing topic of interest in the educational context: the main findings showed that each channel had advantages in different areas (Lan & Sie, 2010). To analyze the successful transfer of information in mobile educational programs, the authors compared three media in terms of accuracy

and adaptability criteria of the media richness theory: Really Simple Syndication (RSS), email, and short message service (SMS). email resulted as the content richest medium, letting significant quantities of detailed information; on the other hand, SMS or text messaging presented more advantages in terms of timelines; finally, RSS, which could instantly inform the subscribers the information updates, was superior in terms of accuracy and adaptability, and the most appropriate for mobile-learning device.

Lan, Hung, and Hsu (2011) provided images, multiuser function, and life-like quality simulations (rich online condition writing tasks), text-based with the option for the participants to perform suggested word searches (lean online condition), verbally led by an instructor with pen and paper directions (theoretically richest face-to-face condition), to compare motivation, anxiety, and enjoyment of writing tasks among elementary students in two levels of a computer mediated classroom (rich and lean), and in a traditional classroom: instructions transferred through rich and lean mediated channels enhanced higher levels of motivation and enjoyment, and lower levels of anxiety in the participants. The rich online classroom was the best choice for students to become happy successful writers.

Balaji and Chakrabarti (2010) analyzed the role of online discussion forums in a traditional face-to-face course. Despite the leaner characteristics of online discussion, it resulted a more successful approach, in terms of effective interactivity and better student performance, than the traditional lecture-only style of face-to-face discussion, by taking technological advantages of each channel. in Furthermore, research showed that communication with theoretically rich media, such as face-to-face, as highlighted by the study of many online courses, may not always produce positive outcomes in terms of students' motivation, satisfaction, and performance (Cole, 2016).

Finally, in the organizational context, successful collaboration among team members resulted significant to achieve organizational goals today often through online collaboration. Some authors (Aritz et al., 2018) studied teams which collaborated using multiple-media communication channels (email, Google Docs, Facebook, texting, phone calls), and insider preference for certain channels and communicative tools. File sharing, web conferencing, messaging, phone was grouped into four categories, basing on their features: for instance, Google Docs and email were grouped into the channel that let to have file sharing capabilities; texting and instant messaging were categorized as messaging class. Well-coordinated teams were able to use richer channels, that allowed immediate feedback (web conferencing and phone), than poorly coordinated teams.

Constantly evolving technology has been enriching "lean" media in multiple ways and transforming communication, highlighting the need to revise media richness theory as showed by inconsistent above results from empirical studies, concerning today seeking gratification technology-driven advanced communication contexts (Ishii et al., 2017).

Moreover, social presence is defined as "the extent to which one feels the presence of a person with whom one is interacting" (Latchman & Latchman, 2000; p. 559), and "the feeling one has that the other persons are involved in a communication exchange" (Carnevale, 2000; p. 188). The degree of social presence is caused by the communication medium and more channels or cues are available in the medium, more attention is paid to the other participants in the communication (Chen & Wein, 2020; Kuyath & Winter, 2006; Walther, 1995).

Organizations are constituted by an interconnected system of social exchange relationships between leaders, subordinates, and coworkers (Sparrowe & Liden, 1997; Sparrowe & Liden, 2005). In particular, in organizations there are two focal social exchange relationships, the individual with leaders (LMX), and individual with team (TMX) (Liao et al., 2010).

LMX was derived from social exchange theory and role theory, and refers to the relationship between an individual and his or her leader (Herman et al., 2018; Bernerth et al., 2016; Wayne et al., 1997): when leaders and subordinates are able to develop mature leadership relationships, mutual trust, respect, congruent values, and affection (in-group perception), the quality of this dyadic relationship positively affects leader and individual attitudes and behaviors, especially the levels of performance (Chen et al., 2018; DeConinck, 2009; Graen & Uhl-Bien, 1995). Employees of the in-group tend to contribute more than the literal job description, while "out-group" workers only perform the routine tasks required by the leaders, because of a lower perceived quality of LMX characterized by policies, formal rules and authority (Tsay et al., 2014; Graen & Scandura, 1987).

TMX represent a theoretical extension of LMX, and, in particular, while LMX focuses on the vertical relationships between leaders and subordinates (Banks et al., 2014), TMX refers to the quality of horizontal relationships among the members of the team, in terms of satisfaction with coworkers and perceptions of cohesiveness, individual's willingness to share ideas, feedback and help other members in a team, in turn, receiving recognition, assistance and information from other members (Farh et al., 2017; Banks et al., 2014; Tsay et al., 2014; Seers et al., 1995; Seers, 1989).

According to organizational support theory (OST) workers develop a general perception concerning the extent to which the organization values their contributions wiht equity and cares about their well-being (perceived organizational support, POS) (Kurtessis et al., 2017; Eisenberger & Stinglhamber, 2011; Shore & Shore, 1995; Eisenberger et al., 1986). The main antecedents of POS, identified by literature, are fairness, human resource practices, and supervisor support; the major consequences are affective organizational commitment, job satisfaction, and job performance (Riggle et al., 2009).

3. Methodology

This study adopts a multi-method approach by combining qualitative approaches, such as focus group and interviews, and quantitative approach, such as the sample survey.

Indeed, according to the most relevant contributions in the literature, combining both qualitative and quantitative methods can really contribute to investigate phenomena still underrepresented. On one side, qualitative research, largely based on inductive reasoning, works as an effective strategy able to analyze participants' meanings and the relationship between them by using several data collection techniques and analytical procedures (Saunders, Lewis, &Thornhill, 2015; Corbin & Strauss, 2014); on the other side, quantitative research, mostly based on deductive reasoning, is recognized crucial for testing objective theories by investigating the relationship among variables.

Indeed, using a mixed method we explore the PhD students' experiences adopting the following approaches with specific techniques:
1. we interview and survey 10 students and 2 coordinators from 2 Italian PhD Programs in 'economic and statistical sciences' area. A focus group interview will be used to gain exploratory data from the PhD students, while interviews will be conducted with PhD coordinators. We'll constitute two groups (one for each PhD program) composed of 5 PhD students for collecting their opinions and experiences on the usage of media for communicating with professors and peers. The interviews and focus group interview were conducted using a well-defined structure, where questions specifically focused on the aim of the study were asked, specifically these questions concern the content of experience for students (if and how their motivation changed before/during/after pandemic; if the students changed their lifestyle; questions inspired to the Study Approach Questionnaire regarding the motivation for studying, individual job organization, flexibility, anxiety management, PhD orientation versus the academic world (Cornoldi et al., 2005);
2. We conduct a follow-up survey by administering a questionnaire to such students to measure their experiences or perceptions on technology usage and social relations. Our short survey consists of five constructs and for each of them multiple item scales were developed, measured on different point Likert scales. Specifically, Perceived Organizational Support (POS) was measured using Eisenberger, Cummings, Armeli, and Lynch's (1997) eight-item scale. Answers were given on 7-point Likert-type scales ranging from 1 = ''strongly disagree" to 7 = ''strongly agree". Leader-Member Exchange (LMX) was measured using Graen and Uhl-Bien's (1995) seven-item scale. Answers were given on 5-point Likert-type scales ranging from 1 = ''strongly disagree'' to 5 = ''strongly agree''. Social Presence Scale (SPS) was measured using Kim (2011) 5-point Likert scale. Finally, Perceived Media Richness (PMR) and Overall Functionally were measured using Sheer (2011) 7-point scale, ranging from 0= "strongly disagree" to 6 = "strongly agree".

4. Results and discussion

This section reports the results of the focus groups and questionnaires obtained from our analysis on the topic of knowledge sharing in doctoral programs during the Covid-19 pandemic. We first proceeded to the mapping of the doctorates present in Italy belonging to the XXXVI cycle and pertaining to area 13 (economic sciences and statistics). Of the 98 Italian universities analyzed, of which 11 non-state telematic, 20 non-state and 67 state, it

emerged that the doctorates under examination were a total of 234; of these 74 are international doctorates and 38 are industrial doctorates. The analysis shows that almost all Italian universities have an e-learning platform, specifically only 9 out of 98 are not yet equipped with such platforms. Through e-learning it was possible to carry out lectures / seminars during the academic year 2020/2021 (XXXVI), years heavily affected by the pandemic emergency. During this period, many universities have adopted mixed teaching methods, i.e., both face-to-face, when obviously allowed by national provisions, and online through platforms such as Teams, Moodle, Zoom etc. After mapping the Italian universities and related research doctorates, to achieve the goal of better understanding the process of transferring knowledge between doctoral students through the study of the qualities of social relations and the use of online learning platforms, a 'qualitative-quantitative survey which envisaged a dual method of data collection. Specifically, 2 universities participated in the survey sample with which to analyze the issue of knowledge sharing in doctoral programs during the Covid-19 pandemic. Were conducted n. 2 remote focus groups via Ms-Teams in which PhD students also not present in Italy participated; following the focus groups, participants were then asked to answer a short online questionnaire. The survey was attended by n. 8 PhDs of the XXXVI cycle, of which 7 replied to the online questionnaire. From the focus group it emerged that the answers to the various questions posed to the doctoral students were mostly homogeneous. As highlighted by the following graph (Figure 1) in most cases the use of digital solutions proposed by their universities in their doctoral programs did not lead to a significant change on the part of the respondents on interest in studying, performance in study, the management of one's time and the yield in the study "before" and "after" the pandemic.
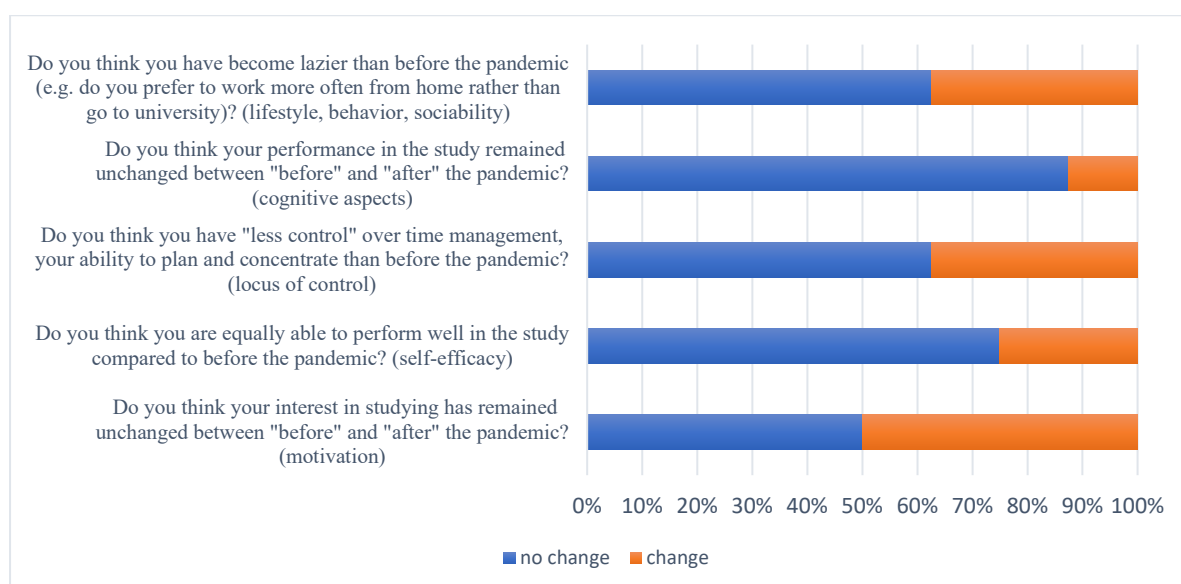

Figure 1: Does the use of digital solutions proposed by universities in doctoral programs lead a change or not? Answers given by the PhD students in the 2 focus groups

Furthermore, during the focus groups, PhD students had the opportunity to answer a series of open questions that gave them the opportunity to better motivate their answers and express their opinions on the topic of knowledge sharing using digital platforms to learn during the emergency period. Specifically, to the question "*If and how your relationship with your supervisor changed during the pandemic emergency?*" all the PhD students stated that through the platforms it is now possible to meet your supervisor / tutor at any time of the day, at any time. All this represents a positive aspect for them. Another positive aspect is undoubtedly a saving in terms of costs in printing documents, relating to one's research, to be given to the supervisor; through the online platforms it is possible to easily share the screen and thus you can have immediate feedback. The negative aspect is, however, that there may be connection problems, internet network problems that do not allow or make connection difficult. For respondents there is therefore a change due to the introduction, during their doctoral program, of digital learning solutions, not so much from a technological point of view but from a psychological point of view, as there is no personal relationship, face to face with your supervisor. When we asked "*Adopting a research perspective, did the digital solutions have the improvements in your research experience? Did you have a better knowledge transfer thanks to the digitalization or not* "Everyone replied that for the transfer, the sharing of knowledge, it is undoubtedly preferable to be present at the university, to attend lectures and seminars in person rather than through online platforms. Only one graduate student stated that "*in terms of*

productivity, in terms of gaining knowledge, I think you can gain the same knowledge and you can share the same knowledge in the same way also if it is done, whether online or offline". Also asking them *"Did you have a specific advantages and disadvantages in during the pandemic emergency using digital solutions?"* Also, in this case the answers were homogeneous. The disadvantage is that there is no possibility to socialize with colleagues and therefore a greater ability to open to new knowledge is lacking, there is no interaction and therefore knowledge sharing. The perspective of the human, social relationship is missing. The advantage is that it is possible to shorten the distances and therefore you have the greatest possibility of interacting more frequently with your tutor and then there is the possibility of participating in international conferences from home. There is the effective use of time through these digital tools, through this new technology. Digitization was mainly fruitful to manage everything and carry out the activities within the PhD.

The above is also confirmed by the answers provided by the PhD students in the questionnaire. Specifically, as shown in the following graph (Figure 2), respondents agreed that having used the online platforms allowed them to use more signals (e.g., text, audio, visual) and it gave a feeling of face-to-face communication. In addition, greater value has been given to the fact that digital solutions are still easy, fun, flexible to use and undoubtedly alleviate one's apprehension about communication.
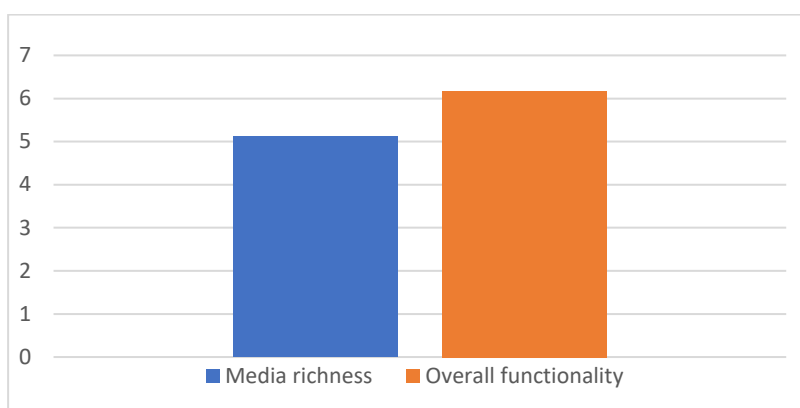

Figure 2: Media Usage.

Also going to investigate social exchange, specifically, how the system of social exchange relations between leaders, subordinates, and collaborators changes, using digital solutions, the answers stand at high values. In detail, as shown in the following graph (Figure 3), the quality of relations with the leader (LMX) and the team-member exchange (TMX) report more than positive values. Leader is close to the needs of the respondents and understands any work problems. The respondents themselves have good social exchange relationships with their colleagues. It therefore emerges that the perceived organizational support (POS) of the respondents is quite high. All respondents quite agree on the fact that the organization considers their own opinions, well-being, goals, and values of each.

Figure 3: Social Exchange.

Analyzing the further answers of the questionnaire administered, it emerges that the social presence, defined as "the extent to which one feels the presence of a person with whom one is interacting" (Latchman & Latchman, 2000, p. 559), and "the feeling one has that the other persons are involved in a communication exchange" (Carnevale, 2000, p. 188) achieved high scores.
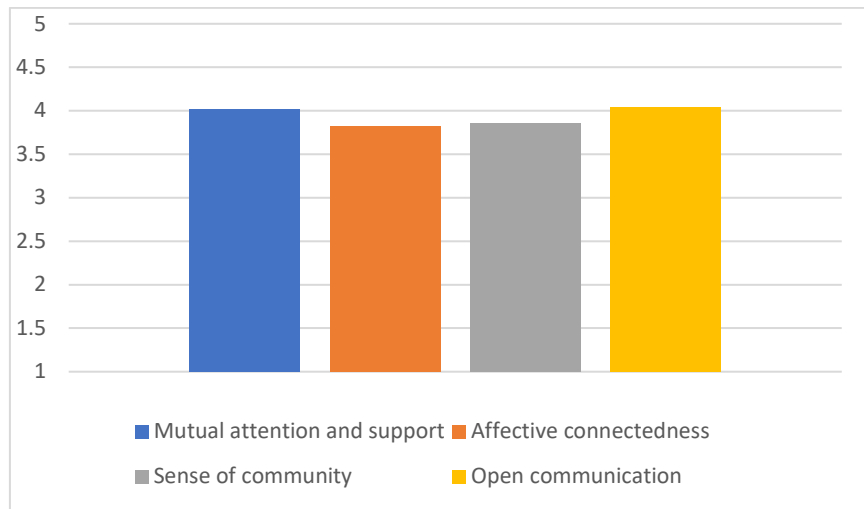

Figure 4: Social Presence.

Figure 4, indeed, shows how social presence allows for the cultivation of emotions and relationships and plays an influential role in promoting and sustaining meaningful and successful learning experiences, as highlighted by (Whiteside, 2017, p. 133).

5. Conclusions

The Covid-19 pandemic has created numerous problems in doctoral training and especially for face-to-face doctoral courses, encouraging the adoption of online learning platforms to allow students to take courses at a distance. It had a negative impact and profoundly limited the social interactions between students and professors and among students, leading them to experiment with new ways of communications and above all sharing knowledge using different communication's tools.

The results of the analysis carried out show that the PhD students used the e-learning platform to communicate with colleagues and professors, thus developing good social relationships, even at a distance, and encouraging knowledge transfer among them.

From the results of the interviews, it emerged that the use of digital solutions proposed by universities in their doctoral courses did not lead to a significant change on interest in studying, study performance, time management and study performance "before" and "after" the pandemic.

For some respondents the disadvantage of distance learning is that there is no possibility of socializing with colleagues and therefore no interaction and knowledge sharing. The perspective of the human and social relationship is missing.

The results provide useful insights for research on KT in doctoral training and for the coordinators of doctoral courses involved in defining the teaching methods and training programs best suited to sharing knowledge through the improvement of social relationships and the use of technology.

The main limitation of this study is certainly the small number of conducted interviews and questionnaires with doctoral students; so the next step for future research it will be to improve the survey with the participation of a larger number of PhD students belonging to different Italian universities in order to better understand the phenomenon.

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