Insights into variation in teachers' conceptions of ICT use; a phenomenographic exploration in a Pakistani higher education context

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Abstract:

The adoption of ICT to transform pedagogical practices is a complex phenomenon. Studies located within the Global South countries suggest that overcoming socio-economic and technological problems will lead to improved forms of teaching. Based on a phenomenographic study located in the context of a Pakistani university, we offer a different view of this body of literature. Firstly, we will argue that no matter how well established the technological infrastructure, not all teachers will adopt ICT with the aim of encouraging higher-level learning experiences. Secondly, a closer investigation of variations in teachers' prior exposure to technology, along with their beliefs as to the pedagogical use of teaching material and role of technology, is needed to better understand why teachers within the same higher education institution come to understand and use ICT differently. We offer insights that could be useful in designing professional development opportunities to support teachers in developing a complex pedagogical relationship with ICT.

Keywords: ICT use, ICT pedagogy, phenomenography, conceptions, Global South

1. Introduction

There is a growing interest in developing a better understanding of how ICT is used and adopted within university teaching (Chou et al., 2019; Adekola, Dale, & Gardiner, 2017; Scott, 2016). Commentators have debated whether having a well-established technological infrastructure will result in improved forms of university teaching that facilitate students' intellectual development and engagement in collaborative learning (see e.g. Gil-Flores, Rodríguez-Santero, and Torres-Gordillo, 2017; Kreijns et al., 2013). We found that existing research available on ICT-enhanced higher education within the Global South countries [countries that are categorised by World Bank with relatively low or middle income level] tends to support this assertion (Amemado, 2014; Khan, Hasan, & Clement, 2012). These studies repeatedly

report issues of limited technological infrastructure along with socio-economic problems as underlying the lack of transformation of teaching practices (see de Freitas & Spangenberg, 2019; Farid et al., 2015).

University teachers in such contexts could wait for a technological revolution while passively accepting and accommodating contextual limitations that affect daily teaching practices; or they could attempt to use available technological facilities to overcome the challenges and improve quality of teaching. We assume that the second option would be a preferred choice, and became interested in the question as to how we might support teachers in implementing this choice. In the paper, our intention is to offer insights into this research question based on our findings of a phenomenographic study located in the context of a socio-economic and technologically challenged Pakistani Higher Education Institution (HEI).

In an earlier published report of the same study (Hodgson & Shah, 2017) we argued that the teachers described either 'information-transmission-focused (ITF)' or 'communication-collaboration-knowledge-building (CCKB)' conceptions of ICT use. We found that teachers with CCKB conception made greater attempts in using the available technological infrastructure to circumvent contextual problems and create student-focused learning environments, whereas other teachers with an ITF conception of ICT use focused more on contextual problems while accommodating their negative impact on their daily teaching practices.

In the present paper however, we extend our analysis to offer an explanation as to why teachers understand and use ICT in different ways. We do so by adopting a phenomenographic *what / how* analytical framework (Marton and Booth, 1997; Harris, 2011) to *(a)* identify the *how* aspects - sources that influence teachers' meanings (or *what* aspects) and understandings of using ICT within teaching (see Methodology section for further explanation of *what* and

how aspects), and *(b)* present the relationship of these *how* aspects with ITF and CCKB conceptions of ICT use. Based on the findings, we support the argument that no matter how well established the technological infrastructure is, investing in developing teachers' pedagogical relationship with ICT, and not just its infrastructure, will lead to improved forms of teaching (Taimalu & Luik, 2019; Cubeles & Riu, 2018). In the paper, we offer insights that could inform policies of ICT pedagogy and for designing professional development activities, particularly within Global South settings and aimed at supporting teachers in adopting ICT for student-focused pedagogical practices.

2. Literature Review

The socio-cultural and economic context of universities has a significant impact on how ICT is integrated within teaching practices (Wilson, 2020; Khalid & Pedersen, 2016). However research has also found that even with a reliable and well-established technological infrastructure, teachers exhibit different ways of using ICT in their teaching (see Khan and Markauskaite, 2017). These studies suggest that some teachers may use ICT to simply enhance their teacher-centred practices - presenting and transferring lecture material and module-related information and/or students' technical skills development, or for administrative purposes. Some teachers may even experience using ICT as challenging and intimidating (see Ghavifekr, Kunjappan, Ramasamy, & Anthony, 2016). Conversely, others may use ICT in pedagogically complex ways to facilitate students' conceptual development and active participation within learning experiences (Lameras, Levy, Paraskakis, & Webber, 2012; González, 2010).

First order barriers - such as technological resources, training, workload support, as well as second order barriers reflecting teachers' pedagogical beliefs, confidence and attitudes towards ICT use, have been reported as hindering ICT adoption (see Taimalu & Luik, 2019; Prestridge, 2017). Research that explores the phenomenon within the Global South context

however stresses first-order barriers as the challenge affecting ICT adoption within higher education (see Farid et al., 2015; Kreijns et al., 2013). For example, Kumar's (2014) study in an Indian University highlighted key issues of lack of access to technology, poor Internet connectivity and a lack of time to experiment with ICT within teaching. Al-Senaidi, Lin, and Poirot (2009) reported similar hindrances to using ICT in an Omani university. Based in the context of African universities, Macharia and Pelser (2014) and Baguma, Khan, and Che Kum (2018) also identified barriers such as inadequate technological infrastructure and funding along with resistance to change and lack of ICT-skilled employees as the main problems affecting ICT integration within teaching practices. Nath (2019) conducted a study in a teacher-training institute in Fiji and identified similar reasons hindering technology integration - which were limited access to technology (computers), lack of funding, shortage of electricity, and lack of technology policies and training. These problems for integrating ICT within higher education have also been reported in Pakistan (see e.g. Sana and Mariam, 2013).

While these studies suggest difficulties teachers may experience within developing higher education contexts, the literature offers little or no insights as to why some teachers, when faced with the same institutional socio-economic and technological problems, are able to use available ICT facilities more successfully than others to improve their teaching practices (Norton et al., 2005). Further, the literature exploring ICT use within less developed countries is marked by an inattention towards second-order obstacles. Better understanding of these obstacles will be useful for two reasons. Firstly, recent studies have reported that teachers' pedagogical objectives and practices have a relationship to ICT integration in teaching (see Taimalu & Luik, 2019; Prestridge, 2017). Secondly, some researchers have argued that second-order barriers present a greater constraint towards using ICT adoption (see for example Ertmer et al., 2012). We therefore need more research insights in order to take advantage of ICT for higher-level student learning experiences within developing higher education contexts.

Furthermore, the literature investigating the phenomenon of ICT use within higher education in Pakistan and in other developing countries is populated by studies adopting quantitative research methods. With scholars calling for more empirical studies within developing contexts (Farid et al., 2015; I. A. Qureshi, Ilyas, Yasmin, & Whitty, 2012), this paper contributes by offering a novel research perspective in reporting findings of an interpretive, phenomenographic study of teachers' conceptions of ICT use within higher education in developing countries.

2.1. Phenomenographic literature on ICT use

There are relatively few studies available that have used a phenomenographic perspective to research technology-enhanced teaching (see for example Khan, 2015; González, 2010; Lameras et al., 2012; Stein, Shephard, and Harris, 2011). More or less similar findings of teachers' conceptions of ICT use have been reported by these studies with conceptions described as 'transferring information', 'self-paced independent learning' and 'engaging in communication-collaboration-knowledge-building' (see González, 2010). These studies have also discussed *how* aspects to account for the differences between teachers' conceptions of technology use in their teaching. We noted that the roles of teachers and students to be the commonly identified sources of variation in meanings and conceptions of using ICT within teaching. The studies identified additional aspects of variation too. For example, González (2010) found teachers' perceptions of the importance of the online component within the module design, along with course participants' interaction within an online environment as key distinctions between their conceptions of ICT use. Lameras et al. (2012) identified additional sources such as epistemic status of subject matter and study level to influence how Virtual Learning Environments (VLEs) were adopted within teaching. Khan (2015) found the 'impact of technology on student and teacher knowledge' and one's understanding of 'who benefits from use of ICT in teaching' (p. 683) as other sources of influence on teachers' conceptions.

Possible reasons for the identification of new sources by these studies could be: *(a)* the study was conducted in a different setting, and *(b)* the research area of teachers' conceptions of ICT-enhanced teaching is underexplored within phenomenographic literature.

We argue that studies within different educational contexts could contribute additional knowledge to the existing phenomenographic literature. According to Khan (2015), prior research in this area has not put sufficient emphasis on the internal relationship among the conceptions revealed in the studies. We propose that investigating the variation in the sources of teachers' conceptions of ICT use in a different context such as a Pakistani HEI is a useful agenda that extends existing research and fills the gap in the literature.

2.3. Focus of this paper

In an earlier published report of the same study (Hodgson & Shah, 2016), we observed that the teachers described using ICT in their teaching in five different ways which were qualitatively different in their meanings and underpinning conceptions of ICT use (see Table 1). Three of these categories of description: 'Retaining Attention', 'Professional Skills Development' and 'Information Enrichment' were underpinned by an ITF conception of ICT use. This conception of ICT is seen as relatively less complex as the teachers described understanding and using ICT primarily for acquiring and transmitting module-related information and/or providing technical skills to students. In contrast to this, 'Connectivity' and 'Omnipotential' categories of description were informed by the more complex CCKB conception of ICT use. Such understanding of ICT use was described as intending to facilitate students' conceptual understanding and/or to create student-centred learning environments.

[*Insert Table 1 here*]

In the present paper, we extend this phenomenographic research and identify the sources (or *how* aspects) that influence the teachers' meanings. Harris (2011) suggested that

better understanding of *how* aspects of subjects' conceptions of the phenomenon can provide insights as to '*why* [original italics] people have differing understandings and what would need to change in order for them to adopt a more complex conception' (p. 117). Such insights can be particularly useful in efforts aimed at conceptual change in teachers' understanding of ICT use. Stein et al. (2011) state that 'the conceptions influence and determine behaviours and responses' (p. 147). For teachers based within developing contexts, efforts to change conceptions of ICT use will have implications for not only their daily use of ICT but also for the way they engage with contextual problems impacting their teaching practices (see Hodgson & Shah, 2016 for a detailed discussion of the teachers' conceptions of ICT use).

3. Research design – a phenomenographic approach

The focus of a phenomenographic research is to identify variation in the subjects' ways of experiencing and understanding a particular phenomenon (Marton and Booth, 1997). In phenomenographic research, it is assumed that a phenomenon can be understood in a limited number of ways and that these ways can be explored, identified and communicated (ibid, 1997). The different ways of understanding the same phenomenon are presented as a set of *categories of description*. Each category of description presents a unique aspect of the experience of phenomenon and is connected with other categories (Åkerlind, 2012) in terms of their similarities and dissimilarities. The categories of description and their interconnections together form an *outcome space* (Marton and Booth 1997). The outcome space is an important phenomenographic concept as it 'provides a way of looking at collective human experience of phenomena holistically' (Åkerlind, 2012). We will present the study's outcome space in this paper.

According to phenomenographic literature, conceptions of the phenomenon can be analyzed using the *what/how* framework (Marton and Booth, 1997; Harris, 2011). As shown

in Figure 1, the *what* aspects represent the meanings people assign to their conception of the phenomenon, and the *how* aspects are sources of variation in peoples' meanings and conceptions (see Trigwell and Prosser, 1997; Bruce et al., 2004; Bowden, 1996).

[Insert Figure 1 here]

3.1. Research participants

An important requirement of a phenomenographic study is to capture a range of experiences of the phenomenon, or to exhaust the variation in experiences (Marton and Booth, 1997). For this requirement, a purposive sampling technique was adopted to maximize the variation among the selected participants (Åkerlind, 2012) which was:

(i) That each teacher to have at least six months or more experience of using ICT within their university teaching to make it likely that they have had significant experience of the phenomenon.

(i) the participants were at different academic levels, from different Faculties, and of both genders;

(ii) while the recommended sample size in phenomenographic studies is typically 15 to 20, to maintain sufficient diversity (Trigwell, 2000), we interviewed 29 teachers.

The basic characteristics of the participants were that there were eight female and 21 male teachers based in a HEI located in Khyber-Pukhtunkhwa Province in Pakistan. Amongst them there were 14 Assistant Professors, 9 Associate Professors and 6 Professors. Their teaching experience varied between 6 months to 30 years. The participants belonged to Faculties of Sciences, Arts, Health Sciences and Law & Administrative Sciences.

3.2. Data collection

Within phenomenographic research, interviewing participants is the preferred data collection method (Harris, 2011). The first author conducted one-to-one, semi-structured interviews with the participants that lasted for 45 minutes on average. These were arranged at the participants' convenience in terms of time and venue (other than their home-settings) so as to facilitate them in describing their experiences of using ICT comfortably and fully. The date, time and place of the interview were confirmed by a prior consent form signed by each participant.

During the interviews, the participants were asked a few pre-determined, open-ended questions inviting them to describe their experiences of using ICT within teaching. The questions included '*What is your understanding of ICT use within teaching?', 'can you describe your experience of ICT use in your teaching?*', '*how do you think use of ICT has affected you as a teacher*? and '*would you like to summarize or provide any other details regarding your ICT use?'*

Follow-up probes were asked for further investigation and understanding of their experience about the phenomenon. Some examples of follow-up questions asked were: *could you explain more?*; *why do you think in that way about ICT use?; how is that example of ICT use important for your teaching?*; and *could you provide another example to clarify your explanation?*. The participants used both English and the Pakistani national language, Urdu. The audio-recordings of the interviews were translated into English and transcribed by the first author.

3.3. Data analysis

In this paper we will focus on describing the analysis steps undertaken in our investigation of *how* aspects (see Hodgson & Shah, 2016 for a detailed review of data analysis steps to identify conceptions of ICT use and their *what* aspects). Hasselgren & Beach (1997)

suggest that 'phenomenography should be a process of analytic juxtaposition' (p. 194). This implies that the descriptions of experiences should be compared and analysed against each other to conceptualize variation in conceptions. With this understanding of the analysis process, the first author reviewed the pools of data representing 'information-transmission-focused (ITF)' and 'communication-collaboration-knowledge-building (CCKB)' conceptions of ICT use. This step was to note the different aspects of the phenomenon that the participants focused on when elaborating their experiences of the phenomenon (Åkerlind, 2012). The review was informed by the question: 'what aspects do the participants highlight as they explain the way they understand and use ICT?' We also focused our analysis on identifying the link between these *how* aspects and the meanings of the two conceptions of ICT use. This review was informed by the question: 'in what ways do the participants describe the sources of meanings (i.e. *how* aspects) as they elaborate their understanding and use of ICT?' We compared and contrasted the teachers' descriptions of the *how* aspects to analyse the ways these are conceptualized within both ITF and CCKB conceptions of ICT use. In the final step of the analysis, we diagrammatically presented our findings of the *how* aspects and their relationship with the conceptions of ICT use in the 'outcome space' of the study (see Figure 4 presented later in the paper).

4. Findings

From this analysis, we identified three *how* aspects, or sources that influenced the way the teachers understand and use ICT within their teaching. These were:

a) Prior exposure to technology

b) Beliefs as to the pedagogical use of teaching material

c) Beliefs as to the role of ICT in teaching

Our analysis of these *how* aspects also revealed that the teachers' prior exposure and beliefs regarding ICT role in teaching varied qualitatively. Also, the teachers described varying pedagogical purposes of accessing and using teaching material within teaching. In this section we will present these distinctions within the *how* aspects and the way these are related to the participants' conceptions of ICT use. To do so, we will first present the relationship of the three *how* aspects to the 'information-transmission-focused' (ITF) conception of ICT use, and then to the 'communication-collaboration-knowledge-building' (CCKB) conception of ICT use. Pseudonyms are used with the excerpts to ensure confidentiality.

4.1. The relationship of How aspects (sources of influence) to an Information-Transmission-Focused conception of ICT use

As shown in Figure 2, we will argue that teachers who used ICT primarily for transferring and sharing information also described an ITF conception and used teaching material to *simplify subject-content* for students and conceptualized the role of ICT *to save time* in teaching. These teachers described having relatively *limited* prior exposure to technology.

[Insert Figure 2 here]

a. Prior exposure to technology within teaching

According to the participants' descriptions, the kind of experiences teachers have had using technology related to the way they adopted ICT within their teaching practice. In comparison to other participants' description, some of the participants described *limited* exposure to the different ways of using technology within teaching. These participants also described ITF conception of ICT use. For example, a teacher describes her prior experiences with ICT to be

primarily for the purpose of transferring and receiving information. This informed how she adopted ICT within her teaching, as she says:

> 'I think about the time when I was a student. My teacher was using Blackboard to give us course information, handbook and the teaching notes. I am doing the same thing, though we don't have Blackboard here so I use email to send this information to students because otherwise I would have to print and copy them and give to students.' (Shaista)

While describing his conception of using ICT to transfer information, another teacher elaborated on his prior exposure of ICT in teaching as being largely about using computers and Multimedia/projectors to make teaching simpler. For him, this meant searching for relevant information online to be included in the lectures, and then to present the learning material to students using Multimedia. Informed by such experiences, he describes his current practices of using ICT to share teaching material:

> 'In my previous job, I was using Multimedia a lot and it helped make my teaching very easy and simple – and its same here too that making use of technology to look for information online, put them on slides and then share them with students later.' (Shabi)

b. **Beliefs as to the pedagogical use of teaching material**

In our analysis, we also found that the way teachers described their pedagogical beliefs in using teaching material was seen to relate to their conception and use of ICT. Participants described using Internet and online search engines to access and download relevant information in preparing their teaching notes/material. However, the participants with an 'information-transmission-focused' conception of ICT use described using their teaching material primarily to *simplify subject-content* for students. With pressures to complete their teaching within semester-timeframes, the lecturers' teaching activities focussed on transmitting concepts relating the topics covered in the module. In addition, these teachers mentioned that emphasis

on in-class students' discussions and debate would be less successful as students were assumed to be passive recipients of information. These assumptions were described as influencing their teaching strategy to share topic-related information with students either by reading it out and/or presenting it using projects and multimedia. One teacher said:

> 'I don't think they are ready for constructivist teaching methodologies where we have discussions and arguments in class. You see students rely on teachers to explain them concepts, they needs us for that – they [students] don't read you know. Also there is usually so much material to cover in a module so my objective is to make sure I finish teaching the topics. I will have my teaching notes ready which I will go through in class and students will copy them down, and sometimes I use PowerPoint slides and projectors too in class to achieve this.' (Niml)

Participants also assumed their students to be dependent on teachers in order to comprehend module-related topics. With this assumption, their teaching focus was on simplifying theoretical concepts so that these could be memorized later by students. One of the teachers described using the Internet, books or other sources to include pictures and diagrams within teaching notes. This was seen as helping to transmit their knowledge and understanding of the concepts.

> 'I clearly tell them when there is this problem you use this theory to solve, when you need to adopt this policy, these are the steps that need to be followed. Then they can easily memorize the steps and theories later. So my teaching focus is to make concepts and theories simple for students. For example what I do for that is I would include flow-charts, pictures, tables, and diagrams in my teaching slides – I look for these on the Internet, books, anywhere. Anything to make it visual and easy for students to understand what I have to say about the topics.' (Ehsan)

c. **Beliefs as to the role of ICT in teaching:**

The way teachers conceptualized the role of technology within teaching practices was another key distinction between more or less complex pedagogical understandings of using ICT. We found in the analysis that the teachers with 'information-transmission-focused' conception of

ICT use also described the role of technology as primarily to *save time* in preparing and presenting teaching material/notes to students. One teacher describes this as follows:

> 'Remember earlier when we used to post letters requesting for journal papers and it would seem ages to arrive. Just look at emails now – saves so much time in sharing and getting information, in contacting colleagues and students about lecture times and topics. Isn't that what technology is for, to open-up time in teaching. I am always looking for new softwares and Apps to get work done quickly [*says this while laughing*]' (Irum)

The participants described feeling pressed for time as they were involved in teaching different modules simultaneously. They particularly highlighted the administration work related to their modules as being rather time-consuming, and perceived ICT use as a way to improve their productivity. One participant said:

> 'There is so much admin work here - calculating student coursework and exams marks, you know the basic statistical work, and recording them. Then there is also coordinating work with other teachers and students about the modules. I find all this work a lot tiring and time consuming. And when you are responsible for two or three modules it becomes worse. With the tight deadlines it becomes stressful to complete things on time. This is when I started using ICT more. A bit of Google for getting latest information but mainly to get done with all the marks calculations and admin work that I use ICT. (Imran)'

4.2. The relationship of *How* aspects (sources of influence) to 'communication-collaboration-knowledge-building' conception of ICT use

In this section, we will argue that the teachers who understand and use ICT for facilitating collaboration and knowledge-building amongst students, had relatively *broad* prior exposure to technology. Furthermore, these teachers described using teaching material as a means of *stimulating social learning* and perceived the role of ICT as a means of *changing teaching strategy* (see Figure 3).

[I*nsert Figure 3 here*]

a. **Prior exposure to technology**

We found that the teachers' previous experiences of using technology within higher education was a key distinction between ITF and CCKB conceptions of ICT use. Our analysis revealed the participants with 'communication-collaboration-knowledge-building' conception of ICT use, described having wider awareness and exposure of the different ways in which technology can be used within teaching. Drawing on their past experiences of using ICT, the teachers focused more on using available technological resources (as limited as they may be) for facilitating discussion with and amongst students, as one participant said:

> 'I really encourage my students to use the Internet. I studied abroad in the UK for 5 years and there we would have these VLEs and our cohort was quite active and lively in debating concepts. When I came back to Pakistan and started my job here, I wanted to do the same thing but this university has no Moodle or such thing, you see. So I want to set up a Google group account for class discussions and sharing information. (Ali)'

Another teacher elaborated prior exposure to technology to shape his conception of ICT use for creating student-focused learning environments (see below). Responding to a current lack of an institutional VLE platform, he also described using alternative available technological facilities for the pedagogical purpose of encouraging student discussions:

> 'When I was studying we had this university online platform, and I had a lecturer who was pretty much into technology and she used to put questions on that platform for us to think about and have a discussion there. Some of us would put up questions for her to respond too. This was good as it helped us understand things better. But here we don't have university online system so I try those google-group emails for class collaborations and discussion. It's not great arrangement but that is what we have got here' (Sarfaraz)

b. **Beliefs as to the pedagogical use of teaching material**

Pedagogical beliefs as to how teaching material is to be used was seen to influence the way the participants used ICT. In our study, there were teachers who described designing teaching activities that aimed to stimulate social learning amongst students. There was emphasis on group discussions and interactions, and their teaching methods carried an expectation that students would review relevant topic-related information and prepare presentations for class discussions. The participants described that this influenced how ICT was brought within the teaching plans, as one participant said:

> 'I will tell my students that what I can say during lectures will be based on what I have read and know. But we can't read everything that is available, right. Then what I do in class is that first half is my lecture on the topic and then in the second half, I will have a student-group make a presentation in class about the topic which is then followed by questions and answers. All this helps expand their thinking and knowledge you see. Now for them to research on the topic I will tell them about the online journals to look and access articles. We have computers and Internet on-campus so they will then have to use them.' (Iqbal)

Another teacher described one of the aims of her teaching as intending to provide opportunities to students in learning collaboratively within online environments. This was in order to facilitate students not only to learn from one another about the teaching material but also to experience different ways they may undertake work within their future organizations. She stated:

> 'You see the way international, also some local companies work now, their work pattern is so different. You might have your IT manager is another country, your colleague in another and you might be working from home – and they all will be working together and learn how to solve the project issues. This is one of the reasons I set-up google email groups as we don't have Moodle or Blackboard like that here – my idea is to use these email groups. This will help them have discussions that will help with learning. It helps them to also to learn how to work together online in the future. (Haji)'

c. **Beliefs as to the role of ICT in teaching**

Teachers' beliefs regarding the role of ICT was another aspect that we found to influence the way teachers integrated technology within their daily teaching practices. In our research, there were some teachers who believed that the role of ICT was to facilitate *changing one's teaching strategy*. These participants reported that using ICT within teaching could influence students' engagement in learning activities and also stimulate higher-level thinking. With students now having access to wider sources of information through the use of ICT, this created an opportunity for teachers to act as facilitators of students' discussion and conceptual development during teaching sessions. One of the teachers said:

> 'You would hardly hear students asking questions and have a discussion. Very few would do that. This psyche needs to change. I have done some reading on this that if there is some kind of balance that teachers and students together discuss and learn that is good for students' thinking. And technology can do that – it motivates them [students] and gets them excited. I am now trying to introduce this in my teaching. Recently I set up a closed Facebook group for the cohort where I am trying to get students to ask questions to one another or myself, share and discuss subject-topics' (Anjum).

From their descriptions, it was apparent that these teachers focused their teaching in ways that encourage students to think independently, to be active learners. They saw their students as co-constructors of knowledge, with sharing of information occurring between students and teachers rather than being unidirectional (i.e. from teachers to students). They perceived their students to be well informed about module-related topics with greater access to information with the use of ICT. Their use of ICT was to facilitate changing their teaching strategy to provide learning environments where students contribute to discussions amongst themselves as well as with teachers. As one participant observed:

> 'I think technology these days can do wonders – it can result in good administration of your teaching and also to change our teaching and adopt new ways of teaching that expand students' thinking, to help them learn how to evaluate and make sense of things. And this is possible because earlier it [teaching] was just one way flow of information because you see students didn't have enough information then. But now students read up and know about things because of technology. So we can change our teaching where

we are also learning from your students. I have done this where it is now more a two-way flow of information between students and with teachers.' (Sajida)

5. Discussion and Conclusion

Research suggests that teachers in Pakistan tend to use ICT predominantly for presenting and transferring lecture material and module-related information, or for administrative purposes (see Farid et al., 2015). In our study we also found that the majority of our participants described using ICT in 'information-transmission-focused' ways. However, there were other participants who while experiencing the same contextual and institutional difficulties, used ICT in 'communication-collaboration-knowledge-building' ways. We used the phenomenographic *what / how* analytical framework to understand why the teachers come to adopt ICT differently. In our analysis, we did not find a pattern relating to the participants' academic position, their associated Faculty, length of teaching experience or gender to account for the different conceptions of ICT use. What appeared to account for the variation in teachers' conceptions of ICT use was their prior exposure to ICT, their beliefs as to technology's role in teaching and the pedagogical use of teaching material. We show this in the Outcome space of this study (see Figure 4) that holistically presents our findings of teachers' collective experience of ICT use.

[*Insert Figure 4 here*]

*** Note relating Figure 4:** Conceptions of ICT use and *what* aspects shown in the figure have been reported earlier in the related paper of the same study (see Hodgson & Shah, 2016)

Our study adds knowledge to the existing phenomenographic literature as teachers' *prior exposure to technology,* and their *beliefs as to role of ICT* and *pedagogical use of teaching material* have not been discussed before as *how* aspects to explain variation in the conceptions of ICT use. Also, these *how* aspects are not only consistent with findings reported in prior studies on ICT adoption within HEIs in Global South contexts but also extend the knowledge

in this literature. While teachers' exposure to and perceptions of ICT's role have been reported before (see Q. A. Qureshi et al., 2011), beliefs about pedagogical use of teaching material which influence the way ICT is used, appear not to have been reported.

Our research also contributes to these studies exploring ICT integration within Global South contexts by adopting a different research perspective of phenomenography and highlighting the second order barriers that appear to be under-appreciated in the literature. As is often suggested in the literature, the assumption is that investments in ICT infrastructure and facilities within HEIs will lead to improved teaching practices (see e.g. Santos Espino, Afonso Suárez, & González-Henríquez, 2020). Based our findings, we challenge this assumption and support the argument that no matter how well established the institutional technological infrastructure, without CCKB conception of ICT use, not all teachers will adopt ICT with the aim for higher-level teaching and learning (see also Atman Uslu & Usluel, 2019; Bayne, 2015). This finding supports the arguments of Taimalu and Luik (2019) who found that 'teachers with more traditional beliefs do not see the use of technology in teaching as useful but teachers with more constructivist beliefs seem more innovative and understand better the value of using technology' (p. 107).

At the beginning of the paper, we asked the question - how do we support university teachers in adopting ICT in more complex pedagogical ways? We respond to the question by offering insights into variation in teachers' pedagogical relationship with ICT use. These insights, we argue, could inform policies and design of ICT pedagogy particularly within Global South settings. This could be useful as, although we have universities investing in developing their technological infrastructures, there are also concerns about lack of effective professional development activities and support available to teachers in using ICT (see Farid et al., 2015).

Based on our findings, we suggest that the designers of teachers' ICT professional development opportunities would benefit by first understanding the relationship between contextual socio-economic and technological problems and teachers' preferred ways of teaching. With the aim of broadening teachers' awareness and exposure to technology within teaching, professional trainers could generate ideas with teachers regarding the use of available ICT facilities in dealing with some of the contextual problems affecting their daily practices. Mueller et al. (2008) assert that contextually relevant experiences with ICT may further contribute to teachers integrating ICT in more complex pedagogical ways. Indeed, we found that teachers' intended pedagogical use of teaching material was one of the key distinctions between more or less complex conceptions of ICT use. The finding supports the assertion that greater attention should be given in encouraging teachers in shifting their emphasis towards pedagogical beliefs rather than focussing primarily on technological issues (Prestridge, 2017; Ertmer et al., 2012). This implies that while aiming to broaden teachers' technological exposure, professional development activities could also aim to facilitate their adoption of teaching strategies that encourage students' collaborative learning and conceptual development. This will be important as the quality of teaching has a direct relationship and influence on quality of student learning (Prosser and Trigwell, 1999). Benefitting from the growing availability and access to the Internet and to smart-phones within Pakistan, the teachers in our study described using relatively less expensive and widely available options (such as Facebook/Google-groups) as alternative arrangements in the absence of having an institutional learning platform such as Moodle or Blackboard. We suggest that facilitators of ICT-related academic development activities could explore with teachers whether social media could be adopted within teaching to deal with some of the contextual challenges. These activities should be aimed to develop student-centred teaching strategies that stimulate students' social learning rather than for just saving time.

The findings reported in the paper, based on research in a particular Pakistani HEI context, problematize some of the assumptions made in the literature and highlight the complexities associated with adopting ICT in pedagogically complex ways in Global South contexts. However we need more research to study the phenomenon in other HEIs. Future research could explore the interconnections amongst the three *how* aspects we identified in the study. In this paper, we described in length the way we used the phenomenographic *what / how* framework in our analysis. It would be interesting to see if other researchers exploring the same phenomenon using this framework may find additional sources of influences (or *how* aspects). This could further inform the design of ICT professional development initiatives aimed at helping university teachers not only to circumvent contextual problems affecting daily teaching practices but also in transforming those practices so as to facilitate higher-level student learning experiences.

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Table 1: Conceptions of ICT use (Hodgson & Shah, 2016 p. 203)

Category of Description	Conception of ICT use	*What* aspects (meanings)	Technological artefacts used
Retaining Attention Professional Skills Development Information Enrichment	Information-transmission focused	using ICT to acquiring and transmitting module related information and/or technical skills to students	Multimedia, Projectors and computers; Internet, online search-engines Profession related end-user computer software programs and applications
Connectivity Omnipotential	Communication-collaboration-knowledge building	using ICT to facilitate students' learning and conceptual understanding and/or for creating student-focused learning environments	online discussions forums e.g. Google-group & Facebook; mobile and radio technology and other technical/ research equipment

Figure 1: Diagram of the analytical *what / how* framework in the context of the study

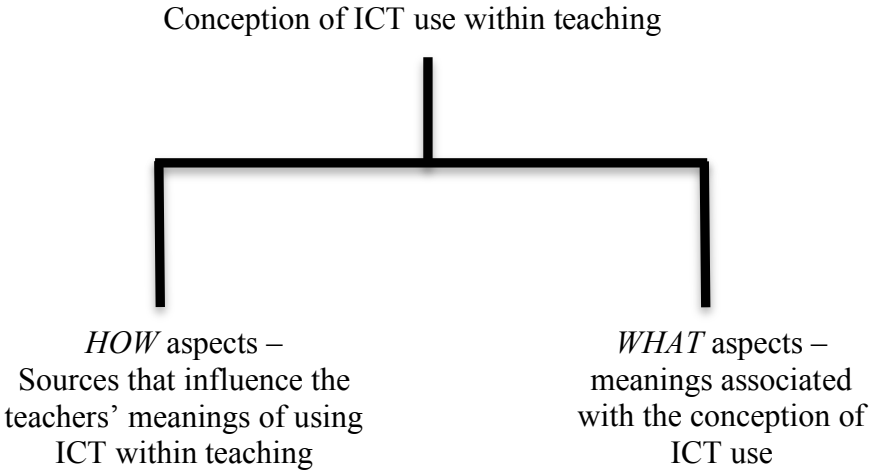

Figure 2: *How aspects* and information-transmission-focused (ITF) conception of ICT use in teaching

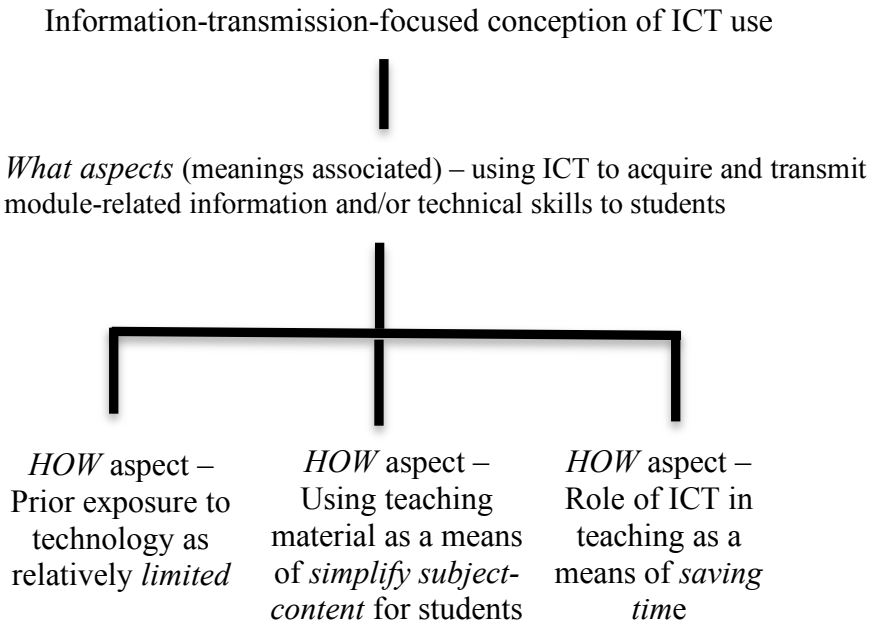

Figure 3: *How aspects* and *'*Communication-collaboration-knowledge-building' conception of ICT use in teaching

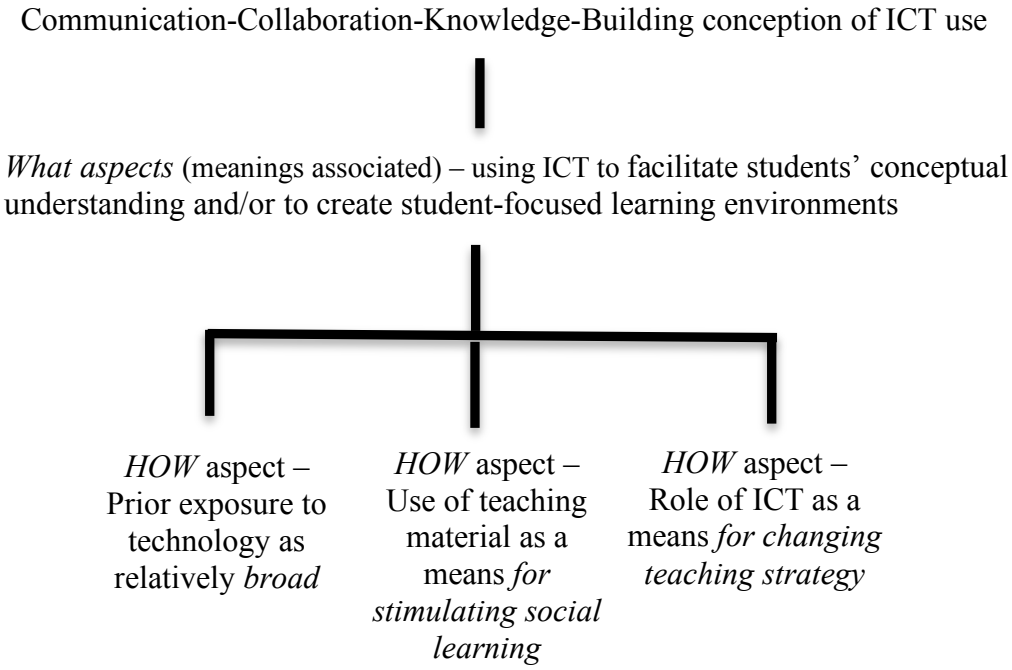

Figure 4: Outcome Space of the study

Category of description*	**Underpinning conception of ICT use***	**Sources of Influence (*How* aspects)**		
		Prior Exposure to technology	Pedagogical use of teaching material	Role of ICT in teaching
A. Retaining Attention B. Professional Skills Development C. Information Enrichment	Information-transmission focused *what* aspects - using ICT to acquiring and transmitting module related information and/or technical skills to students	Limited	For simplifying subject-content	To save time in preparing and transferring teaching material
D. Connectivity E. Omnipotential	Communication-collaboration-knowledge building *what* aspects - using ICT to facilitate students' conceptual understanding and/or for creating student-focused learning environments	Broad	For stimulating social learning	For changing teaching strategy