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Guidelines for practice

Reconstructing the Roles of Information and Communication Technologies in Doctoral Research Processes

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Introduction

Information communication technologies (ICT) have long been important in supporting doctoral study. But while ICTs are prominent in educational practices at most levels of formal learning, there is relatively little known about the skills and understandings that underlie their effective and efficient use in research higher degree settings.

From our work in academic development and doctoral supervision, we have encountered both staff and students talking about their experiences of using information and communication technologies (ICTs). Often, for many of them, ICTs can bring either joy or challenge to their well-versed academic practices, and either create barriers to their learning and development or be the answer to their needs. While some grasp and pursue opportunities to make use of various ICTs for study, research and teaching, others struggle.

Despite documented and anecdotal positive and enthusiastic urges to adopt ICTs to reap benefits for increasing and improving efficiency and effectiveness of academic work, staff and students who struggle experience ICTs as needless interruptions to their work and learning, and difficult to learn and use. There is often little need seen to change practices by introducing ICTs into their ways of working.

Being empathetic to the views such as those expressed by Castañeda and Selwyn (2018), we did not approach these encounters with staff and student experiences from a stance that assumes that ICTs are the natural and needed solution to problems related to improving and facilitating effective learning, teaching and research. Rather, we took a more neutral stance, wishing to explore the experiences of those involved, namely, students and staff, through discussion with them about their practices and views, and with a specific focus on doctoral study and supervision.

This study revealed tensions and debates where ICTs in doctoral research process are concerned. The findings raise questions for discussion with respect to the nature of doctoral education and the explicit roles that ICTs do, and could, play in supporting and enhancing doctoral research processes. These provide the bases for developing practical approaches to information and training provision for supervisors and doctoral students to encourage reconceptualising how ICTs are viewed in relation to doctoral study.

Depending on the perceptions held about ICTs and the relationship between ICTs and the person in the context of the task and its goals (i.e., the doctoral study) as depicted in the key findings, ICTs tend to be seen as a challenge, a change or an opportunity in doctoral research processes.

Research Overview

This project aimed to identify doctoral students' perceptions of using ICTs within their research work. Focus was not on the specialist technologies that students might use within certain discipline and research contexts. Rather, it was on the range of commonly used ICTs – such as word processing, data management, organisational and project software and applications – and perceptions of how those ICTs were adopted within doctoral study processes. Data were gathered through participative drawing and individual discussion sessions. Participants included eleven students along with two supervisors from two New Zealand universities to provide an opportunity for some comparison with those people with whom students work closely. Focus of the thematic analysis was on the views expressed by students in their drawings and in discussion about their ideas, practices and beliefs, in relation to the drawings they made. Similar analysis processes were applied to data gathered from supervisors, with findings from the supervisors' data being used to reflect on and discuss students' views.

Findings

The major findings are captured in the following statement, which serves as a reminder about general human behaviour rather than a completely new or unknown insight.

Individuals hold assumptions about and expectations of ICTs use; and they make judgements and act based on those expectations and assumptions.

Evidence from the study highlighted the relationships that individuals have with ICTs and their research work and goals. The findings are presented in the form of two perceptions, illustrated by examples from the data and characterised through the nature of the relationships between and among students, ICTs and doctoral research work.

Perception-1

Some doctoral students perceive that it does not matter how ICTs are used, the endpoint, that is, thesis completion, justifies whatever ways are used. In other words, ICTs are viewed as a means to an end. ICTs are seen to exist in order to support the completion of the thesis in ways that suit the individual student.

Relationships

- *ICTs and people are perceived as separate and separated entities.*
- *ICTs and individuals work alongside each other.*

Perception-2

Some doctoral students view ICTs as tools or mechanisms that prompt active thoughts on practices with respect to planning and managing thesis writing and project execution. For such students, decision-making features prominently in which, how and why they incorporated ICTs into the doctoral research practices.

Relationships

- *ICTs and the person are in a complementary partnership.*
- *ICTs and the person are intricately linked through multiple active, practical, goal-oriented connections.*

Implications for practice

Building on these bases, the following statement proposes a conceptualisation of ICTs as they relate to the doctoral research process.

ICTs are not neutral: There is a two-way interaction between technologies as artefacts (ICTs) and the use of them to achieve ends (doctoral research).

This means that knowing about ICTs and knowing about the research process separately form only part of the work of doctoral study. Just as supervision cannot be considered independently of the research project and the student involved, ICTs skills and the use of ICTs cannot be considered in the absence of the people and the project. What is more important in terms of facilitating the doctoral research process is students getting their "flow" right. This points to the need for professional development and support for students could be beneficial if it incorporates explicitly on enabling students to embed ICTs consciously and deliberately within their research process in ways that suit their personal, discipline and specific research project.

Key Findings from the Research

Participants' perceptions that emerged through exploration of their thoughts, practices and behaviours while engaged in interview/discussions and drawing activities provided illustrations that support the claims. Relationships between people and ICTs are the focus of the findings as they relate to both specific and broad areas of concern, and highlight participants' perceptions about the roles, places and uses of ICTs within the context of doctoral study. Appropriately labelled quotations from the interviews/discussions are used to illustrate the relationships.

Relationship-1: *ICTs are impartial tools. It does not matter how ICT are used, because the end-point, that is, thesis completion, is the justification.*

> *"So long as it's formatted – it shouldn't matter - that's their [editors'] responsibility, not mine."*

For many participants, to be motivated to learn about a new ICT needed to have a purpose that sharply focussed on achieving that end.

> *"... I don't want to go down a rabbit hole. I don't want to be distracted. So sometimes things that work for you, just work for you."*

On the other hand, effort is expended on ICT-related processes if there is certainly about how the ICT is working and surety about the result. For example,

> *"Because I have my own system... it's quite tedious but I get to see it clearly compared to having it done all automatic. You don't really know what's happening in some parts. This one I get to see clearly so I know this is my work. I know I'm not plagiarizing even though there are some typos there and stuff. I know it's clear and I'm not becoming lazy and just by copy pasting... because I have to really do it manually to transfer everything."*

This view of the 'end justifies the means' was, according to this student, reflecting the stance taken by their supervisors:

> *"[My supervisors] show no inclination whatsoever to have a look at [how I am doing it] at all. Because their view of things is that it's worth it, if I produce in terms of potential publishable, reputable material in the thesis."*

At the same time, our data from the supervisors' side reflected this too,

> *"Generally, people think the standard of the people getting or earning a PhD is that this person should be an independent researcher. After all, we only examine a particular thesis [and] there are lots of inputs from supports and supervision from supervisors.*

In summary, ICTs are framed as necessary but also fraught, especially due to the effort and time that draw attention away from the primary goal. In this relationship, ICTs are viewed as a means to an end.

ICTs and people are perceived as separate and separated entities.

Relationship-2: *ICTs are tools or mechanisms that prompt active thought on practices with respect to planning and managing thesis writing and project execution.*

Views that expressed notions of there being a close interaction and collaborating relationship came through in a number of the discussions with the participants.

> *"Sometimes I just like playing with stuff to see what they can do and then if they tick my boxes then I keep them and if they don't, I move on. So it's more kind of search and discover than kind of looking for something, you know... I might have an idea that I wanted an app that does something but I sometimes just see something I'm like, ooh I want what that does and just have a play with it and see if it's good."*

There was a sense expressed in comments that there will be a way to manage the "problem" that needed to be solved, which then generated the necessary motivation to engage effort. For example,

> *"You just what you know when you start off; when you're unsure about what you need to do. There's a bit of a barrier in front of you. It feels a bit intimidating and overwhelming, and then you get into it and it just works. And you just kind of put all the pieces together and get something out at the end."*

Making judgements, weighing up negatives and positives, examining and exploring possibilities and limitations were all features of comments that contributed to the development of relationship-2.

> "*I'm very good with Excel ...So I started holding my qualitative information in NVivo and then it became confusing because NVivo would have so many clicks. So I said you know what? Everything would be easier if I just use Excel and put everything there and have my own system."*

Sometimes, it appears that the supervisors' perspectives of ICTs might support this perception. For instance,

> *"[ICTs are] integral to everything now – there's no such thing as doing it without anymore – these are the tools with which we do all the things we do ..."*

In summary, this relationship thus captures the views of students who engage actively in making decisions about which, how and why they incorporated ICTs into the doctoral research practices.

ICTs and individuals work alongside each other.

Relationship-3: *Knowing about ICTs is only part of the thinking. What is more important is getting the "flow" right.*

A number of students described the challenges to bring everything together into one big process made up of many parts, sections and subsections, which is the "workflow".

> *"What systems do I use, what's my workflow? So I actually spent some weeks looking at ... getting ideas from other PhD students about their workflows and how they manage it."*

Further, students talked about how hard they had worked to set up routines and processes to enable them to manage time and their research projects.

"If you kind of understand what your own learning needs are, and what your own organisational needs are, then you are looking for certain attributes within apps and programmes and stuff so you are looking for the system that meets that need rather than taking a system and trying to squeeze yourself into it....but you have got to understand how you work and what is natural for you, so you are not fighting against yourself all the time"

These comments suggest a meta-cognitive level of thinking (Flavell, 1979), where self-regulation and control are important with respect to thinking, time usage, and management of the research project in the context of the capacity of the individual. For example,

"So this is really all about how I organize and how I think and what do I need across the whole time. And some of this may change but I think these are the tools that I would use for the whole time. And it's better to have, in my view, two or three that you rely on and you are confident with because the transaction cost of learning can be quite high and you can lose the very thing that you wanted to capture by doing it."

There was a hint that at least one of the supervisors saw the need for a workflow in this same vein.

"So long as [the students are] happy with what they're using – they should use 'a' system"

In summary, this relationship is about students actively seeking to understand the whole picture of their doctoral study in which a number of elements feature, one of which is themselves and one of which is ICTs.

ICTs and the person are in a complementary partnership.

Relationship-4: *ICTs are not neutral. There is a two-way interaction between technologies as artefacts and the use of them to achieve ends.*

This relationship draws attention to the nature of technology as a phenomenon; that it is not an impartial tool that has no influence on the way humans act and react. On what could be argued as a superficial level, this student noted some active connection between the person and the software application, beyond simple use, when he commented:

"I think it goes both ways, the product has to be intuitive and you've got to have a little bit of inclination to try out different things."

Others went beyond the superficial to describe more in-depth relationships between themselves and the ICT they were using.

"*... instead of being overwhelmed by the whole PhD ... instead of listing in terms of projects, I started to think of it terms of what do I have to do this week. I'll feel really happy if I can get that week's "bucket" emptied ... [Using the application] really changed the way I started to think about it. I started to be less worried about the big overwhelming long term stuff that was out there and just think, okay, this week, what am I going to do this week, how am I going to be really efficient and targeted, and I think that really helped me."*

Another example of how the ICT helped solve a problem and at the same time had an influence on the way the person behaved, in this instance with organising notes, ideas and document.

> *"... and it's the same with my note-taking because [the programme] that I use has a similar sort of functionality that it can search text that you've written but also search notes and PDF docs and those kind of things, so it means that when you've had a random thought and put it somewhere you can find it again. Which is huge for me, so I guess that ... the power of the search engine is probably the thing that drove me to become paperless so it helps me to organize myself much better. I'm not great at organizing paper. When I say I have no paper, my desk is full of paper that I haven't filed but none of it's related to my research really, so filing paper is a skill that I have not mastered whereas filing digital stuff is not as important because you can always just find it again so you can kind of just pop it in anywhere and you've kind of got it forever, so just... that, that I think is the driver for going paperless, really... that searchability and organization of stuff."*

Similarly, one supervisor identified ICTs as a complementary tool in doctoral research process:

> *"I think a nice technology would be nice templates for articles and theses – they are templates - I could probably build them into my system but I just never have... Word, I'm quite happy using ... I wouldn't mind going to learn another statistical system but SPSS works fine ..."*

In summary, relationship-4 describes a deep and entwined relationship between people and ICTs that verges on the symbiotic.

ICTs and the person are intricately linked through multiple active, practical, goal-oriented connections.

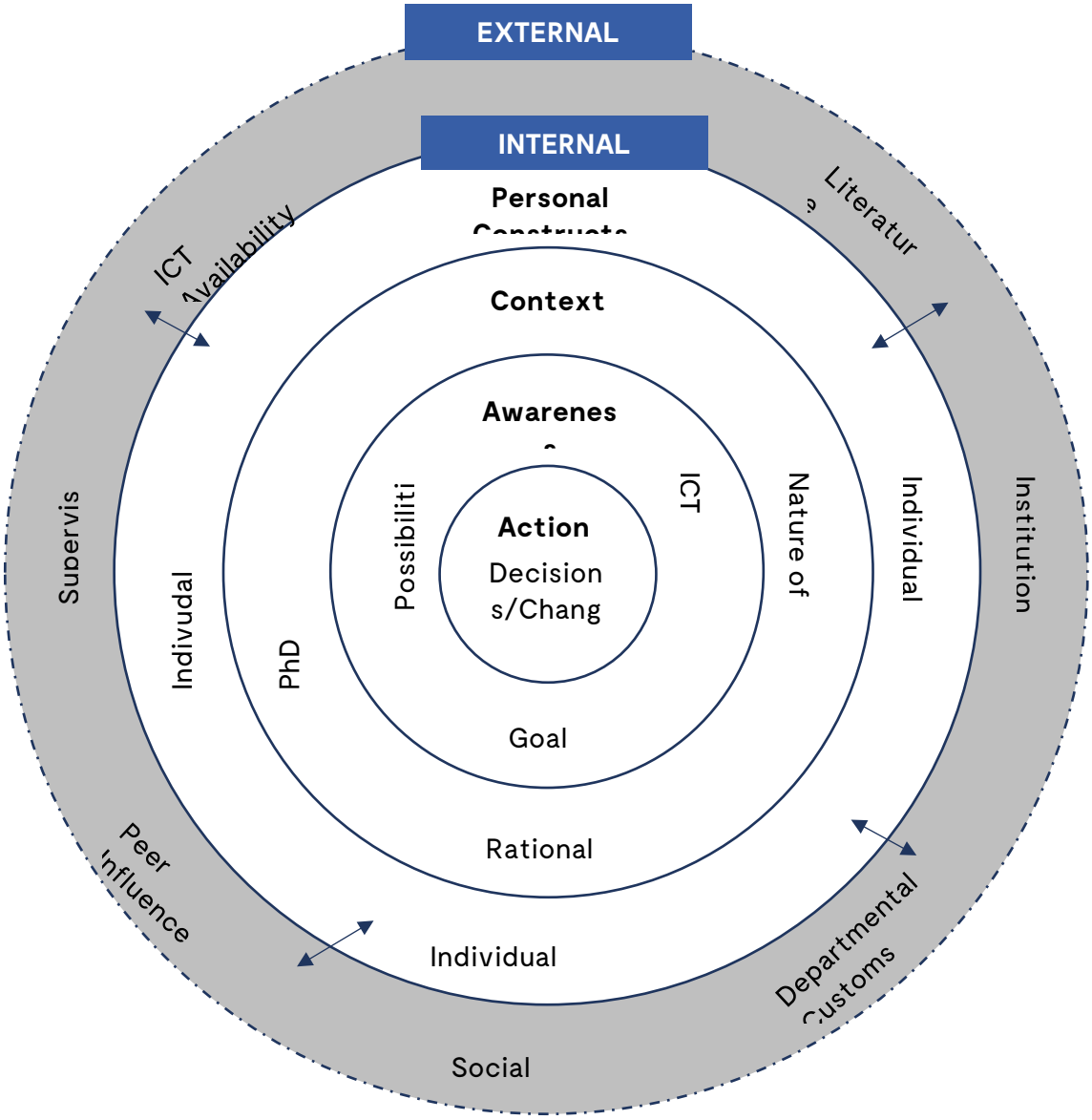
Relationships 1 and 2 highlight that individuals hold assumptions about, and have expectations of, ICT use; and those expectations and assumptions influence and determine their judgements about ICTs and their use of ICTs. The relationships point to connections between perceptions and practices. *Relationship 1* describes a perception that ICTs are separate from the person and the task-at-hand, while *Relationship 2* presents a perception in which the person and the ICTs are working alongside each other in harmony or at least in a partnership. Both relationships focus on end-points, but the end-points vary according to the perception of where ICTs fit into the journey towards their achievement. For Relationship-1 type expressions, there is one major end-point. For *Relationship 2*-type expressions, there are multiple, shorter-term endpoints that build towards achieving the major goal of completing the thesis.

Building on *Relationships 1 and 2* are *Relationships 3 and 4*, which highlight what may be argued as more complex levels of perceiving and working with ICTs within the doctoral research process. Both relationships give some focus to inter-connections, where people and ICTs partner or collaborate. *Relationship 3* depicts a perception that is about complementarity; where ICT affordances are seen as worthwhile when they support and enhance the work of the individual in ways that make sense to that individual. *Relationship 4* builds on the *Relationship 3* perception by bringing to light the relationship in which the person alters and changes thinking or practices because of

the influence that ICTs affordances can have. No evidence was found to support a possible additional claim that as well as ICTs causing individuals to alter and modify thinking and behaviours due to their existence, ICTs, in turn, are perceived to be able to alter their ways of responding to the people who use them. This is not out of the realms of possibility of course, with ICTs increasingly being designed and built to be able to respond to users' needs.

The following model maps the relationships amongst students, the doctoral study, and other human and contextual factors that have an influencing and determining impact on the perceptions that doctoral students hold about ICTs and their research study work.

Model of ICT-People Relationships



Recommendations for Practice and Change

The four relationships (*Relationships 1 to 4* described above) illustrated in the Model can be used to provide some guidance to those supporting and participating in doctoral research processes. The model has bases in ideas drawn from Bronfenbrenner's models of ecological systems., which frames interconnections between and among the individual and the systems and subsystems within which that individual exists and grows (Bronfenbrenner (1979).

Students and supervisors do possess a vast array of skills, knowledge and abilities. They have a variety of experiences as well as varying reasons and levels of motivation for being involved in a doctoral research process. Their skills and capacity to make use of ICTs to support their roles in the research process vary as well. The relationships that have emerged from this study will inform the planning for support activities to enhance supervisors' and students' professional development, whatever their background and needs.

For institutions

In order to achieve a shared sense of ICT use, institutions could articulate a vision about the role of ICTs and ensure that the vision is communicated clearly and embedded in institutional practices. This may include the need for supervisors and students to focus on a process of undertaking doctoral research as well as the outcome of the process; one that integrates ICTS within the core research process.

a) Recast the commonly expressed assumption about the doctoral research process - which does not include the role that ICTs play - to embed ICTs within it and seek the possibilities of ICTs affordances in the doctoral research process.
b) Not focus only on the research outputs but realise that the research process is as much about how it happens as what happens.
c) Emphasise that learning is accompanied by risk to quality, efficiency and effectiveness of the doctoral research process as it does not mean one has to remain their practices without any change even if they think there is no reason to change.

For generic doctoral processes

Address the barriers to effective and efficient ICTs use to not only support and facilitate the doctoral research process, but also to improve and enhance it.

a. Academic departments in the various disciplines could run workshops/seminars on ICT use for research practices.
b. Include plenty of project management, scheduling etc. processes, techniques and strategies in how to work out one's own "flow"; highlighting how to critique ICTs in the light of personal and project needs and requirements.
c. Highlight the link between ICTs and practices: using ICTs can enhance or raise ideas that were never thought of before.

For supervisors

Include (explicit) responsibilities for supervisors to guide doctoral students in making the most efficient and effective use of ICTs in their doctoral research practices.

a) Look beyond their own experiences and promote ICT use actively in their day-to-day research practices so that their students can optimise the use of ICT.

b) Bolster doctoral students' positive thinking about ICT use or even take the initiative to introduce research-related software to their students without any prior assumption or expectation during supervision; learn alongside students.
c) Encourage and support openness and flexibility in thinking about making use of ICTs to improve effectiveness and efficiency.

For doctoral students

Be proactive by taking up opportunities (individual and with others including fellow students and supervisors) to learn using various ICTs effectively and efficiently during the doctoral research process whilst not neglecting the outcome, which is the completion of the project and production of the thesis.

a) Spend time reflecting on their ICT-research project practices in order to raise to consciousness their assumptions and perceptions about their relationships with ICTs and their research project.
b) Be open to possibilities; and understand that change to embedded practices does take time and effort.
c) Learn what it means to thinking technologically, as well as making use of ICTs as a neutral tool to achieve an end.
d) Embed ICTs into practices to explore how ICTs can aid and facilitate their personal "flow" (systematised organisation, thinking, and action), in order to achieve project and thesis goals.

For ICT support

a) Provide explicit opportunities for students to reflect on their personal study and research work preferences and tendencies, including their perceptions about ICTs and hoe those assumptions and perceptions affect their practices.
b) Workshops and other forms of training and education opportunities should cast doctoral research work as necessarily including project management, scheduling processes, techniques and strategies with a view to supporting students in how to work out their own "flow" using ICTs.
c) Include (explicit) responsibilities about the thinking and planning skills with respect to making the best use of ICTs to ensure efficiency and effectiveness.
d) Reflect on the meaning of effectiveness and efficiency and what they mean in terms of the doctoral candidature and undertaking a research project; and along with that the effects of the use of ICTs to support and facilitate the process.
e) Avoid assuming that doctoral students will work the research process out for themselves.

Conclusion

As Castañeda and Selwyn (2018) argued, it is important that we have an active commitment to 'think otherwise' about how ICTs might be better implemented across higher education settings" (p. 8). We should not assume that ICTs are not important enough to make assumptions about, not let them fade into the background as they become normalised without questioning the interrelationships that are happening between the person and the ICTs. In the doctoral research setting, as one example of a higher education context, ICTs do have a role to play. They cannot and should not be ignored. But seeing ICTs in relationship to the person and to the setting is essential.

Doctoral education that takes this perspective into account may result in more informed supervisors and doctoral students about the way ICTs, humans and research practices are embedded and entwined. Concurrently, just as Kandiko and Kinchin (2012) argue that supervision cannot be looked at in the absence of the research work that it occurs within, we argue that doctoral students' understanding and use of ICTs cannot be considered independently of the work that they are involved in; and that work includes their relationships with their project, their supervisors, with the ICTs they do and could engage with and within the context of the institution.

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