

12-2013

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Recommended Citation

Zhang, Jingjing (2013) "The Nature of Distributed Research: Narratives of Shifting Experience," *Journal of Educational Technology Development and Exchange (JETDE)*: Vol. 6 : Iss. 1 , Article 5.

DOI: 10.18785/jetde.0601.04

Available at: <http://aquila.usm.edu/jetde/vol6/iss1/5>

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The Nature of Distributed Research: Narratives of Shifting Experience

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Abstract: *Distributed work over geographical distance is not new, but this century has witnessed a rapid extension of this kind of work (Juan, Daradoumis, Roca, Grasman, & Faulin, 2012). In academia, it seems that the use of many technologies has inevitably led to an increasing trend of distributed research. In an attempt to explore this phenomenon, a qualitative study involving 24 senior researchers was conducted, and their lived and told stories illustrated that they worked together privately and publicly, informally and formally, with a high degree of reciprocity and with written records of their discourse. All forms of research activities, mediated or not, can be seen together as varied combinations of proximity and distribution. In the digital age, it is not technology that enables distributed research. Instead, trust and a willingness to work together are the keys to interdisciplinary work undertaken at a distance. Discovered in this study is a new type of trust, namely distributed trust, which has emerged in distributed research. With distributed trust that is a prerequisite for generating mediated dialogue conducive to research exchange is more likely to be developed in mediated dialogue at a distance in modern research.*

Keywords: distributed research, trust, personal relationship, academia

1. Introduction

Distributed work over geographical distance is not new, but this century has witnessed a rapid extension of this kind of work (Juan et al., 2012). In academia, it seems that the use of many technologies has inevitably led to an increasing trend of distributed research. In an attempt to explore this phenomenon, a qualitative research was conducted at the University of Oxford, involving semi-structured interviews with 24 senior researchers from three divisions: science, social sciences, and the humanities.

The findings of this qualitative research showed that all forms of research activities, mediated or not, can be seen together as varied combinations of proximity and distribution. In the digital age, it is not technology that enables distributed research. Instead, trust and a willingness to work together are the keys to interdisciplinary work undertaken at a distance. This echoes what Thompson (2003) once stated that, in a loose network setting, research practice is more dependent upon trust and accord than on rules and orders, and offers an alternative means for productive work. In the literature, for some distributed

research, the issues of trust and accord are seen as fundamental to the success of such interdisciplinary research. Nevertheless, trust identified in this study differs from the traditional trust commonly discussed in the literature. Discovered in this study is a new type of trust, namely distributed trust, which has increasingly emerged in distributed research. With distributed trust that is a prerequisite for generating mediated dialogue conducive to research exchange is more likely to be developed in mediated dialogue at a distance in modern research.

In modern research, the research structures can be seen as concentrations of research that tie across traditional boundaries of time and distance. Doing research, or more specifically interdisciplinary research, leads to dynamically embedded interactions with a range of academics and further ensures the formation of research networks connecting scholars from different backgrounds. In the literature, Wellman also argued that old-fashioned research environments have moved away from being “hierarchically arranged,” “densely knit,” and “bounded groups” to network settings (Wellman, 2001). They no longer fit the group model, which is small and clearly bounded. In networked societies, “boundaries are more permeable, interactions are with diverse others, linkages switch between multiple networks, and hierarchies are flatter and more recursive” (Wellman, 2001, p. 33). In this study, such emerging networks of research are largely interdisciplinary, distributed, and interconnected, and it is argued that research networks of this kind are conducive to academic progress.

2. Research Background

The use of many technologies has been regarded as one of the key factors that encourages and enables an increasing

geographic distribution of work (Anandarajan & Anandarajan, 2010; Hinds & Kiesler, 2002). Friedman (2007) mentions that, “It is now possible for more people than ever to collaborate and compete in real time with more other people on more different kinds of work from more different corners of the planet and on a more equal footing than at any previous time in the history of the world” (p. 8) in regards to interdisciplinary research at a global level.

In academia, it has also been increasingly common for geographically dispersed researchers to work together (Haythornthwaite, Lunsford, Bowker, & Bruce, 2006; Phillips, Kristiansen, Vehviläinen, & Gunnarsson, 2013). In the old days of academia, physical distance not only reduced the likelihood of distributed collaboration (mainly among scientists), but also had a negative impact on possible distributed work (Cummings & Kiesler, 2005; Kraut, Egido, & Galegher, 1990), as communication at a distance used to be very costly and slow (Borgman, 2007).

Today, in contrast, advances in technology have made distributed research feasible, as new technologies allow researchers to exchange information and resources more frequently and rapidly (Anandarajan & Anandarajan, 2010; Sonnenwald, 2003). As Atkins (2003) notes, “New technology-mediated, distributed work environments are emerging to relax constraints of distance and time” (p. 9). When network technology is widely used in this digitalized world, people are “unlocked from the shackles of fixed and rigid schedules, from physical limitations” (Salmon, 2003, p. 11). Thus, advanced network technologies are allowing researchers to share ideas and expertise across distance and time.

These new issues arising in distributed research have gained considerable attention in

scholarly debate. A large number of researchers (e.g., Armstrong & Cole, 2002; Juan et al., 2012; Schunn, Crowley, & Okada, 2002) have focused their research on the distributed work that is made possible by technological advances. Many of them (e.g., Kraut et al., 1990; Liang, Moreland, & Argote, 1995) tended to study remote research collaborations that heavily relied upon technology in a distributed work environment. Cummings and Kiesler (2005) conducted a study of 62 scientific collaborations in 1998 and 1999, supported by a programme of the United States National Science Foundation, with a focus on the structure of such collaborations facilitated by technology at a distance. Moon and Sproull (2002) investigated an online work group whose members rarely met if ever. It seems that these studies were often carried on the assumption that most of academic research today was conducted at a distance. Their studies seemed to imply that technology revolutionized the way scholars organize their research work and that academics working in the same office had already become an idea of the past.

Very few studies took a broader approach to study how distributed research may be occurring as part of the real-world research environment. For those who looked at both distributive work and collocated work, it seems that they made an explicit distinction between face-to-face communication and communication at a distance in their research. For example, Nardi and Whittaker (2002), in an ethnographic study, studied the place of face-to-face communication in distributed work. These studies shed little light on how distributed work fits into the main collocated research environments (Cummings & Kiesler, 2007).

In the real world of research, researchers constantly engage in varied research activities in multiple research contexts, neither exclusively at a distance nor just face-to-

face. For instance, some research requires intimate interactions, which often occur opportunistically in collocated groups, but may be difficult to generate in distributed groups (Nomura et al., 2008). These studies perhaps implied the importance of studying the use of technology in natural research settings. Research into distributed research should not be taken out of the real-world research contexts that it takes place within. The focus of research into technology use should neither be constrained by a purely distributed work environment nor excluded from what is happening at a distance.

3. Research Design

A qualitative design was adopted in this study, privileging the lived experience of researchers as well as their accounts of research and technology. The qualitative design consists of 24 semi-structured interviews based at the University of Oxford. The University of Oxford is the research site for the study, because this university, as one of the largest UK (United Kingdom) research universities, is world-renowned for the quality and diversity of its research. Indeed, according to the University's own literature, "(t)he University's position as a centre of excellence is enhanced by the on-going development of interdisciplinary research centres, and collaboration with international academics and industrial partners" (Oxford, 2008).

Academics identified as experienced researchers in each department or faculty at the University of Oxford were approached to participate in interviews. Experienced researchers associated with a range of different departments at the University of Oxford constituted the population chosen for this study. This choice was made for two main reasons. First, a pilot study (see Zhang, 2008) revealed that experienced researchers

were likely to share their ideas and thoughts about research development by providing a fuller picture of their academic careers, while early career researchers tended to report their work with others using very specific cases from their work experience, and perhaps raised more questions about research in general than they could answer. Second, a wide range of disciplines was desirable, as the pilot study demonstrated that the nature of different academic disciplines influenced the processes of higher education research. In particular, disciplinary cultures played a key role in differentiating research activities, as well as the ways in which researchers interacted with each other. Understanding practices related to specific disciplines thus appeared to be crucially important for gaining an understanding of academic professionalism in this study.

In total, 24 experienced researchers working in different research fields from three divisions – science, social sciences, and the humanities – constituted the sample. Of these 24 senior researchers, only five were women, but this was a fair representation because HESA data (HESA, 2009) showed that only 19 percent of professors in higher education institutions were female in 2007/08. The 24 research fields were: humanities, cognitive science, accelerator science, particle physics, social work, law, social anthropology, biology, mathematical biology, engineering, archaeology, physiology, international relations, politics, geography, geology, computer science, computational science, economics, comparative politics and societies, social policy, applied biology, European studies, and refugee studies. Identifying the fields was needed to help the reader obtain a better understanding of the interviewees and what they talked about in the interviews, but the study maintained anonymity as not to reveal

the identity of participants. Thus, these field names above have been changed in a way that they reveal some information about the participants' field, but not enough to mean they can be seen to represent any particular department at the University of Oxford.

Individual interviews were conducted with 24 experienced researchers (approximately 60 minutes). Thirteen of them were interviewed for a second time (approximately 30 minutes) because of the need for more detailed questioning regarding their particular research experience and the necessity for relating their thoughts to others. The semi-structured interviews were conducted with participants, as the semi-structured interview format allowed the researcher to probe participants at length regarding their ideas and thoughts on key issues most relevant to the research questions. To a large degree, semi-structured interviewing receives “a more considered response than closed questions and therefore provides better access to interviewees' views, interpretations of events, understandings, experiences and opinions” (Seale, 2004, p. 182). During the interviews, senior researchers were encouraged to reflect upon certain aspects of their research experiences, their views of what had happened in research, and their vision of the future.

4. Findings

4.1. Collocated Work and Distributed Work

Interview participants reported that many aspects of their research work are facilitated by network technology. In most cases, network technology is used for enabling distributed work. With the new communication channels mediated by network technology, face-to-face contact seems to no longer be indispensable for many aspects of research work as one professor mentions, “(i)n the age of emails,

computer networks, I am sure it's perfectly possible" (female, politics). As a consequence, a large volume of people's research is now conducted at a distance.

Nevertheless, in some cases, the use of network technologies has led to an increase in distributed work as well as in face-to-face encounters. The faculty of computer science illustrated this point by saying that, while much of his distributed research was conducted via mediated communication across the globe, he actually travelled to meet research partners more often than he did a decade ago. When he adopted varied network technologies to facilitate his distributed work, he was not expecting an increased number of frequent trips across the globe. He later found that he was able to learn about more opportunities to travel via new communication channels mediated by network technologies such as email, mailing lists, and the Web:

Electronic communication is obviously a lot better now than it was ten or twenty years ago, but I also travel a lot more than I did ten or twenty years ago. Maybe they are just sort of accidental things happening together, but maybe the fact that I have better electronic communication means that I learn about more opportunities to go and visit people. So, I also get on plane more often than I would without electronic communication. (male, computer science)

It is found that, in distributed work, some participants themselves are actually seeking the opportunity to engage in face-to-face interaction. In the case of a faculty member of social anthropology, although network technologies such as email and the Web are frequently (usually on a daily basis) used to facilitate communication between her and her research collaborators, she is also committed to visiting them on a regular basis:

I organise workshops every year with all five teams together in one place. Every six months, I go to each member of the team and work with them individually, at six monthly intervals. (female, social anthropology)

Similarly, in the case of the professor of accelerator science, he once initiated a large collaborative research project which involved academics mainly from the UK and the United States (US). He, speaking from his experience, pointed out the importance of meeting the US team before they started to work on the project. For example, "the first thing I did on appointing them was to fly them to the UK to meet my people" (male, accelerator science).

Actually, the use of different mediated communications and face-to-face communication is increasingly integrated. Some participants play creatively with ideas in asynchronous informal email exchanges more often. Of course, many of these abstract discussions in email (or perhaps in other formats) can lead to a misunderstanding about the real value of knowing what they know. Subsequently, they continue to fuel the discussion in the same format or perhaps seek to create new dialogue in an alternative format, which can potentially address issues better. Face-to-face discussions therefore, sometimes follow email conversations. In this sense, mediated communication in the written form to some extent aids follow-up simultaneous communication in which intellectual exchange might occur. In some other circumstances, academics send each other articles after they have had a face-to-face meeting. This, to some extent, extends the on-going dialogue between scholars and blends mediated dialogue into other daily research activities.

These examples, as well as other similar stories collected from the interviews show that network technology has made distributed

research possible. Nevertheless, in such work, participants are actively seeking opportunities to engage themselves in face-to-face interactions. Most of their real-world research has actually involved a mix of collocated work and distributed work.

4.2. Informality of Mediated Communication

Several participants explicitly pointed out that they sometimes used mediated communication in an informal way. The professor of computational science often uses email as a communication means to learn about another's work. The professor of applied mathematics also commented that they used a blog as an informal platform where they could easily pull-up their maths problems. He found blogging works effectively in terms of collectively solving maths problems within a study group:

The most recent example of that was at the last study group in the UK... They put the problems up, they had a blog effectively on each problem. And so a network formed immediately around the problems, electronically. (male, applied mathematics)

The professor of social policy also commented that email conversations tend to be fairly informal, as illustrated by his account, "You move from formal letters into much more casual writing" (male, social policy). Nevertheless, he further indicated that as "(y)ou hit the send button before you think," some of his informal email potentially created misunderstanding, both culturally and conceptually in terms of expectations and achievements.

Interestingly, the interview accounts show that, in talking of informal mediated communication, participants sometimes addressed this as an important feature of

mediated communication, but most of the time they criticized the problems induced by this informality. In contrast, the majority of participants expressed a positive belief in the importance of informal conversation in person. They talked about many different forms of face-to-face academic dialogue, and see its informality as the key to evoking intellectual exchange. In talking of this informality, they rarely made reference to the potential problems that it might engender. The professor of cognitive science, for example, talked about his informal weekly meetings as one example of academic dialogue in which intellectual exchange occurred:

We have weekly meetings where anyone can put a problem on the table and say, 'I'm trying to solve this and I'm getting stuck on this issue.' And so we will try as a group to solve it and we are learning from each other all the time through that process. Not only if I put a problem on the table – of course I learn from people's solutions or proposed solutions – but when I'm helping to solve someone else's problem. I'm learning both from the person explaining the problem but I'm learning from the contributions of my colleagues. So it's a constant learning process. (male, cognitive science)

The professor of the humanities stated that he received rich intellectual stimulus from informal conversations with a colleague in a café:

I get invitations to conferences to speak. I turn down many more invitations to speak than I accept... I am willing to kind of put myself out to make an effort to make sure that I see her ... intellectually I get more stimulus from an hour of our kind of informal conversation with her, just learning about what she's been doing, what she's thinking, and what she's reading, and so on. (male, humanities)

Important is to draw attention to the fact that informal academic dialogue often takes place in formal settings. He further pointed out the importance of informal discussion outside conference rooms:

Informal networking often takes place in a formal context... I might go to a conference, but mostly the most memorable thing that happens there is that I go out for a drink with somebody. Not that I sit and listen to the papers. (male, humanities)

Similarly, in the case of the professor of geography, he also considers informal conversations at conferences are sometimes more stimulating than formal presentations:

It's an old anecdote: the best business in conferences doesn't happen in the formal sessions. It happens outside, often in the bar, because it's just striking up a conversation about something, where you can have that brainstorming potential. (male, geography)

These different types of informal academic dialogue seem to be happening anywhere: at weekly meetings, in a café, an office corridor, a pub, academic conferences, by email, and in blogs. Among the different ways they interact with their fellow researchers, participants generally believe that it is the informal communicative relationships that are to a larger extent conducive to the kind of academic dialogue in which intellectual exchange occurs. What bind researchers together in interdisciplinary work are not merely formal procedures, but the common interest in research. Informal communication to some extent helps them to discover what they share with their fellow researchers, which then leads to further joint work. The attitudes of participants found in the interviews are in opposition to forced collaboration, but of course in reality they are sometimes involved

in commissioned projects. Nevertheless, several participants in the interviews stated that an informal relationship enables them to create social bonds with their colleagues, and further enables intellectual closeness. The informality of academic dialogue actually stems from its nature, reflecting on the fact that they enter into such dialogue and are prepared to have their views changed.

4.3. Personal Relationship

The majority of respondents in the interviews pointed out that working relationships in academia are both professional and personal. The personal relationships are developed alongside the professional ones. In some research (e.g., in a long-term research project), ruling out personal relationships is impossible as researchers inevitably develop some personal relationship during the time when research is conducted:

I'd find it extremely strange if you had a group of people [working with you] for five years, if you knew absolutely nothing about their personal life and interests. (male, accelerator science)

A number of respondents explicitly addressed the importance of personal relationships in research work. Different respondents hold different views on the degree to which such personal relationships should be involved in academic research. The faculty member of computer science commented that perhaps it is possible not to hold a personal attitude towards his research partners, but there is a need to form a personal attitude towards the research work of his partners:

I mean that you don't have to like the person... You like his work... by talking to people, sort of questioning them about their views, you discover, at least on these professional topics you are talking

about, that you both have the same way of looking at it. (male, computer science)

The professor of engineering also stressed the importance of having a positive personal attitude towards research work, and further added that the existence of personal relationships with research partners affected his willingness to commit himself to some research work:

Scientifically we both trust each other absolutely, that's part of it ... and then in a general sense, we get on very well together... If you go away from your family four weeks a year, you've got to like the people you are dealing with. (male, engineering)

In the case of the professor of physiology, she strongly claimed the importance of personal relationships in her scientific research discoveries:

The chemistry has to be right. You have to like each other ... you have to understand each other ... You have to get very excited or very worried or usually very worried or very disappointed together. (female, physiology)

The professor of politics also pointed out the importance of personal relationships in social science research: "On the whole... it's been based on social ability, you know, liking each other, enjoying being with each other... "(female, politics).

In some cases of distributed research, personal relationships seem to be more admittedly important in the sense that it mitigates the impersonality of network technologies, which is illustrated in the account by the professor of accelerated science:

Once you get this personal relationship, then it [collaborative efforts at a distance] can

survive the impersonality of the networking, telephone, videoconference, Skype or whatever. (male, accelerator science)

In the interviews, this academician further stated that he is able to start to work with his collaborators on top of this established personal relationship.

As illustrated in the interview accounts above, personal relationships are important in that they affect participants' willingness to commit themselves to joint work as well as to engage in academic dialogue. With a strong willingness wrought from personal relationships, engagement in academic dialogue could more likely lead to intellectual exchange.

4.4. Distributed Trust

Among many personal relationships, a trust relationship is seen as a prerequisite for generating academic dialogue conducive to distributed research. The professor of geography found that distributed collaboration happens between colleagues only if there is trust in their expertise:

What I would say is that I have to trust and rely on the expertise of people, who bring something to the activity I don't have... There is an element of trust there, in terms of that they are the knowledge holder or the expertise holder. (male, geography)

The professor of social work also commented on the importance of trust: "They have to trust you... You have to work out whether I can work with this person and is this person going to take me to places where I want to go. " (female, social work).

Similarly, the professor of geology, speaking from his experience, also found trust an issue in his successful research work: "If

I look back at the success of research, it is because you know the people, you can trust them.”(male, geology).

As for geographically dispersed researchers, there seems to be distributed trust, as it was termed by the faculty member of computer science, which potentially leads to research collaboration at a distance. A large number of respondents spoke of distributed trust in their work. Distributed trust, as described by the participants, seems to be a trust relationship between two academicians who do not know one other, but are connected via a mutually trustworthy academic. The relationship is usually established as a result of introductions. Participants mainly made comments on geographically dispersed academics with distributed trust. In the case of the law fellow, he was introduced to a PI by the practitioner who knows both of them and, as a consequence, the three worked together on a research project:

I was asked. A professor wanted two English law advisors to be on the project, one practitioner and one academic. She asked the practitioner. He said ‘yes I would do it and I know who might do it as an academic’. (male, law)

In this case, distributed trust between the fellow and the PI is established by the introduction through the practitioner. In the interviews, the professor of biology gave another example showing that distributed trust sometimes led her to commit herself to some research activities in which she did not originally intend to participate:

Do I want to go to Copenhagen for three days? No. But because this person who was organising was somebody I know, I trust them. Basically I trusted him to invite people I would want to talk to. (female, biology)

Thus, as there is distributed trust, the professor of biology participated in research activities in Copenhagen. She further pointed out that there is an increasing number of research activities that rely on distributed trust, and the degree to which intellectual exchange occurs in these research activities has correspondingly increased. Another example was given by the professor of geography. With distributed trust, he managed to write papers with geographically dispersed researchers: “I have published papers where I’ve never met some of the co-authors.” (male, geography).

Many more examples about co-authorship via distributed trust are found in the interview accounts. Although a striking number of participants wrote papers with researchers whom they did not know, they were keen to point out that they also have been actively seeking opportunity to meet their co-authors in person. They felt that distributed trust is different from “real” trust, in that distributed trust seems to have only resulted in loose and indirect connections between them and their research partners. In order to further develop a well-connected relationship, there is a need to introduce collocated work into distributed research.

5. Discussion and Conclusion

This paper presents findings from the semi-structured interviews with a group of 24 senior interdisciplinary researchers. They are, on average, technologically competent, using a wide range of network technologies such as email, the Web, video conferencing, and blogs in their research work. Important to point out is that as users of these technologies they played an important role in many aspects of the nature of technology use. In addition, the main purpose in them using network technology is to facilitate research work, and this use has consequently changed many aspects of their research activities. In distributed research, the

transformation of research communication has been most significant: more information is shared over wider channels at greater speeds. Beyond these perceived quantitative changes in research communication however, the use of technology seemed to have also changed, in a qualitative way, many aspects of research communication that occurred in academic research. All forms of research communication, mediated or not, can be seen together as varied combinations of proximity and distribution. There is this suggestion that in some situations academics can be seen as communicating all the time in the way they frequently switch between different communication means. They communicate privately and publicly, informally and formally, with a high degree of reciprocity and with written records of their discourse. These changes in research communication, as direct consequences of technology use, have consequently impacted the nature of academic research.

Academic research, which had been a privileged activity within universities, is now a more distributed activity. Especially in interdisciplinary settings, research groups are likely to be geographically distributed, and a complex interactive system is formed to maintain the quality of scholarship. Unlike distance learning, there seems to be little criticism about the quality of distributed research in recent scholarly debate. Most scholars regard distance research as the way to promote research collaboration in the next generation. Distributed research is a fashion. Nevertheless, this study argues that the distributed research that is enabled by network technology is still at a distance, which is by nature different from collocated work that is conducted by researchers located in the same research office. This echoes a general view found in the literature that distance has not been altered by technology (Cramton, 2001; Herbsleb, Mockus, Finholt, & Grinter, 2000; Hinds & Kiesler, 2002; Zhang, 2008). As for

the possibility of working with geographically dispersed researchers by using network technology, the perceived distance between academics is perhaps, to a certain degree, shortened. That is, the concept of distance can be seen to have changed in that academics are able to work together via mediated communication across the globe.

In fact, distributed research and collocated research are not entirely separate. As a matter of fact, distributed work usually involves both researchers who are geographically dispersed and colleagues nearby. Likewise, real-world research seems to always involve a mix of collocated work and distributed work. There is also a need to have face-to-face communication in distributed research. There are interview accounts to illustrate that, while some participants communicate with others through email more frequently, they travel more often as well. A number of participants also indicated that, although they attend conferences to meet new researchers, they keep meeting the researchers they already know at the same conferences each year. Conferences has to some extent brought researchers who are geographically dispersed together to share ideas and thoughts, even only intermittently. As there is a tendency that more collocated work is involved in distributed research, collocated work within distributed research, to some extent, lessens the tension caused by the impersonality of electronic communication between geographically dispersed researchers.

Furthermore, trust and a willingness to work together are important in interdisciplinary research undertaken at a distance. This echoes what Thompson (2003) once stated that, in a loose network setting, research practice is more dependent upon trust and accord than on rules and orders, and offers an alternative for productive work. In this study, distributed trust is commonly found

in distributed research. The issues of trust and accord are seen as the key to the success of such distributed research.

In distributed research, the research structures can be seen as concentrations of research that exist across traditional boundaries of time and distance. Doing distributed research, or more specifically interdisciplinary research, leads to dynamically embedded interactions with a range of academics, and further ensures the formation of research networks connecting scholars from different backgrounds. In the literature, Wellman also argued that old-fashioned research environments have moved from being “hierarchically arranged”, “densely knit,” and “bounded groups” to network settings (Wellman, 2001). They no longer fit the group model, which is small and clearly bounded. In networked societies, “boundaries are more permeable, interactions are with diverse others, linkages switch between multiple networks, and hierarchies are flatter and more recursive” (Wellman, 2001, p. 33). In this study, such emerging networks of distributed research are largely interdisciplinary and interconnected, and it is argued that research networks of this kind are conducive to academic progress.

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