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Investigating Knowledge Exchange amongst School Teachers, University Teacher Educators and Industry Partners.

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Abstract: This article reports on a study in which teachers, university teacher educators and a software company formed a learning community which provided a mechanism for knowledge exchange regarding pedagogical approaches using mobile technologies. The study employed an interpretivist methodology. The findings indicated that the collaboration promoted reflection on practice and facilitated development of innovative pedagogies. All partners benefited through this knowledge exchange: the teachers developed new approaches and ways of thinking about teaching; the teacher educators gained insights informing their practice and feedback on theory-practice alignment; and the industry partner derived insights on how to support other schools in technology knowledge exchange.

Introduction

Educational technologies that are potentially able to enhance students' learning are becoming more commonplace, diverse and powerful. One such technology is the mobile device. This technology has the potential to allow teachers and students to learn anywhere, anytime, in flexible ways and flexible locations. In order for teachers to successfully integrate the use of mobile devices into their teaching for effective learning, it is important that they be provided with professional learning opportunities to become familiar with the technological and pedagogical affordances of the devices. One way these opportunities can be offered is through establishment of learning communities that provide for knowledge exchange between different organisations.

Establishing a learning community is often suggested as a way to support the professional learning of teachers in schools (Hsu & Sharma, 2008; MacDonald, 2008). Most of the research on such professional learning communities has considered communities of school teachers only (Stoll & Seashore Louis, 2007). However, such communities can include a variety of stakeholders such as universities and industry partners. In particular, the roles that various organisations play in the community and the benefits gained for all partners through participation in the community may be significant. This article reports on research on a learning community comprising three different stakeholders (school, university and industry) and investigates the knowledge exchange that occurred.

Communities can take a variety of forms: some meet face-to-face to support their ideas; while the advent of online collaborative spaces has meant that members can build the community

through sharing resources and ideas online in a blended community, that is, through a mix of face-to-face and online interactions. In this article, we examine how the community transcends more traditional forms of interaction.

This paper reports on a project carried out in Sydney, Australia in which teaching with innovative pedagogies was initially the focus. Teachers from two schools collaborated in a project incorporating mobile-intensive pedagogies, focusing on the areas of mathematics and science. They were supported by teacher educators from a local university and provided with access to mobile devices and technical support by the industry partner, a major software company. The term ‘mobile-intensive pedagogies’ is used in this project to describe pedagogies which use the affordances of mobile devices to enhance teaching and learning. These affordances include their mobility, ability to be personalised and capacity to be used for authentic learning experiences (Kearney, Schuck, Burden, & Aubusson, 2012). The university team facilitated the professional learning process, researched different aspects of the project and provided resources and pedagogical suggestions regarding the implementation of the mobile devices. The software company provided mobile devices which included related educational software. They also provided two workshops on how to use the devices and associated apps and offered technical support to get the teachers started. The teachers developed appropriate teaching and learning experiences and provided insights into their use of the mobile devices and associated resources.

This study, initially of teacher learning in the community, changed direction as the project progressed. It became clear that the teachers were not the only members of the community who were learning within and from the community. This led to a new focus on knowledge exchange between the teachers, teacher educators and the industry partner.

The questions that guided this aspect of the research project were:

1. What principles support knowledge exchange on professional practices and innovative pedagogies in a community comprising teachers, teacher educators and personnel from a software company?
2. What are the possible benefits and limitations of knowledge exchange for the different stakeholders in the community?

In answering these questions, we investigated various knowledge exchange opportunities at different levels; firstly, between the teachers at two different schools, secondly between the schools and teacher educators and thirdly, in the triadic partnership between the school, university and software company.

Background

Teachers constantly need to evaluate their practice to ensure that their teaching and their students’ learning is current, relevant and in step with changing contexts (Aubusson, Ewing & Hoban, 2009). While the ubiquity, accessibility and power of mobile technologies make these technologies of interest for educational purposes, as with other technologies, it is important that adoption does not occur simply because the technology is available. Adoption and usage should have a clear pedagogical or professional benefit. Accordingly, a challenge for teachers is to develop pedagogies which leverage the affordances of digital technologies to support students’ learning (Ahmed & Parsons, 2013; Looi et al., 2014).

Pedagogical practices using mobile technologies call for new approaches including the ability to “... support unique forms of one-to-one access, learning in context, and seamless

integration of formal and informal learning spaces” (Philip & Garcia, 2013, p.303). They also allow for “real-time data gathering and analysis with little time delay,” which enables students to “constantly redefine their own goals” as learners (So, Seow & Looi., 2009, p. 370). It seems clear, therefore, that if teachers wish to provide opportunities for learning that include these benefits, they have to ensure that they are able to use mobile devices to good effect in their teaching practice. Teachers who wish to develop effective mobile-intensive pedagogies can benefit from professional learning in a community to develop their thinking about these pedagogies (Wenger, White & Smith, 2009).

While there is agreement among researchers that the goal of a community is “to engage in systematic collaborative discourse, reflection and inquiry for the purpose of improving professional development and practice and contributing to the field at large” (Wesley and Buysse, 2001, p.119), there is little research on communities that traverse organisational boundaries. Where such research occurs, it is generally positioned as in Hoadley (2012), who suggests that in a community, learners should have access to experts, who can be industry experts or experts in universities. This suggestion has an assumption implicit in it that only the teachers in the community will benefit from the community having a broader membership, which includes university and industry partners. This assumption suggests a top-down model in which experts support learners, thus positioning the teachers as non-experts. It also indicates a one-way knowledge transfer, from expert to teacher, rather than a knowledge exchange. These assumptions are problematic as teachers bring expertise to the community and the benefits and learning that occur in the community are not restricted to the teacher members only. The question then arises as to what benefits the community provides for all members. This paper explores this aspect using a theoretical framework of knowledge exchange.

The importance of university-school partnerships has been recognised for many years (Brady, 2002). As suggested by Mullen (2000), while it is beneficial for school and university practitioners to build professional communities, research on these partnerships has typically focused on the university’s research or training needs (Edwards, 1995; Walsh & Backe, 2013) and the benefits to teachers of the university’s involvement. What is more useful for both teachers and university educators is when partnerships provide benefits for both partners. Some of the possible benefits of such dialogic partnerships include shared knowledge and resources and the potential for organisational growth (Thorkildsen & Stein, 1996). Additionally, when teachers and teacher educators collaborate with each other in a community, there arises the opportunity to examine and reflect on practice. The significant role of reflection supporting teachers’ professional learning is supported by Cuesta, Azcárate and Cardeños (2016). It is the opportunity to engage in reflection that may lead to changes in pedagogy grounded in collaborative research (Potter, 2001). Similarly, such reflection is beneficial for the participating teacher educators.

Industry-school partnerships also may provide professional learning opportunities for teachers (NC Schools, n.d.). Much of the literature on industry-school links tends to focus on readiness from school to work (for example, Flynn, Pillay & Watters, 2014). More recently, large technology companies have begun to engage with schools directly, in part, to gain leverage for their products in schools but also to explore the pedagogical implications of their product use in schools.

Universities are also engaging with industry partners, to ensure that the end-users of their research benefit from the research and to provide much needed funds and equipment from the relevant industry for the research project (for example, see Australian Research Council Linkage

grants: <http://www.arc.gov.au/linkage-projects>). Currently, in Australia, industry-university partnerships are being promoted by the government as a way of supporting innovation (Australian Government, n.d.). However, little literature exists on partnerships which are triadic, and include school, industry and university personnel, and there is little research on the learning and benefits that might arise from such triadic partnerships for all partners and little research at undergraduate level apart from teaching practice contexts.

This paper explores whether knowledge exchange within a community is an effective way to support teachers' professional learning with mobile technologies, and simultaneously provide new insights for industry and teacher educators. The qualitative study discussed in this paper examined opportunities, both face-to-face and online that facilitated the development of a community focused on implementing mobile-intensive pedagogies. The results of the study highlight the importance of building opportunities for partners to collaborate both within and beyond their settings.

Theoretical Framework

The research was underpinned by a constructivist interpretivist paradigm (Opie, 2004). Research under this paradigm considers reality as a human construction and acknowledges that there are multiple perspectives derived from individual participants (Guba & Lincoln, 1994). The framework used to analyse the data draws on concepts based on the construct of 'knowledge exchange'. This aligns well with the underpinning constructivist paradigm. The definition of knowledge exchange is "a process which brings together academic staff, users of research and wider groups and communities to exchange ideas, evidence and expertise" (The University of Edinburgh, 2016). One of the potential outcomes of knowledge exchange is development of innovative practices (Cowan & Jonard, 2004). Such innovative practices are important where new technologies, such as mobile devices, are adopted into or alongside existing practices within schools.

Within this framework is the notion that knowledge is co-produced by partners within a community through dialogue. "Engaging in critical transformative dialogue provides a mechanism of rigour in the development of the knowledge base and practices. ... Such conversations allow members of the community to constantly reconsider, challenge and renew the quality of practice in their field" (Daniel, Auhl & Hastings, 2013, p.160).

In order to build regular sustained knowledge within a community it is important that dialogue occurs over a sustained time frame. Research indicates that one-off professional learning sessions bring little change to teacher practice (McConnell, Parker, Eberhardt, Koehler & Lundeberg, 2013) and that teachers benefit most from professional learning when it occurs over a period of time (Darling-Hammond & Richardson, 2009), in situ and where they are part of a community. It is also likely that the university and industry members of the community will need prolonged dialogue to benefit from successful knowledge exchange.

Through ongoing knowledge exchange, group members form a set of common understandings and shared pattern language. Pattern language is defined by Smethurst (1997) as a community's "own way of expressing and discussing the unique qualities of its chosen art" (p. 1) or as Daniel et al. (2013) call it: shared conceptual language. According to the latter authors, shared conceptual language enables communities to build, reassess, and modify their conceptual understandings and practice.

There are several implicit understandings in discussions about knowledge exchange communities. One is that all members are equally invested in the outcomes of the community and that all are positioned as learners. Another is that the co-production of knowledge through dialogue is easily done. Finally, it is clear that an extended period of time is needed to produce successful outcomes. This study investigates and critiques the feasibility of these features in the project.

Methodology

The focus of qualitative research is on understanding and interpreting other people's social world through accessing their lived experiences (Mason, 2002). In this qualitative study, a multi-site case study approach was adopted (Audet & d'Amboise, 2001). Case studies allow a detailed study of a particular bounded phenomenon, which in this research was a group of teachers using mobile devices for learning and teaching. In this study, the case study was multi-site as it took place at two major sites, a high school and a primary school. It retained a common focus across these sites (Wiersma & Jurs, 2005). The study gained all necessary ethics approvals before commencing.

The focus of the study was a community consisting of school teachers, university teacher educators and software company personnel. The case study was exploratory, that is, it was used to explore a situation in which the intervention being evaluated had no clear, single set of outcomes (Yin, 2003). The university educators were interested in what might happen when teachers were given the mobile device and supported in their learning to develop mobile-intensive pedagogies, and also wished to investigate what learning would occur for all members of the community.

The project commenced in the middle of term one, 2015 and concluded early term three that year, with an overall duration of 20 weeks. The research team facilitated the professional learning through the implementation of an action learning process (Aubusson, Ewing & Hoban, 2009). Throughout the project there were regular meetings held at approximately fortnightly intervals at each of the primary and secondary schools to facilitate the action learning process. The first meeting at each school developed the action learning process; this was followed by six action learning meetings at each school of one hour each. On another three occasions the two groups met together. On two of these occasions professional development sessions were facilitated by an educator who was an expert in educational technologies and the sessions were organised and funded by the software company, on whose site they took place. These sessions lasted six hours each. On the third occasion the group met at the primary school for an hour. A final meeting at each school concluded the project with a showcase of teachers' projects to invited staff.

To support the community, a number of online spaces were used. An online collaborative site allowed participants to share their ideas with each other and also allowed the teachers and teacher educators to document their ideas. Reflections by teachers were available to the researchers, who had permission to access these data for the project. Email was also used to share ideas amongst the community.

Given that the development of mobile-intensive pedagogies in the two schools, through the use of a learning community, was the key stimulus for initiating the project, more data were collected on this aspect. On reviewing the data the team realised that it was not fully capturing all

the knowledge exchanges that occurred. At that point additional data were collected from the teacher educators and the industry partner.

Participants

Participating teachers came from one primary school and one secondary school, both in Sydney. Five teachers from the primary school were involved. Three of the participating teachers taught year three, one taught kindergarten and one teacher taught year six. Two Deputy Principals also participated, one also being an ESL support teacher. There were four teachers from the secondary school involved in the project, three teachers were from the Mathematics Faculty and one teacher was from History. The latter was the staff member who initiated this project as she was on the school leadership team.

The university team consisted of three teacher educators. Two members attended all action learning meetings and participated online with the teachers. The third member of the university team coordinated the project with the partners and participated in some of the sessions, including the industry workshop sessions. Two other university staff members were invited to lead sessions on action learning and on mobile pedagogy and to join the research team as members of the audience for the sharing sessions at the conclusion of the project.

The industry team consisted of two members. The first member was employed by the industry partner as a trainer and she provided the two professional learning sessions at the industry site. The second member, the industry contact, facilitated the project and attended some planning meetings with university staff and liaised with the university staff at strategic points throughout the project.

Data Collection and Analysis

Data were collected through a variety of methods which included observations, field notes, interviews, focus group discussions with teachers during face-to-face action learning sessions, interviews with the industry partners, discussion amongst the university teacher educators, and material from shared online spaces, including teacher educator reflections and teacher reflections. There were 17 face-to-face sessions total in which observations of the action learning, group interactions and accompanying discussion took place and audio recordings were gathered. A forty minute interview was conducted by the university educators with each school participant in the final week of the project and individual interviews were conducted with each of the educator and the industry liaison personnel from the software company.

The online data consisted of ideas, links and comments posted on a OneNote site set up for the project. Within this site was a public section where all participants could share ideas. Another section of the site allowed the teachers to record their reflections. These reflections were only visible to the individual authors of the material and to the university educators. This section also contained the university educators' reflections. Once all these data were collected, they were read by the research team and data that related to the research questions were highlighted for analysis.

Analysis followed the process suggested by Creswell (2009). We identified three types of partnerships which we then used as an analytic framework. All the data were read through by the three members of the research team, and thematically coded (Gibbs, 2007) according to the

aspects of the project to which they related. Coding for this part of the study focused on any data relating to interactions, knowledge exchange, perceptions of partner institutions, learning that had taken place and benefits and constraints of working together. The researchers independently coded all the data, and then we discussed and compared our coding to provide inter-rater reliability. In this process, we considered if any of the codes needed to be merged with or subsumed by another code, or modified to gain inter-rater agreement. Agreement was reached through discussion and re-visiting the data where necessary. The next step was that we used the codes to develop themes. This was done by looking at commonalities between codes and extracting the underlying theme. Data on each of the key themes arising from the coding were placed under the appropriate framework heading, depending on which partnership they referred to.

The analysis was also sent back to the teachers for their member checking. Those teachers that responded (8 of the 11) expressed satisfaction with our analysis. Others did not reply, which is not unexpected due to their workloads.

Because the project was conducted under a qualitative paradigm, criteria for quality were used that align well with the qualitative methodology. Constructs of trustworthiness, verisimilitude and transferability are more appropriate constructs of rigour in a qualitative study such as this one than reliability and validity (Lincoln & Guba, 1985). The following steps were taken to ensure these constructs were adhered to: we ensured that the arguments were credible, results made sense, the text appeared 'realistic' and recognisable and that researchers would have sufficient information to build on this study and assess if the results are transferable to other contexts.

Findings and Conclusion

A number of key findings emerged related to participants' learning through the community. As noted previously, we interrogate the learning at different levels: teachers learning from each other, the school-university exchanges and the triadic knowledge exchange. Different themes emerged for each type of partnership.

Teachers Learning from each other

This section considered data in relation to the partnership between teachers within each school and also to exchanges between staff at the primary and secondary school. Themes of collaboration, learning across sectors and reflection emerged.

Collaboration

Data on collaboration indicated ways in which teachers worked together and supported each other in the project. The focus here was on collaboration within the school, amongst the participating teachers.

A sense of collaboration between teachers was evident throughout the project. The planned meeting times, provided through the facilitated action research process, were considered extremely beneficial as ways to 'bounce ideas', reinforce positive changes and progress, and

allow for future planning. This notion is reflected in a comment made during an interview with a stage three (primary school, years 5-6) teacher:

“... and I was saying to her it’s so nice to have someone else in the room to talk through your process ...”

Teachers in the schools indicated that they valued working with each other, a finding supported in the literature. For example, Veugelers and Zijlstra, (2002) note that opportunities for collaboration provide teachers with a forum for professional discussions, and that teachers tend to find this opportunity valuable.

Learning across Sectors

The data here centred on the experiences of the teachers when working with others from the partner school. Teachers discussed the value of working across the sector. Primary school teachers and secondary school teachers do not often have the opportunity to work with each other to build an understanding of practice. Through this project teachers were provided with this opportunity which they valued. As one of the secondary school teachers commented in an interview:

“... probably the biggest benefit I saw from the project was seeing primary schools because we don’t have that much contact with them.

This knowledge exchange across the primary and secondary schools was also commented on by one of the primary school teachers:

“I liked it. For me the best part was the practical side so I really liked speaking to the High school teachers on PD [professional development] days and also in the meetings. I thought that was really good because I know nothing about high school teaching and it is really nice to see where the kids continue onwards with the continuum. We don’t really know what happens after that so it was great seeing where they can get their students”

Teachers appreciated the ability to bridge the primary-high school gap and learn more about the continuum of learning for their students. They were inspired by each other and felt armed by a sense of authority provided by participation in the project.

It was through the learning community that participants were able to sustain and build ideas over time. This community was fortunate in being provided with sufficient time to engage in a sustained way, due to the support of the schools’ executives and the teacher educators’ ability to devote the necessary time to participation. The teachers took ideas generated through community discussion and implemented these ideas in their teaching practice. They then returned to the group to discuss what had occurred, in further dialogue. This enabled the teachers to successfully implement new ideas and develop mobile-intensive pedagogical approaches.

Sharing ideas both within and across schools provided the teachers with new ideas with which to drive innovative practices. Such knowledge exchange has been found to be important to support teachers’ professional learning (Atkinson, Springate, Johnson & Halsey, 2007). This notion is reiterated by Prestridge (2010) who states that “enabling teachers to talk critically to one another is an important professional development process” (p.253).

Teacher Reflection

Teacher reflection refers to the process by which teachers considered and evaluated their work during and after they had enacted their action learning projects. Through sustained collaboration within the community, the teachers were able to learn with and from each other and reflect upon this learning. As one teacher stated, “... *Sometimes you don't get enough chance to reflect, I think... so it's nice to have someone else in the room to talk through your process; 'actually I could have done that better'...*” (Stage 3 Teacher: Interview).

One of the important aspects of teaching is critical reflective thinking. According to Dewey (1933) “the kind of thinking that consists of turning a subject over in the mind and giving it serious and consecutive consideration” (p. 3) is essential. There were many opportunities for the teachers to reflect upon their practice in the face-to-face sessions that were held, both in the afternoon action learning sessions at each school and in the sessions held at the software company's headquarters. These were facilitated both by the academic partners for the action learning sessions, and by the educator employed by the industry partner during the professional development days at the company headquarters.

Others saw the time and opportunity to reflect as a way to make meaning, step out of silos and remove themselves from the ‘hectic’ surroundings to “... *think about what you've achieved currently and what you then need, to go to go forward and work collaboratively with colleagues...*” (Secondary Teacher: Interview).

As suggested by Levine (2010), inquiry communities provide the opportunity for teachers to talk about their teaching and reflect on it. Ongoing critical reflection is a crucial process within communities (Cushion, 2004). This was evident in the examples above where the teachers were able to reflect together with their colleagues and also take away ideas from the community meetings and reflect upon these, and then to use these reflections to support further discussion in community meetings.

The online spaces also provided opportunities for teachers to reflect on their experiences which were able to help shape the future sessions. One example of this is where the teachers reflected in the shared online space on the usefulness of the first professional learning session at the industry headquarters. Some of the comments provided by the teachers were:

*Too many apps on display with not enough creating or pedagogical planning
There were too many apps introduced quickly. It would have been good to have more focus on student creation and design process.
I would like more time to play and workshop with others learning at the same time.*

It was clear from these reflections that the teachers wanted less on the technical and more on pedagogical processes. This view is aligned with the suggestion by O'Rourke (2001) that ICT professional development should help teachers “to focus on pedagogy rather than on the technology itself” (p.13).

As a result of the online reflections, there were discussions at the following action learning sessions to discuss what content the teachers would like at the next PD session organised by the software company. Through this discussion a tailored session was provided which the teachers found to be more useful in informing their practice. This type of discussion and subsequent fine tuning for future sessions is only possible where there is extensive time available.

Meeting in the community over a period of time provided teachers with chances to reflect on the previous meeting as well as their own practice in the classroom. This process allowed

sustained opportunities for teachers to critique and evaluate each other's ideas. This is in contrast to one-off sessions often provided for professional development. Lee and Brett (2015) agree that sharing ideas in the form of dialogue is an important aspect of professional learning as it supports transformative learning. Dialogue is defined as "a sustained collective inquiry into the processes, assumptions and certainties that compose everyday experiences" (Isaacs, 1993, p. 25).

School-University Exchanges

This section considers all the data concerning the partnership between the schools and the university research team. Emerging themes were benefits of the partnership for the schools and benefits for the university.

Benefits of the Partnership for the Schools

This section considers what the schools gained from being involved in the project. The opportunity for teachers to work with the university was considered a benefit of the project by the teachers. The partnership provided a stimulus for teachers to share innovative ideas from different perspectives as well as providing an opportunity to learn more about the challenges and successes of mobile device integration in each schooling context. Teachers' learning was also scaffolded and supported by the university team. This was highlighted in a discussion with the primary school deputy principal who stated:

The project was a perfect opportunity to leverage the academic support, expertise, evidence-based research (action learning and model/framework), advice, ideas sharing, collaboration with outside agencies such as [the] university ...

Leaders in both schools recognised the importance of outside influences to stimulate change, with one leader indicating that she always feels "...that an outside authority helps to leverage that kind of work, and action learning has been something that I've been working with for a long time. It helps teachers to engage and focus, and to have that outside support is fantastic" (Primary leader, Interview).

Part of the role of the university staff was to facilitate the building of ideas. As facilitators, the university staff worked on understanding the perspectives of the different teachers in the project. Perry, Komesaroff and Kavanagh (2002) emphasise that facilitators need to recognise the importance of taking time to understand how different staff members perceive the work of the community. In this project, this occurred on two levels; first at the individual level recognising the differences between the teachers and secondly at the school level, where the primary and secondary schools had varying institutional differences. The role of the facilitators was to provide space for each member to contribute through discussion and help build on ideas.

Another way that the university staff was able to support teachers was to introduce a framework that one of them had previously developed with colleagues (Kearney et al., 2012) to scaffold teacher understanding about ways that mobile technologies can support learning.

Using this mobile pedagogical framework provided a mechanism through which teachers could understand the various affordances provided by the devices and importantly, it gave them a shared vocabulary with which to discuss ideas with university staff. This notion of shared

vocabulary using the framework was particularly evident in the second industry led session as evidenced in one of the primary school teacher's presentations, where she discussed the concepts in the framework:

One of the highlights for me in terms of a shift was the personalisation of the learning for my students. In my class I have a huge range of students. The ways that technology has helped is to break down the walls to flip the classroom.

According to Louis (2007), individually held knowledge is turned into common knowledge when there is a shared vocabulary and incentives to discuss ideas. The framework allowed for this shared vocabulary.

Benefits of the Partnership for the University

The teachers were able to provide ideas and feedback to the university staff on how the pedagogical framework worked in their situations. It gave the teacher educators a chance to see how practice informed theory, in contrast to usual exchanges between teacher educators and teachers, in which the theory informs practice. The feedback provided to the university staff by the teachers also allowed the teacher educators to understand how the devices and apps were being used in the field and the pedagogical implications of such use. These understandings informed the ways that the framework was used subsequently as a mobile learning scaffold. The interaction between the framework and teachers provided a clear example of the sociocultural notion that the use of a tool changes both the user and the tool.

The opportunity for university staff to be able to observe mobile device use in situ was invaluable. While there are professional learning opportunities for university staff at university, as pointed out by Mostert and Quinn (2009), "discourse on using ICTs in HE [Higher Education] teaching and learning, however, seems to focus on access to technology; that is, on the availability of computers, the Internet and bandwidth rather than on the way ICTs are being used in support of teaching and learning" (p. 73). Participation in the community by the university members enabled them to understand the pedagogical affordances associated with the use of the device at a primary and secondary level of schooling. The ideas generated provided valuable input to the university's teacher education program ensuring that pre-service teachers gain a current and research-based perspective of mobile-intensive pedagogies. The teacher educator's new understandings also provided insights for further research projects in this area.

As illustrated by the data and discussion above, these findings support the views of Smolin and Lawless (2011) that a successful technology professional development partnership between a university and schools can yield mutual benefits when designed around the common goal of supporting classroom practices and student learning. These mutual benefits are further explored below.

Effective professional learning communities are able to connect work-based learning to external expertise such as that held by university staff (Greany & Brown, 2015) and in turn inform the teaching practices of the university teacher educators. The conditions under which this is best able to be achieved is where a model of Joint Practice Development (JPD) is utilised. This term is defined by Fielding et al. (2005) as the process of learning new ways of working through mutual engagement that opens up and shares practices with others.

The process of learning new ways of working was also supported through critical reflections which were enabled for both the school and university members. These reflections were supported through discussions in the action learning sessions and also through the online

posts and dialogue. Through these forums, discourse developed over time where the language used by both the school and university members also became shared much like the shared vocabulary amongst the teachers.

All members were able to share their critical reflections and there was a strong sense of commitment for the outcomes of the project. Some of the reflections were sometimes debated fiercely and a strong sense of collegial support helped maintain the cohesiveness of the community.

School-University-Industry Partnership: The Triadic Knowledge Exchange

This section considers findings that concerned all three partners in the project and discusses the data related to each partner's contributions to the project and the benefits that ensued for the other partners. All three partners were able to bring expertise and resources to the partnership to provide knowledge exchange of benefit to the whole community. In this section, the themes concern the inputs provided by each partner, as well as the benefits and/or limitations for each partner.

Contributions of the Industry Partner and Ensuing Benefits

Teachers and university staff saw significant benefits from having participation by the industry members, especially in relation to the supply of the devices as well as the provision of information about how to use the device and its specific technical elements. As one teacher stated in regard to the first full-day session at the industry partner headquarters: “...*The timing was really good because we were all thinking, “Well, how do we actually use this device?” We had just got the keyboards and that type of thing so I mean, that was really good. Before that I didn't realise how you could even download Apps...*” (year 3-4 primary teacher interview). The other key contribution from the industry personnel was the provision of access to cloud computing and the provision of spaces within which to work. This provision was also accompanied by tuition in how to effectively use the cloud spaces and software in schools, both for teacher and student use.

Likewise, for the university teacher educators, the instructions in the use of the device and cloud software provided them with an increased understanding of the technical features of the mobile device and the various apps that went with it. A number of these apps were very new and had the potential to be used in the teacher education program in which a number of university staff members taught. The professional learning of teacher educators about the effective and appropriate use of educational technologies is very important in order to prepare student teachers and the sessions provided valuable information towards this end.

Working with an industry trainer across both days allowed for some rapport to be built for all community members, and the provision of time set aside in the second day for personalised support was recognised as significant and beneficial by them. There was both a one-to-many level of support on the day as well as a one-to-one level of support. The one-to-one level of support was strengthened because both the presenter and the teachers had pedagogical knowledge of the devices and how they were being used. This was possible because of the sustained community that was being developed.

One of the aims of collaboration is to foster the development and spread of innovative ideas, and to develop new educational approaches and materials (Hill, 2004; Rudd, Holland,

Sanders, Massey & White, 2004). This was evident in the project where participation in the community supported teachers to change the way they conceptualised and used virtual and physical teaching spaces to support learning.

On the first visit to the software company's headquarters a tour was conducted of the office spaces. This space was open with no worker having a set desk, and was conceptualised as an activity-based workspace. The workers chose different spaces for different purposes. Some spaces were set aside for reflective private work while other spaces were provided for group meetings. One of the teachers commented in the reflective space of the group's blog regarding the tour:

"I particularly liked chatting with the other participants and loved Janet's tour of [company's name] working spaces, discussing the work ethic and how it models collaboration."

The primary school teachers took these ideas and applied them to their own settings back at school. They used space around the schools in ways they had not been able to before the implementation of the devices.

Benefits for the Industry Partner

There were a number of benefits for the software company in being part of the community. One of the major benefits was that they were provided with access to quality schools where they could observe innovative practices. It is important, as pointed out by the software company trainer, that schools with a commitment to enhancing practice with technology are part of the community:

"I worked with a school in Victoria and it was not as sophisticated as the New South Wales school. The report that came out of it wasn't as good either."

In order to get useful insights which could be used to provide reports on teacher learning that the software company could use in teacher development they ran with other schools, it was important that schools with committed staff were selected. As suggested by the software company contact, this is about *"providing access to reality, to those real classroom teachers."* The school provided the software company partner with an understanding of how their mobile device was being implemented in the classrooms and also provided insights to some of the affordances and barriers associated with such implementation.

Working with the university was seen as important to the software company partner. The university was able to provide access to these quality schools. This ready access for the industry partner was seen as beneficial as working with large systems can be challenging. As suggested by the industry contact in relation to working with many school education departments around Australia, *"you [the industry partner] are not really at the coalface, the department will have its own agenda that it wishes to respect."* The university team acted as a bridge between the schools and industry partner.

Another advantage for the industry partner of working with the university was that the university provided evidence of the usefulness of their device in an authentic setting through using an evidence-based approach. As stated by the industry contact, *"partnering with the university can look at showing real impact with real academic rigour. Nothing we can do can do that, we don't have the ability to."*

Whilst there were several benefits for the industry partner, these were not realised as fully as they might have been as there was limited on-going commitment to the community compared

to that shown by the school and university partners. The software company trainer noted that *“coming in and having a few PL [professional learning sessions] will not lead to change. ... We need long term professional learning communities.”*

Without such regular meetings, dialogue cannot become shared and thus, successful outcomes were limited. Having an action learning partner from a software company who was able to attend the sessions and come to the development days would have drawn the partner deeper into the community. This ultimately, would have provided for a richer community. Having stated this, the software company contact explained that her organisation, *“is a commercial organisation who would like to sell more of our technology”*. This aim is different to the aims of the schools and university whose core aim is provision of effective education. Given this, there is always likely to be some tension in this type of triadic partnership, which needs to be recognised.

Some knowledge exchange principles that emerged from the study are discussed below. Firstly, the study demonstrated that a genuine commitment to active participation and contribution to the community by all members is essential. Secondly, the positioning of all members of the community needs to be on an equal footing with all members deemed as experts from whom others can learn. Thirdly, learning should be an outcome for all members of the community but it should be recognised that this learning will differ according to the varying needs of the community members. Fourthly, the community needs to be supportive of all members and a level of trust needs to be developed. Finally, sufficient time and collaboration needs to be available to the community to achieve its goals.

Conclusions

The importance of teachers being able to collaborate with each other across school sectors was a key finding of the project. Opportunities for such collaborations are few and establishing a community between schools allowed for sharing of ideas which the teachers found to be beneficial.

Having the community run over a sustained time frame allowed teachers to reflect, both privately and publicly which enabled the community to evolve and develop. Having a prolonged timeframe also allowed the language to evolve through dialogue and inform understanding of practice.

The partnership between the schools and university was noted as being strong, given that there was a strong common focus on education for both partners and there was sustained dialogue which allowed for knowledge exchange to occur.

Given the call by the Australian Government for universities to engage in partnerships it is important to research and understand the partnerships industry has with schools and universities. As noted, the software company provided much in the way of resources but did not participate as actively as they might have in the community. This ultimately meant that the benefits for them were not as pronounced as for the school and university partners.

The project has highlighted the partnerships amongst three types of institutions and provided insights into an area in which there is limited literature. The paper argues that all stakeholders in the community are equal partners and learners. What should occur in such a triadic partnership or learning community needs to be knowledge exchange rather than knowledge transfer. This assertion critiques much of the literature which talks about university

educators as experts and other partners as novices. As discussed, participants came to the project with existing and diverse expertise on which they were able to draw, to benefit other members of the community.

Given the benefits of this project for all participating stakeholders it would appear that there is a continuing need for partnerships between teachers across school settings and partnerships between school, university and industry where genuine communities are established that provide opportunities for knowledge exchange for all partners.

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