30 years of ICT in education: reflecting on educational technology projects

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Abstract

Over the last thirty years educational technology has not impacted the delivery of education that might have been predicted for it. Part of the lack of impact may relate to the introduction of new technologies through one-off educational technology projects which lack permanence and effective evaluation. In this paper I present a reflective and reflexive account in relation to seven educational technology projects carried out, over the last ten years, in Scotland. While reflecting on one project I developed a framework to understand why some of these educational technology projects were successful and why others were not. The framework includes four factors: Purpose; planning; passion; and pedagogy. I have attempted to learn from my involvement in past projects in order to influence and shape future experiences. It is hoped that this work can help to link practice back to research as well as indicating a way for lessons to be learnt in future educational technology projects.

Keywords: Educational technology; educational technology project; reflective practice; reflective evaluation.

Introduction

The use of technology to educate has greatly increased with the closure of school buildings and other educational establishments due to the coronavirus COVID-19 pandemic. However, up until now, the way to successfully implement educational technology has been elusive. Part of the difficulty may be that educational technology is often adopted in short-term temporary projects. To explore this, I present a framework to assess

educational technology projects based on reflections on seven discrete projects. I explicitly take a more practical stance than scholars have argued for, e.g. Selwyn (2010). In addition to the issue of educational technology's effectiveness, there are democratic and social justice issues involved in the success of educational technology projects, for example ensuring that public funds are not wasted on projects unlikely to succeed, and that inequality is not further entrenched.

It is useful to define the concepts being used. The Project Management Institute defines a project as 'a temporary endeavor undertaken to create a unique product, service or result' (Project Management Institute, 2020). Januszewski and Molenda's (2008) define the concept of educational technology as:

> Educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources (1).

Learning is put at the centre of their definition on purpose (Januszewski & Molenda, 2008: 13). To successfully implement digital technologies, we need to think and act differently in relation to our teaching and learning (Underwood & Dillon, 2011). Pedagogy needs to be rethought with primacy given to learners with teachers taking a step back (Wan & Nicholas, 2013). Using the term 'educational technology project' means there does not have to be a choice made between 'technology-enabled' and 'technology-enhanced' although the former is to be preferred as it fits with facilitation and does not imply the positive effect that 'technology-enhanced' conveys (Kirkwood and Price, 2016). Therefore, combining definitions of project and educational technology, in this paper 'educational technology project' refers to: A venture to create a unique resource or process to facilitate learning. From defining what is understood by the term 'educational technology project' now the process from taking part in several educational technology projects to creating a framework through which to understand them is presented.

Over the last thirty years, educational technology has not changed the delivery of education as much as might have been predicted. Hardware like tablet PCs or a new platform such as Google Classroom may make people think that this particular technology will finally turn the classroom inside-out (opening up opportunities beyond the classroom walls) and outside-in (bringing the world into the classroom). Using technology in this way would mean schools reflect what is happening in much of the rest of society, both at home and in the workplace. Perhaps, in response to the global coronavirus COVID-19 pandemic, with the closure of so many school, college and university buildings, educational technology will revolutionise the understanding of how education can be delivered, received and assessed.

While academics are exhorted to be reflective practitioners in relation to their teaching, following Schön's seminal works (1983; 1987), here I suggest that academics have not been active enough as reflective practitioners in relation to educational technology research, in

particular when we are asked to be part of a project introducing a new tool or teaching process when we are part-insider in the implementation project as well as part-outsider trying to evaluate and research the phenomenon at the same time. In this work I have tried to embody both sides of practitioner-researcher and researcher-practitioner as Schön stated:

> reflective researchers cannot maintain distance from, much less superiority to, the experience of practice. Reflective research requires a partnership of practitioner researchers and researcher practitioners (1983: 323).

The projects presented below have my involvement in common so I am aware that part of the problem, when the projects did not go to plan, may relate to my own actions. Nonetheless, I aim to explore the 'swampy lowlands' (Schön, 1987) of educational technology work where we cannot see what is ahead nor be sure of what was behind us.

Reflection and evaluation of Educational technology projects

With educational technology projects there can often be an assumption that change, in particular, improvement is required (Spector & Yuen, 2016). The focus for evaluation is then to what extent the desired change or improvement took place. Romiszowski (2004) created a matrix of possible problems and their causes for E-learning projects which included problems in the design/decision-making process (such as need, context, constraints, risks, logistics and infrastructure) and problems in project execution (namely, project planning and implementation, project management and evaluation) (23). While Khan's framework for e-learning focuses on eight dimensions: Pedagogical; institutional; technological; interface design; evaluation; management; resource support; and ethical considerations (Khan, 2003). As Spector and Yuen (2016) state 'an explanation of why observed changes did or did not occur as planned is a primary focus of evaluation' (13). Tennyson (1995, cited in Spector & Yuen, 2016) developed a more complete model of evaluation of projects that included the domains of design, foundation, production, maintenance and implementation as well as situational evaluation. This type of evaluation divides educational technology changes into projects, programs, products, practices, policies and combinations of these. Theory-based evaluation, also termed theory of change, or the intervention logic, might include implementation theory or program theory. There can also be theory-driven evaluation which can be understood as causal-model evaluation and considers which components of the change worked well and which did not. Effective evaluation of educational technology projects requires effective planning and project management, for example gap analysis – the project is conceived to fill an identified gap. Evaluation is difficult if there has been no logical chain linking a current problem or situation to a desired goal to improve the problem or situation with a proposed intervention or solution. Too often we perhaps presume that form, such as an intervention, follows function, for example a defined purpose of intended outcomes. While in some projects the introduction of digital technologies per se is the objective in other instances it

is a tool for achieving other goals (Pettersson, 2018). However, whatever the goal of the project, digital knowhow is not enough to implement lasting change, technological, pedagogical and organisational understanding are still needed (ibid). As Kenny (2004) stated:

> new learning technologies require staff not only to acquire skills in using the technology in a learning environment, but also to re-consider its implications for educational design and teaching practices (391).

In relation to educational technology projects it has been found that pedagogy is important to the success of such projects (Kenny, 2004; Khan, 2003), as well as planning (Romiszowki, 2004) and enthusiasm (Kenny, 2004). Kolb (2017) encapsulated these elements as engagement, enhancement and extension.

Schools identified as digitally competent schools have been divided into two different categories: Goal-oriented schools; and culture-oriented ones (Pettersson, 2018). An important finding in Pettersson's study was that in goal or structure-oriented schools there was more focus on formal structures and courses for professional learning while in culture-oriented schools there was more emphasis on collegial learning. This difference between schools in relation to digitisation has also been found in relation to how new teachers are treated in learning environments with expansive and/or restrictive practices (Attard Tonna & Shanks, 2017). Without collegial support teachers can suffer stress, what Syvänen, Mäkiniemi, Syrjä, Heikkilä-Tammi and Viteli (2016) termed 'technostress'. In educational technology projects it can be necessary to learn about new tools and technologies which may lead to an increased workload and less time for other duties. If we can critically reflect on the implementation of educational technologies then we can avoid what Brookfield (1995) referred to as being the victims of fate; we can combat our own exploitation; we can teach with excitement and purpose; we can be grounded in practice; and we can know that what we do can change the world by developing trust and maintaining democracy (265-267).

Methodology

In order to explore the educational technology projects that I have been involved in I used a process of reflection. The aim was to understand why some projects were more successful than others. Dewey defined reflection as 'an active, persistent and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends' (1933: 9). He saw reflection leading to a conclusion while not specifying the mechanics or process of how to reach that conclusion (ibid). Following a systematic literature review Marshall provided the definition: 'Reflection is a careful examination and bringing together of ideas to create new insight through ongoing cycles of expression and re/evaluation' (411). Reflection has been defined as an 'in-depth

review of an event' (Bolton, 2018: 9) with the reflector considering 'why?' questions. This can bring experiences into focus, particularly if many angles are considered including people, places, relationships, timing, chronology, causality and connections (ibid). Beyond reflection, reflexivity leads us to work out how our own presence has influenced knowledge and actions. Argyris and Schön (1974) wrote of practice development as single loop reflection and then double loop reflection and reflexivity which includes more why questions. Kolb (1984) wrote of the need to examine our beliefs and theories and Schön referred to theories-in-use as well as reflection-in-action and reflection-on-action (1983; 1987). When being reflexive it can be disconcerting to realise things that went unnoticed at the time of the events. In this situation it is necessary to reflect on the pressures and prevailing discourses and ideologies which may have distorted perceptions at the time. By examining the political and social structures that influence or prevent action we are doing more than practising a confessional. As a critical reflective and reflexive practitioner, I wish to understand the core of my practice in the educational technology projects I have worked on. It is important to challenge assumptions about ourselves and our work. In one project covered in this paper Massive Open Online Courses were found to be a 'means of achieving the reflexivity required for lifelong learning professionals to meet an emerging need linked to online learning with their participants' (McArdle, Al Bishawi, Marston & Shanks, 2015: 25).

By looking at problematic situations we can begin the process of working out solutions as Schön (1983) stated:

> When we set the problem, we select what we will treat as the 'things' of the situation, we set the boundaries of our attention to it, and we impose upon it a coherence that allows us to say what is wrong and in what directions the situation needs to be changed. Problem setting is a process in which, interactively, we name the things to which we will attend and frame the context in which we will attend to them. (40)

The implementation of educational technology is a problem that cannot simply be solved by the application of professional knowledge. First, it is necessary to 'set' the problem. This often involves widening our vision to include aspects of the context within which the problem rests - economic, political, social, educational and so on - to explore multiple definitions of the problem and the key concerns. If too tight a focus is taken with complex problems, such as introducing new practices or tools, too soon in the process of problem setting, this can lead to defining the problem prematurely and perhaps examining the problem from limited theoretical, philosophical or other perspectives.

Brookfield (1995) set out four lenses through which we can reflect on our teaching: Our own eyes; students' eyes; colleagues' eyes; and through the lens of literature. This paper may only achieve the first lens, the autobiographical one, but as a researcher and user of educational technology it is an important first step to acknowledge what has gone before to

understand professional practices as both researcher and university teacher. As Brookfield notes, critical reflection entails dangers as well as hopes, and the pressure to publish can result in people focusing on positive outcomes rather than learning from mistakes. Reflective practice can also be understood as a form of experiential learning as it entails learning from, sometimes painful, experience, learning from failures as well as successes.

By reflecting on the educational technology projects, I have taken part in, I wish to take part in what Jarvis (2003) terms the higher forms of reflective learning which enable us to develop individually and collectively. These higher forms of learning include contemplation, reflective practice and experimental learning. There is a real danger that if we do not take time to reflect, then much of our experience will remain at a level, which is neither critically examined nor used as a springboard for further development. As Tarrant notes 'Reflection should be something initiated by the individual, for the individual' (2013: 64). However, reflection can also take us beyond our own actions. By critically reflecting it is possible to better understand the ideological basis for the implementation of educational technology. The figure below shows how experiences can be used in a reflective process to produce new perspectives and be ready to change behaviour in future activities.
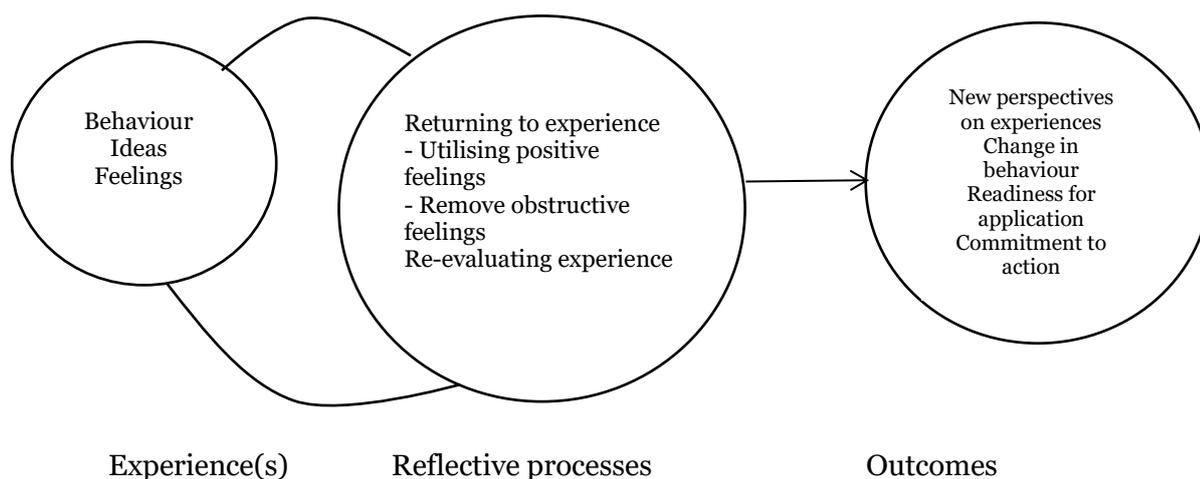

Experience(s)   Reflective processes   Outcomes

Figure 1. The reflection process in context (adaption of Boud, Keogh & Walker's 1985 model).

After reflecting on one project on which I worked for two years, I then considered the many other educational technology projects I had worked on as a freelance researcher and/or permanently employed academic. I used Boud, Keogh and Walker's 1985 model (see figure 1 above), to understand the experiences of working on these seven different educational technology projects. In this process of reflection, I considered the lessons that had been 'learnt' and/or reported at the end of each project. Lessons such as understanding that the hardware should not overshadow the pedagogy (two school projects), that overcoming people's lack of confidence using digital technology was important (professional learning project), that it was hard to change practice (multiple projects), then I thought about what was present and also what was missing in the successful and unsuccessful projects. I

considered questions that would be useful for future projects: Could participants/stakeholders explain why the educational technology was being adopted/implemented? Secondly, were the teachers and students passionate about using the technology? Thirdly, what planning had been done? Finally, on what pedagogical basis was the educational technology being adopted?

In the table below I provide some anonymised details of the seven projects that I reflected upon.

Table 1 Details of the seven educational technology projects that were reflected upon.

Scope of the project	End results
Bespoke software to analyse video recordings of everyday classroom activity. Pupils and teachers identified pupils' learning moments.	Municipality firewalls prevented school access to the project software. Two teachers who were fully engaged in the project had both previously studied at a distance.
Proto-type MOOCs for professional learning of rural and remote practitioners with aim to model MOOCs as a learning tool for them to then use in their practice.	Some practitioners were prevented from accessing the MOOCs because of work firewalls. Practitioners enjoyed the second MOOC which had one platform (Google Communities). The project did not have the ripple effect intended with no subsequent practitioner-led MOOCs.
iPads used in a cultural and heritage outdoor learning project	Multiple digital artefacts (e.g. an e-book, a podcast, an animated film) were created by different classes and schools.
iPods for all pupils and teachers in one primary school	Mixed results with some teachers using iPod activities as a 'treat' to do when other work was finished.
Schools and a university sharing learning spaces for professional learning, initial teacher education and pupil learning with live video conferencing via interactive smartboards	Initial teacher education students observed school classes and eight schools joined together in some live activities.
1-to-1 iPads for secondary school pupils and teachers	Several teachers incorporated the use of iPads into their teaching and learning in action research projects. The use of iPads for reflective blogging activities was most popular.
Podcasts for parentcraft (antenatal) education in remote rural areas	Podcasts became integrated into the text service the health authority had implemented with reminder texts and links to the podcasts sent to all pregnant women.

While there are similarities with Kolb's (2017) Triple E Framework (engage, enhance, extension) I assessed the projects using a four-part framework of purpose, planning, passion and pedagogy. Kenny's (2004) study relating to the management educational technology projects in universities referred to the need for autonomy, a distinct but flexible team with shared goals, good communication, enthusiasm, staff development and support at all stages of the project. I use the term 'passion' in my framework rather than

'enthusiasm' as I considered that more than enthusiasm was needed to see a project to fruition. There had been enthusiasm for the project I was analysing but this had not been enough to make it successful, in particular it was not sustainable. After reflecting on my experiences in that one project I then turned to my experiences in other educational technology projects. As table 2 below shows there were very few projects that I have assessed as being excellent to good in all four areas. Often a lack of communication compounds deficits in the four areas (Al Bishawi, 2015). Clearly if a project is lacking purpose then it is unlikely to be well-planned with a clear pedagogy, however some projects did have a clear purpose which focused on pedagogy but then were not planned out well and lacked passion in the organisers and/or practitioners/participants. For ethical reasons, the projects are not named (Brooks, te Riele & Maguire, 2014).

Findings

It is useful to note that the educational technology projects mainly took place across the north of Scotland, including in remote rural areas. The use of educational technology can be a solution to different types of isolation. There is physical isolation from centres of population but also professional isolation, for many are sole practitioners who do not have the opportunity to meet or collaborate with colleagues in their field on a regular basis, for example school subject specialists, Gaelic medium educators and Community Learning and Development practitioners.

The seven projects included in this reflective process involved educators in the school, community and higher education sectors. Four projects centred exclusively on participant learning: One with primary school pupils learning with iPads (Shanks & Bain, 2015); one with primary school pupils learning with iPods (Cornelius & Shanks, 2013, 2017); and one via podcasts with parents-to-be (NHS Highland, undated). Two projects covered both professional learning and the teaching and learning of school pupils: Using 1 to 1 iPads (Shanks, Coyle & Thomson, 2017); and videoing lessons and teacher education students through live smart board video conferencing (Al Bishawi, 2015). One project exclusively concerned professional learning: Community Learning and Development practitioners learning in mini-MOOCs (McArdle, Al Bishawi, Marston & Shanks, 2015; McArdle, Al Bishawi & Shanks, 2015).

In the table below I have brought together the reflections that I noted for each project and what actions I would take in the future. I present my assessment of whether a project had a clear purpose, good planning and project management, the extent to which key players were passionate about the project, and whether there were clear pedagogical goals. In the final column I have noted how I would act differently if I was involved in a future version of a similar project. I have changed the order of the projects from Table 1 in order to anonymise them as much as is possible. The projects are rated 1 for excellent to good, 2 for adequate and 3 for poor.

Table 2 Reflections on my experiences of seven educational technology projects (rated 1 for excellent to good, 2 for adequate and 3 for poor).

Purpose	Planning	Passion	Pedagogy	Future actions
Authentic and clear purpose. (1)	Detailed planning and well-developed project management. (1)	Teachers, pupils and local authority staff were all keen. (1)	Clear goals for pupil learning and professional learning also took place. (1)	Ensure staff are involved in planning their own projects.
Time was taken to ensure that there were clear goals for the implementation of the technology devices. (1)	Detailed planning linked to a Masters course. Good project management – organised to suit the staff involved. (1)	Many teachers and pupils were enthusiastic. (1)	Teachers completed a Masters course based on the changes they introduced. (1)	What worked best was making the teachers choose their own project.
Initially there was not clarity but after individual visits to the schools and teachers each teacher found an individual purpose. (1)	There were some difficulties with firewalls which prevented teachers using the project software in schools. This was a planning error. (2)	Teachers, pupils and university staff were keen but other stakeholders were not so interested. (2)	Professional learning for teachers and the enhancement of pupils' metacognition skills. (1)	Do more at the beginning and throughout the project to ensure buy-in from all stakeholders.
It was left up to each teacher how to deploy the technology so there was no clear purpose for the school as a whole. (3)	Due to the donation of technology devices there were not clear goals or planning to begin with. (3)	Some of the teaching staff, younger pupils and local authority staff were keen. (2)	Pupil learning was the focus of the project with teaching staff also learning along the way. (2)	Taking more time to discuss clear pedagogical goals with each teacher.
Clearly defined purpose which was part of a research project. (1)	Some detailed planning but also tension between project members about the use of different technologies. At times it felt like we were 'spinning plates' online as so many different platforms were being used simultaneously. (2)	University staff and some practitioners were enthusiastic, but it was hard to introduce technology to those who saw themselves as 'people people'. (2)	The pedagogy was clear – to enable more reflexive practitioners. (1)	Take time to ensure clear understanding between educationalists and technologists.
There was a very clear purpose – to ensure availability of up to date information in an accessible way. (1)	Detailed planning took place with scripts peer reviewed. (2)	Some hospital staff were more passionate than others. (2)	Aim to increase knowledge, understanding and confidence of parents. (2)	Successful project due to determination of key staff members.
Purpose was not clear at beginning and due to high turnover of headteachers the	The project had many strands and themes and a focus on a smaller number of themes may	Not all teachers, local authority staff and university staff were keen. Several	Learning for pupils, teacher education students and	Application process for schools. Educationalists and technologists

Purpose	Planning	Passion	Pedagogy	Future actions
agreed themes were not 'owned' equally by all stakeholders. (3)	have been easier to manage. (3)	headteacher changes in the schools. (2)	professional learning of teachers. (2)	spending more time together at the start.

In the next section I discuss the four factors in relation to the overall success of the projects.

Discussion

In this study a series of reflections were performed on seven educational technology projects that the author had been involved in. From these reflections several factors to increase the likelihood of success for a project emerged: Purpose; planning; passion; and pedagogy.

In one of the most successful projects the teachers and learners appreciated that the technology was not simply being used for the sake of it. In that particular project mobile devices enabled various artefacts to be created such as an e-book, a podcast and an animated film. There was a clear purpose for the activities: To link local history and places together by the pupils through digital technologies and the key aim for the education administrators, that of improved literacy, was achieved. Without a clearly defined purpose for educational technology projects it may be harder to persuade people to set aside the time to learn how to incorporate it into their everyday practice.

Closely aligned to having a clear purpose for an educational technology project is planning the project. As noted above, my intention in this study has been to reflect on my experiences of educational technology projects, reflecting on the positive and negative aspects in order to re-evaluate my experiences and learn from these reflections for future projects. While reflecting on the seven projects in terms of planning, I assessed them as excellent/good (two projects), adequate (three projects) or poor (two projects).

Planning can be understood as a project management issue but is linked to school culture. Petterson's (2018) study found that school culture was a defining feature in relation to digital technologies:

> a digitally competent school organization can be said to embrace the environment in which actors and practices are given room to change and evolve, where conditions for new forms of digitalized teaching and learning are provided and where goals on digitalization and educational change can be accomplished.

Furthermore, Petterson (2018) notes that it is necessary that a school is well-organised for there to be digital learning that is sustainable with 'shared goals and visions in both long-

term and short-term perspective' and that what is needed is 'an organization that recognizes the importance of supporting its actors and what culture and structure are needed for sustainable technical and pedagogical development'.

In relation to a time-limited project, the level of passion for the project may be linked to school culture. Without passion those involved may see involvement in an educational technology project as an additional duty that takes them from other more 'important' work. Organising collaboration, joint events and training can be difficult but planning how and what to do together is an essential part of a successful educational technology project. In one of the projects I worked on the schools that took part were allocated by the municipality rather than the schools asking to take part and this appeared to impact on the level of passion for the project. One reason that teachers and other educators may shy away from educational technological innovation is that of 'technostress' (Syvänen, Mäkiniemi, Syrjä, Heikkilä-Tammi & Viteli, 2016) and as I noticed when reflecting on the various projects I have been involved in, if teachers or other professionals were not keen or passionate about the project then it was much harder for the project to be successful. Part of the lack of passion was likely to have been due to the factors that lead to technostress, namely competence in using the technology, their style of teaching fitting with the use of the technology, support from the school, and their attitude to educational technology (ibid).

I found that without clear pedagogical goals for an educational technology project it is hard to define its purpose or create and sustain passion for it. Kenny (2004) stated it is imperative that learning is embedded into technology projects. Neither new pedagogical goals nor new knowledge are necessarily required as existing goals and professional knowledge may simply be achieved and deployed in new ways. For example, in the creation of a new data observatory, much of the professional knowledge and skills utilised in the development of the project were already known; it was the way in which they were then brought together that was unique (Shanks, Scharlau, Saevanee & Stelfox, 2018).

As noted above the themes that developed when reflecting on my experience in multiple educational technology projects was that for successful change to take place it was important to have clear purpose, planning, passion and pedagogy. Without a clearly defined purpose for the introduction of new technology, people will not set aside time to learn how to incorporate it into everyday practice. Organising collaboration, joint events and training can be difficult but planning how and what to do together is an essential part of partnership working. In several projects there were challenges that needed to be overcome when developing digital professional learning communities and it has been found that issues of power and control are often absent in discussions of workplace learning (Hodkinson, Hodkinson et al., 2004). Without passion those involved in such work see it as an additional duty that will take them away from other work. If there are no explicit and defined pedagogical goals, then it will be difficult to track or assess the

difference that the educational technology has contributed to.

Conclusion

In this small-scale personal reflection on seven educational technology projects I have attempted to understand what factors I could use to increase the likelihood of success for future projects. I saw that without a clearly defined purpose it was harder to persuade people to set aside the time to learn how to incorporate new technology into their everyday practice. In addition, to ensure passion for a project it was not helpful for municipality staff to choose which schools would take part in a project rather than asking for schools to apply. From several projects I saw that technical issues needed to be speedily resolved. After difficulties in one of the seven projects, a new position of 'Relationship Manager' was created in a university in order to ensure that researchers and IT colleagues were able to communicate more usefully. This leads back to Kolb's advice not to be a bystander but to shape what happens:

> For the reflective person the awakening of the active mode brings a new sense of risk to life. Rather than being influenced, one now sees opportunities to influence. The challenge becomes to shapes one's own experience rather than observing and accepting experiences as they happen. (1984: 145).

While many educational technology projects and programs are not planned nor executed as we would want, there are other problems such as the lack of evaluation of wider digital technology policies (Spector & Yuen, 2016) at municipality, regional and national level. Through this study I have attempted to learn from my involvement in past projects in order to influence and shape future experiences. It is hoped that this work can help to link practice back to research as well as indicating a way for lessons to be learnt in future educational technology projects.

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