

‘Being in the kindergarten of blended learning’: Exploring teachers’ processes for sustainable blended learning practices

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The potential of blended learning has yet to be reached and this paper presents an alternative lens for researching teachers who work with blended learning environments. The teachers’ role in creating blended learning environments is not yet well understood. This paper proposes the Social Construction of Technology (SCOT) as a model that may be used to explore the processes that teachers engage in when creating blended learning environments. Exploring the ways in which teachers are creators of blended learning environments provides a new lens for sustainable practice. This may signify a shift away from the focus of attempting to create a perfect product to an emphasis on sharing the process development. This paper first presents an overview of the SCOT model which is followed by examples of the ways in which the SCOT model was applied in a recent research project.

Keywords: Social Construction of Technology (SCOT), blended learning environment, blended teaching, sustainable process, teachers’ perspectives.

Introduction

Current research in the field of blended learning has focused on the use of technologies for learning activities and their inclusion in curriculum design. Motivation to use blended learning is evidenced in the literature in phrases that allude to “the best of both worlds” (Gruenewald, 2003; Nielsen, 2008; Ward, 2004) and the “hope for the 21st century” (Connolly, Jones, & Jones, 2007; Daniel, 1997). Daniel (1997) indicated that ideas for the potential of blended learning have been anticipated for some time, however much of this research has had a student focus and the area of teachers (as future makers), has remained under researched. There is a scarcity of literature that looks at exactly how blended learning environments are created by teachers from the teachers’ perspective. However, there is an abundance of literature about advice, design, and reports on what has happened (Bonk & Graham, 2006; Littlejohn & Pegler, 2007; Stacey & Gerbic, 2009). Accounts of the ways in which teachers are transitioning to blended learning are now appearing in the literature (Samarawickrema, 2009; Wiesenberg & Stacey, 2009; Wilson, 2011) however detailed accounts of the teachers’ perspectives are yet to be fully explored (Gerbic, 2011).

The SCOT model is put forward in this paper as a theoretical model that may be used as a lens to view the work in which teachers are engaged. Furthermore the model provides a way to investigate the iterative processes of creating blended learning environments, which may be used to focus on sustainable development. This paper theoretically locates the SCOT model, describes the four stage model followed by suggestions to mitigate the critiques of SCOT in the context of teachers’ practice in creating blended learning environments. The paper concludes with a brief overview of the SCOT model applied to a recent research project, highlighting aspects that may support a focus on teachers as future makers and their sustainable practices.

Concepts underpinning the SCOT model

SCOT provides a theoretical perspective for understanding technological development from within the constructivist paradigm. The basic premise of the SCOT concept is that there is no one correct way for technologies to be developed and that variation in development occurs as a direct result of the different people involved and their social connections (Pinch & Bijker, 1984). Prell (2009) expands the SCOT definition stating that: “Technologies emerge from social interactions among social groups... SCOT sees no ‘right’ or ‘wrong’ technologies, as all technologies have the potential to be shaped differently” (p. 2).

Foundational to the SCOT model is that there are various ways in which technology could be developed. Oliver (2011) contends that SCOT can be used as an alternative way to conceptualise the relationship between education and technology which has often been deterministic in nature. Pinch and Bijker’s (1986) concept counters technological determinism that allows for only one right way in which technology can develop.

Therefore it is a good fit to apply the SCOT model to viewing the multifaceted field of blended learning. One of the challenges in the field of blended learning is that there is great variation between how this concept is understood and applied. Sharpe, Benfield, Roberts and Francis (2006) specifically stated that “the term blended learning is difficult to define” (p. 24). Pinch and Bijker state that there are many ways in which artefacts could be developed (‘artefact’ is the terminology used in SCOT to describe technological developments), as a result of the different people involved (which in SCOT terminology are referred to as the relevant social groups [RSG]) and the choices they make in the construction of their technology use.

The SCOT model

Pinch and Bijker (1984) developed a model comprised of four interrelated stages which are RSGs, interpretive flexibility, closure and stabilisation (Pinch & Bijker, 1986; Prell, 2009). Table 1 is an adaptation of Prell’s (2009) presentation of the model with a brief description and key concept displayed beside each of the four stages.

Table 1: SCOT four stage model adapted from Prell (2009)

Stages in the model	Key concepts
1. Relevant Social Groups (RSG)	May or may not be members of the same institute RSG has a shared interpretation of the artefact
2. Interpretive flexibility	Numerous interpretations of the artefact exist Each RSG has their own interpretation
3. Closure	Multiple interpretations cease to exist Interpretive flexibility diminishes and an approach is chosen
4. Stabilisation	The development of the artefact within the RSG This happens in degrees

The SCOT assumption that technologies are socially constructed and shaped by the people active in the development process is the starting point for the SCOT model. RSG is the term used to describe those involved in the process. Once the RSG is identified, the focus then moves to “interpretive flexibility” which is the beginning of the development phase where numerous possibilities and variations are explored. When the development phase becomes concentrated on one particular idea, the artefact is said to have reached “closure” where the RSG reaches agreement to develop aspects of the artefact (for example the Learning Management System [LMS]) and “stabilisation” when the actual artefact is developed. The stages of the SCOT model are expanded upon next with the connection to social constructivism highlighted.

SCOT Stage 1: RSG

Defining the different people involved and categorising them into RSGs is the first stage of the SCOT model presented in Table 1. RSGs are defined as a group that shares a common purpose or understanding of the artefact (Prell, 2009). The primary reason for identifying a RSG is to provide a useful starting point for research, however it is also noted that some researchers may find this too simplistic (Pinch & Bijker, 1986). Humphreys (2005) recognises that “the choice of relevant social groups is highly subjective and dependent upon the researcher” (p. 234) and that this is a way in which to simplify the focus that may include biases. Pinch and Bijker (1986) assert that the RSG need only be sufficiently defined for the context at hand, and that exhaustive locating of social groups was not the goal since “all groups and structures are themselves embedded within an endless web of other groups and structures” (p. 353). This approach is well aligned with social constructivism.

The term RSG indicates that there can be more than one group, and research can focus on a particular group or several RSGs, which may or may not be from the same institution. The RSG may be a group that has existing connections, or the connection may be constructed entirely for the purpose of the research where people with similar views of the technology are considered as a RSG (who may never have met or have little connection in real life).

SCOT Stage 2: Interpretive flexibility

Creating multiple interpretations for the artefact is the definition of the interpretive flexibility second stage of the SCOT model (Pinch & Bijker, 1984). This is an explorative phase during which different ways of designing and working with the artefact are explored. The theoretical position of SCOT is that all technologies could be different and the final design is dependent on the RSG (Pinch & Bijker, 1984). The malleable nature of

technology is inherent in this stage of the SCOT model; it is the different interpretations of the artefact by the RSG that is explored. This is supported by Meyer and Avery (2010) who noted “studies that unearth the developmental stages of a technology and follow it through its implementation phase show that users are not passive [and] they are capable of interacting with technologies in ways the designers may not have predicted” (2010, p. 158). Humphreys (2005) contends that there can also be flexibility of structure concerning how the artefact is understood. Pinch and Bijker (1984) clarified that interpretative flexibility applied to both the way in which people thought about the artefacts and the variety of ways in which the artefact could be designed and used.

The way in which the artefact is interpreted is therefore flexible and socially constructed by the RSG. Interpretive flexibility is the stage where variations are explored by the RSG. The socially constructed ideas may be developed within and between RSGs (Pinch & Bijker, 1984) and also potentially within sub-groupings of RSGs (Humphreys, 2005). The first two stages of the SCOT model are closely connected and demonstrate the connection between social constructivism and the SCOT model.

SCOT Stage 3: Closure

Closure occurs when the RSG develops a tighter definition for the artefact and defines how the technology has become an accepted part of their practice (Pinch & Bijker, 1984). Prell (2009) describes closure as a diminishing of interpretations, and Bruun and Hukkinen (2003) identify closure as the streamlining of interpretations. To clarify the shift from interpretive flexibility to closure, the RSG moves from multiple interpretations in interpretive flexibility to a shared definition of the artefact in closure. There are several ways in which closure is reached ranging from a redefinition of the problem, rhetorical closure, or consensus of a definition by the RSG (Humphreys, 2005; Pinch & Bijker, 1984). Bruun and Hukkinen (2003) state that closure is never truly reached and that technology continues to develop. However, this is not necessarily seen as a problem because technologies are constantly evolving, which becomes part of the development cycle (Pinch & Bijker, 1986) and process of technology development (Bijker, 2010). The approach by the RSG viewing technology as a development process is the point at which SCOT may be used to explore continued and therefore sustainable practice adopted by the RSG.

SCOT Stage 4: Stabilisation

Stabilisation, the final stage in the SCOT model, occurs when the actual artefact is developed and used (Pinch & Bijker, 1984; Prell, 2009). Stabilisation may happen in degrees (Pinch & Bijker, 1984) or as a fluid process (Prell, 2009), where the refined definitions attached to the artefact are developed over time both within one RSG or across different RSGs. To expand this point further, the development of ideas across the RSG must allow time for the social interactions (social constructivism) to take place, and the clarifying of definitions may take several such interactions. Rosen (1993) clarifies stabilisation in that “the characteristics of this artefact then come to be ‘taken for granted’ as the essential ‘ingredients’ of the technology” (p. 483). Stabilisation can therefore be described as both a social and a slow process. Humphreys (2005) identifies the major critique of stabilisation, in that Pinch and Bijker (1984; 1986) do not state what happens if stabilisation is not reached (they only go so far as to say that it happens in stages). Humphreys (2005) raises concern that this process of stabilisation happening in degrees is insufficient and suggests a more flexible approach, by focusing on the way in which the artefact is spoken about, used, and structured.

Closure and stabilisation are described as “two sides of the same coin” (Bijker, 1997, p. 85). Humphreys (2005) further characterises the distinction by stating, “the most pertinent difference between stabilisation and closure is that closure is about relevant social groups while stabilisation is about the artefact” (p. 243). These explanations provide a simple way to distinguish between the last two stages of the model.

Critiques of SCOT concept and model

There are a number of critiques of the SCOT concept, focused primarily on the RSGs and the overemphasis of their function (Jasanoff, 2004; Russell, 1986; Winner, 1993). Initially SCOT critics argued that SCOT was a form of social determinism (Hughes, 1994; Lipartito, 2003; Russell, 1986) in that although SCOT views the many possibilities for development of the artefact, the choice of and focus on RSGs that shape this development is linear and determined by the researcher who might only focus on the groups that had successful impact on the development, as opposed to groups that did not influence the development, thereby being deterministic in approach. Winner (1993) continues this line of argument by stating that SCOT research is superficially focused on the chosen RSG and does not allow for other groups to be considered.

In the context of applying SCOT as a lens to view teachers practice in blended learning, I contend that multiple RSGs can be used to focus on the different aspects of blended learning usage. Multiple views of different RSGs can be clearly explored using the SCOT model.

The next critique takes this point further by stating that SCOT excludes the RSGs who do not influence the development of the artefact (Wajcman, 1995, 2010). The idea that is of note within this critique, is that issues of social power and political standing are not addressed by SCOT (Winner, 1993). The social groups whose ideas are not considered are ignored, and even more concerning is that those without a voice are ignored completely, thus allowing for a selective view of technological development (Winner, 1993). This critique generated a subfield within SCOT research led by one of the seminal authors concentrated on ways in which users (and non users) of technology have important consequences for research (Oudshoorn & Pinch, 2003).

Variations of the SCOT model have been developed that extend the model beyond the first four stages. Most notably Bijker (1994) extended the model with a further four stages to enable research to include a focus on the issue of power relationships (which is also the model that Prell [2009] extends). Bruun and Hukkinen (2003) propose the combination of models: evolutionary economics (EE), SCOT and Actor Network Theory (ANT). Alternatively, Dayton (2006) explores the full cycle of development within a workgroup “as they collectively learn, analyse, adopt, and redefine a new information technology (IT) tool or system” (p. 355). In order to see these developments fully, Dayton combines SCOT with the adoption and diffusion theory (ADT, first put forward in 1962 by Rogers [2003]) and cultural–historical activity theory (CHAT, developed and discussed in relation to social construction by Engestrom, [2000]). Other strategies to mitigate this critique would be to select multiple RSGs to represent the different roles (users, producers, bystanders and advocates) in technology development (Humphreys, 2005) or to potentially create a new model in the application of SCOT.

Utilising SCOT to focus on the application of software is supported by the research conducted by Jump (2011) and Prell (2009). More specifically, I contend that the SCOT model can be used to research the teachers’ use of software in the creation of blended learning. Van Lieshout, Egyedi, and Bijker (2001) found in relation to teaching with technology that “it depends almost solely on the intrinsic motivation of individual teachers” (p. 14), which I contend is a valid point in relation to the current technologies and investigation into the teachers’ processes. Literature concerned with the application of SCOT highlights the need for research studies that focus on the actual use of technology (Bissell, 2010; Edgerton, 2004; Winner, 1993). Specifically, in the area of ICT it has been noted, “the whole area of practical use of ICT-supported learning technologies appears to be under-researched” (Bissell, 2010, p. 539). Winner (1993) critiques SCOT for ignoring the consequences of technologies after they have been developed. Therefore, it may be important to plan for research projects that follow development beyond the development phase through to the practical application of ICT in blended learning environments.

SCOT applied to a specific research project

My research project focused on applying the SCOT model to provide visibility of the ways in which teachers create blended learning environments, a necessity argued by Cornford and Pollock (2002). Researchers in blended learning have found that the role of the teacher is changing significantly (Kaleta, Skibba, & Joosten, 2007). How teachers are actually changing their work, and the approach they use when creating a blended learning environment, is the gap on which my research project focused. The project I undertook was a masters thesis investigating “Teachers’ creation of blended learning environments at a campus-based university” (Wood, 2011). The project was focused on the practices within a single university in a large New Zealand city. Purposeful sampling including snowballing was used to select the six teachers from different study areas across the university. The way in which the teachers who participated in the research study were identified as an RSG stemmed from their descriptions of their role that empowered them to make changes with the LMS (specifically Blackboard™ at the case study site). Their shared belief was that they could shape the LMS to suit their own teaching practice and that this was a choice they had made at differing stages of the LMS implementation. It is important to note that the teachers in this research study were not all early adopters of the LMS technology.

Interviews were selected as the main data gathering tool to support the investigation into discovering the new invisible work that the teachers had undertaken in relation to developing blended learning environments. Specifically a two-phase semi-structured interview was the main tool used to collect data, which was supported by a demographic detail form. The data gathered from the interviews was in the first instance analysed thematically with the use of mind mapping. When it became apparent that the rigor of the case study could be improved by the application of a theoretical model, the SCOT model was applied strengthening the connection to the social constructivist case study approach. To summarise, thematic coding was the first cycle of analysis

which generated broad themes. The SCOT model was the second cycle of analysis applied to the themes generated in the first cycle. The next section of this paper highlights the way in which the SCOT model was applied in my research project.

SCOT Stage 1: RSG comprised of teachers using the LMS

Pinch and Bijker (1986) stated that it is useful for researchers to identify the RSG and their shared interpretation of the artefact as a starting point. The RSG in this research study was based on identifying the teacher participants as active users of the LMS. The participants' shared interpretation of the LMS was that they each recognised a potential to improve their teaching practice through incorporating the LMS. The choice to use the LMS was made of their own free will, and while it was strongly supported by the institution, it was not a requirement. This RSG of teachers shared interpretations were founded on their willing and autonomous shaping of the LMS to develop their own blended teaching practice. The research project revealed that the teachers self-directed choice to use the LMS, and the influences that supported them, were critical to their engagement in the blended learning design process. The use of institutional support was evident in the range of grants and individual work that the participants undertook utilising a range of training options. Therefore these supporting internal and external influences may be important considerations for teachers generally when engaging with the blended learning design process. Lindsay (2003) states that users actively co-construct their identity in relation to the technology they use, these identities could then be used to develop sub groupings for future research. Meyer and Avery (2010) heralded the need to specifically focus on teachers as users of technology. These distinctions could be used in future research projects as the foundation for additional sub groupings within the RSG focusing on teachers as users of technology and the ways in which they co-construct their identities.

SCOT Stage 2: Interpretive flexibility in the teachers' exploration of the LMS potential

Interpretive flexibility in my research project was characterised by the participants' experimentation with the LMS and the range of potential they described. The data show an exploratory phase in which the participants focused on using the new tools that the LMS afforded. Exploring the use of new tools led to many interpretations of the way in which the LMS could be used. Experimentation was a pivotal aspect of interpretive flexibility. The project illustrated that in essence the teachers chose the better of the two environments (online or face-to-face) for their learning content as a result of exploring the LMS options, and decided what to put back into the face-to-face classroom. Awareness of this possibility drove the participants to experiment with the ways in which the LMS allowed them to create the best blend of both environments. The participants focused on what the addition of the LMS allowed them to then do in their face-to-face classroom, rather than just focusing on the LMS technology and what they could do online, revealing a dynamic impact between the LMS and the face-to-face settings. Interpretive flexibility made the dynamic nature of the blended learning development process apparent. Power (2008) suggested the need for investigation into how teachers plan for online teaching. An interesting way to extend Power's suggestion would be to investigate how online teaching may impact on face-to-face teaching, thereby taking a holistic view of the impact of blended teaching.

SCOT Stage 3: Closure in the teachers' approach to continued use of the LMS

The final two stages of the SCOT model are closure which focused on the people and stabilisation which focused on the technology (Humphreys, 2005). Table 2 clarifies the nuanced distinction between these phases in relation to my research project.

Table 2. The distinction between closure and stabilisation

Closure	Stabilisation
Focus is on the RSG (humans – in this case teachers) and their approach to using the LMS	Focus is on the LMS (technology) and how the technology is put to use (developed)

SCOT closure is the stage where the teachers shifted from multiple interpretations about the LMS to a focus on their practice and how they would approach using the LMS. A key idea expressed by the participants was that they were at the beginning of developing their own blended learning practice, which one participant identified as being at the kindergarten stage of blended learning. The LMS had become an accepted aspect of the teachers' practice and they could no longer imagine teaching without the LMS. The participants described their plans for

using the LMS, the associated procedures and administrative tasks as well as LMS uptake by their wider team. These factors provide evidence of the LMS becoming a fixed aspect of their individual teaching practice which included an acceptance of the continual development that was required to maintain the use of the LMS. Their approach demonstrated closure in the development of their preferred teaching environment and in the commitment to the long term development processes the LMS required. As a result the teachers developed a mature and sustained understanding of the purpose of the LMS and the impact it had on changing their approach to blended teaching with the LMS technology. These descriptions may go some way towards “[taking] stock of what it is that teachers now do” (Selwyn, 2010), and illustrate the broader range of planning and procedures that teachers now need in order to become proficient in managing their teaching context. These concepts illustrate how SCOT may be used to highlight areas to focus on in the development of a sustainable approach to blended teaching practice.

SCOT Stage 4: Stabilisation of the teachers’ implementation of the LMS

Stabilisation is the stage where the LMS technology was physically developed through use of the LMS by the RSG. The technology in this research study was software, therefore it was the configuration (and implemented use) of the LMS software that constituted technological development. It is important to recognise the intangible nature of the LMS software. While the participants did reach stabilisation in their application of the LMS, Prell (2009) describes the development of software as a fluid process of stabilisation. The participants view that their course with the LMS could continue without them (in case of an emergency), signaled that development had taken place, indicating achievement of Pinch and Bijker’s (1984) concept of stabilisation. However, ideally the participants wanted to perfect their LMS course prior to sharing the LMS aspect of their blended environment. The participants developed a clear way of working with the LMS through their application of the software, which illustrated Rosen’s (1993) view that stabilisation may be observed when the technology is perceived as essential and “taken for granted” (p. 483), a sentiment that the participants clearly expressed. Teachers thought that it would be difficult for others to pick up their course, and this indicated that although the LMS had reached a certain level of stabilisation, that stabilisation, like closure, happens in stages (Pinch & Bijker, 1984). This research study identified that the participants were focused on passing on a finalised LMS artefact rather than a descriptive exemplar of the process in which they had engaged, in regard to their work with the LMS technology and in their incorporation of the LMS into their blended learning environment. Bijker’s (2010) recent call for a focus on the process of technology development may now provide a focus for both interpreting the findings and signifying areas for further research. Describing the process of blending and documenting suggestions for improvements could be one way of working with teachers to identify sustainable practices for LMS development within their blended teaching practice.

SCOT insights regarding sustainability

This paper has shown that the Social Construction of Technology (SCOT) is a model that can be used as a lens to view the process of creating a blended learning environment. The SCOT model highlighted the contradiction the teachers experienced in the last two stages of the SCOT model: The sense of still being in the kindergarten of blended learning in the closure stage yet the desire to share the perfect course in the stabilisation stage. The SCOT model highlights the complexity of the continuous process in developing blended learning. The participants hoped that synergies could be gained from their work for future users of the LMS. In essence the teachers’ hoped that their work was both transferable to other future makers and sustainable, they wanted to share their experiences across the university when their courses were perfected.

Laurillard (2008) cautions that education has been on the brink of transformation for some time, necessitating a focus on teachers’ practices, supporting the use of the SCOT model to focus on the process of creating blended learning environments. Bijker (2010) emphasises the benefit of applying SCOT as a tool to investigate the process of technology development. Rather than waiting for the perfect blended course to be created, it is imperative to focus on the process of creating the blend, due to long development cycles in education and the fast changing nature of technology developments. Therefore the findings from the research study indicate that it may be appropriate to focus on creating exemplars that highlight the process of blended learning, and that also are developed during the development process rather than at the conclusion of the teachers perfected blended learning creation. This view is supported in the research by Hallas (2005) and Moron-Garcia (2006) who recommend the sharing of exemplars within the institution, providing insight into how the LMS is currently used and how it could be applied by future users. Bates and Sangra (2011) also suggest that effectiveness is increased when localised projects are connected to the wider context and strategy of the institution. Cornford and Pollock (2002) call for visibility into how teachers create the blended environment, to which providing such exemplars focused on the process could be one part of the solution. A focus on the process could entail the

participants sharing of how they first learnt about and then explored the multiple possibilities of LMS, which they then refined through reaching closure and stabilisation (in essence each stage of the SCOT model).

Conclusion

This paper has outlined the SCOT model and a potential way in which this model may be applied to research to gain insights into opportunities for sustainable practice. One of the key findings highlighted by the application of the SCOT model to a small scale case study research project was that a contradiction was revealed between the teachers approach and development of blended learning environments. In their professional development the teachers expressed that they were at the beginning of learning about blended teaching which was likened to being in the ‘kindergarten’ of blended learning also suggesting long term and iterative development cycles. This contrasted with their desire to prepare for succession and develop the perfect course for dissemination. Perhaps the potential for blended learning has not been reached because the participants were not ready to let go of their creations; they wanted to perfect their work first before handing it on, which may be an unobtainable ideal. The foremost recommendation from the research study this paper was based on was “to focus on the way in which teachers navigate the process of shaping their blended practice” (Wood, 2011). Furthermore I contend that the focus on how teachers navigate the process of blending may lead to the development of sustainable models and capture the kindergarten like enthusiasm for the creation of blended learning during the early development stage.

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