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A Learning Theory Rubric for Evaluating Mobile Learning Activities

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ABSTRACT

Learning theories underpin the expectations of meaningful outcomes that any given learning task should have. However, educators' understanding and application of such theories is likely to vary with their own experience and context. In this article, we explore the potential value of a rubric for the design of mobile learning activities that is based on a core set of six learning theories, which we have identified from the literature as being highly relevant to the context of mobile learning. The key concepts of these theories have been used to create the evaluation rubric, which supports the analysis of learning activity design from the perspective of each of the chosen learning theories. The application of this rubric is explored from two perspectives. First, we apply it to an existing mobile learning activity to evaluate to what extent the activity embodies the theories within the rubric. Then we propose a redesigned activity by using the rubric as a guiding framework for improving the task design. This process demonstrates the potential value of applying such a rubric to designing mobile learning activities, to ensure that they adequately leverage the components of one or more relevant theories.

KEYWORDS

Learning Activity Design, Learning Theory, Learning Theory and Mobile Learning, Mobile Learning, Rubric

INTRODUCTION

A learning theory can be described as a conceptual framework used to understand and frame how information is absorbed, processed, and retained during learning (Luis & D'Cunha, 2014). Considering how relevant theory underpins learning activities is important to ensure appropriate pedagogical practice. This is especially important when adopting emerging technologies, such as mobile technology, to ensure that the learning, not the tool, is the driver of the activity. Since mobile learning is primarily a 21st century phenomenon, there has been considerable debate about whether it is significantly different from more traditional forms of learning to warrant its own unique theory, or whether it is simply underpinned by a range of existing theories. Harasim (2012) notes the historical context of 20th century learning theories and questions whether new contexts and technologies require new learning theories. In addressing whether we need a new theory of learning for the mobile age, Sharples, Taylor and Vavoula (2010) identified the criteria that should underpin mobile learning theory and differentiate it from other existing learning theories. Most crucially they stated that a theory of mobile learning should account for the mobility of learners and should analyse learning as a personal and situated activity mediated by technology. It is not the focus of this article to consider any new theory of mobile learning. Rather, it considers which pre-existing learning theories are important for the design of mobile learning activities, since we believe that many theories that pre-

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date mobile learning are nevertheless congruent with the criteria above. As Harasim (2012) notes, there is an intrinsic link between theory and teaching practice even if this is implicit, thus theory, old or new, is what we operationalise in our pedagogy. The assertion of this article is that consciously mapping appropriate learning theories to a given activity can help educators to understand and apply appropriate mobile learning and teaching practices.

There are many learning theories, most of which have been developed over the last century or so. There are also many categorizations that may be applied to these theories, but we might make a distinction between those that look at intrinsic factors, such as the cognitive processing that goes on inside the brain, and those that look at extrinsic factors, such as context, social interaction and (increasingly digital) learning tools. Some theories are grounded in experimental methods, such as classical and instrumental conditioning, while others are less rigorously validated and open to more interpretation (e.g connectivism). Some families of theory are so broad as to embrace the work of many researchers and include a multiplicity of concepts (e.g. constructivism).

Herrington and Herrington (2007) state that guidelines for learning with mobile technologies should be theory-informed. A clear understanding what learning theories underpin a learning activity will help inform and ensure effective pedagogy. Laurillard (2009), having earlier mapped mobile learning to her conversational framework (Laurillard, 2007), outlined how a number of different theories underlie the framework, emphasising instructionism (i.e. behaviourism), constructionism, social constructivism and collaborative learning (or 'social constructionism'). However, the focus and context of a learning activity will lead to different levels of each element as each one is appropriately applied. Mobile technologies lend themselves to certain activities, and they might be only one element of a larger learning experience; mobile activities are often integrated as part of blended learning contexts, including face to face classroom interactions. Therefore, it is important to clearly understand how a given learning activity interacts both with its context and with relevant theory.

Which theories apply most directly to mobile learning may, perhaps, be analysed through the lens of affordances. In an earlier article (MacCallum & Parsons, 2016) we used an analysis of affordances to select a subset of six theories that we believe are fundamental to mobile learning, namely; behaviorism, constructivism, experiential learning, situated cognition, communities of practice and connectivism. These are outlined in the following section. In each case, there is a brief outline of how the use of mobile devices can support each type of learning.

Six Theories of Mobile Learning

Early learning theories tended to focus on aspects of behavioural conditioning, such as Pavlov's classical conditioning, where stimulus leads to response, and Skinner's instrumental conditioning, where behaviour leads to reinforcement (Olsen & Hergenhahn, 2013). While such approaches might seem somewhat mechanistic, the concepts of rapid feedback embodied within them are important in helping learners to work at their own pace. The idea of positive reinforcement was outlined by Thorndike, who emphasised how 'satisfaction' could reinforce positive behaviours (Tapp, 1969), while Skinner (cited in Sobel, 1990) noted that the ideal of behaviorism is to eliminate coercion, to apply controls by changing the environment in such a way as to reinforce the kind of behavior that benefits everyone. Behaviorist principles are commonly seen in mobile learning tools that enable quizzes, in-class polling, discussion, and question and answer, as well as for skills-based learning such as mobile assisted language learning. Reinforcement through immediate feedback is a core feature of these types of tools.

Not all of the early learning theorists were experimental behaviorists. Dewey (1933) stressed the value of outdoor education and hands-on, experiential learning, while Vygotsky (1978) emphasized

the social role of learning, with the help of 'more knowledgeable others' (which might these days include digital sources) in the zone of proximal development. Other theorists also looked at the learner's interaction with their environment, for example Piaget, who stated that knowledge was built, not transferred (Glaserfeld, 1982), and Bruner (1961), who believed that educational environments should provide the opportunity for discovery learning. These theorists are generally referred to as constructivists, since they focus on the learner being able to construct their own knowledge. Mobile devices offer many opportunities for working with physical or conceptual materials to construct new artefacts and knowledge, such as tools for recording, mixing and disseminating various types of multimedia content.

Experiential learning is developed from many other learning theories, in particular Dewey's work on experience (Beard & Wilson, 2013). The key aspect of this theory is that knowledge is created through the transformation of experience (Kolb, 1984). The value of mobile devices for experiential learning is that they can assist in the capture of experience and provide the materials for later reflection, and transformation into knowledge. Devices can be used to capture evidence from an experience and subsequently to communicate, analyse and visualise the knowledge gained from that evidence.

Brown, Collins and Duguid (1989) asserted that learning is embedded in the activity, context and culture in which it is learned. Their concept of situated cognition resonates well with experiential learning, but goes further to stress the integral nature of the situation in which the learning activity takes place, thus "situations might be said to co-produce knowledge through activity" (Brown, Collins & Duguid, 1989, p.32). The value of mobile devices in relation to this theory is that their portability enables them to be taken into different contexts. Learning activities can take place outside the classroom and across multiple spaces. Mobile device features such as location awareness, communication tools and sensors can be very valuable in this type of learning experience.

The importance of learning with others is central to the community of practice (Wenger, 2000) which similarly emphasizes context and culture but also regards the authentic domain of the learning community as important. A community of practice is a social learning system, which can usefully be supported by mobile devices. The rich set of messaging and social media tools that are available on mobile devices provide a range of options for learners in any context to collaborate and learn with their community.

While most learning theories are grounded in 20th century thinking, in the 21st century we have seen the rise of new theories such as connectivism (Siemens, 2004), which has been proposed as 'a learning theory for the digital age.' The concept of connectivism is based on the idea that Internet technologies have created new opportunities for people to learn and share information across networks. The connectivist approach to learning is that "the connections that enable us to learn more are more important than our current state of knowing." (Siemens, 2004, para 21). Connectivist learners will share and communicate dynamic knowledge creation through networked interaction with machines and other people. The communication tools in mobile devices, coupled with the resources available through Internet connectivity, make connectivism an important theory for mobile learning.

In the next section, we take these six learning theories and use them as the basis for the development of an evaluation rubric for mobile learning activities.

An Evaluation Rubric for Mobile Learning Activities

When designing a mobile learning activity, it is important to understand how theory underpins the learning design. An appropriate and considered pedagogical approach will help ensure that learning is the primary and main concern and that the technology is not used for technology's sake. Multiple learning approaches may be adopted within one extended activity, so it is important to conceptually frame the learning within the targeted learning outcomes that one would expect from operationalising one or more learning theories. We have addressed this need to be able to assess the relationship between theory and design by creating an evaluation rubric. This rubric is based on the six previously

identified learning theories; behaviorism, constructivism, experiential learning, situated cognition, communities of practice and connectivism.

The creation of the rubric was underpinned by a set of criteria identified in a previous paper by the authors (MacCallum & Parsons, 2016), where an analysis of the literature identified the principles which frame learning design within the six identified learning theories. From learning design literature, five criteria were drawn out that operationalised each learning theory. Within the previous paper these criteria were then used to map and analyse two different learning activities. The rubric outlined in this article expands on the original concept to further refine and clarify the role that each criterion plays within the relevant learning theory. It acknowledges that there are important core aspects that are fundamental and thus operationalise the essence of each learning theory. These key features therefore should be present when leveraging a particular theory. Since this prioritisation may be overlooked when simply using a checklist of criteria in isolation, a scaled rubric has been developed, which is used in this article.

This latest version refines the original criteria, identified in the earlier paper, and includes additional key sources which were used to develop the rubric for the following theories; Behaviourism (Ertmer & Newby, 2013; Ally, 2004), constructivism (Ally, 2004), experiential learning (Weller, 2006; Beard & Wilson, 2013) situated cognition (Brown, Collins & Duguid, 1989; Herrington & Oliver, 1995), communities of practice (Wenger, 2000; Lai, Pratt, Anderson & Stigter, 2006) and connectivism (Siemens, 2004; Armatas, Spratt & Vincent, 2013; Kizito, 2016).

Table 1 shows the rubric for all six learning theories, the rubric has 6 levels, where level zero indicates a complete absence of any evidence of this learning theory in a given activity, while level 5 indicates that the activity fully operationalises that particular learning theory. Levels 4 and 5 both indicate a design intent, whereas levels 1, 2 and 3 suggest that certain components of learning theories may be present but may not be an integral part of the learning design. The rubric has synthesized and assimilated the major aspects of each identified criteria to embody the key aspects of each theory into a form that gives evaluative structure to observations (Brookhart, 2013).

It should be noted that this is not intended as a cumulative rubric of performance skills, as is evident in some rubrics such as those published by ITL Research (2012). In those cases, individual criteria are identified that accumulate in a specific sequence, making it possible to create a logical flowchart of each evaluation step. We acknowledge that the components of a given learning theory are generally too diverse and interdependent for such a discrete separation of stages to be identified. Nevertheless, we have attempted to be consistent in our approach to the rubric such that each theory is expressed in a similar way. In doing so we have attempted to identify the most fundamental components of each learning theory so that even the lowest levels of the rubric above zero acknowledge these fundamentals. For example, level 1 of experiential learning requires a cycle of experience, since this is fundamental to all other aspects of experiential learning. We also acknowledge that the components of various learning theories are not necessarily exclusive. For example, four of these learning theories include an acknowledgement of collaboration as an important part of learning. Similarly, the creation of knowledge is explicitly noted in more than one learning theory. Thus, any given learning activity would be expected to exhibit a range of features that could lead to that activity being associated with aspects of multiple learning theories.

It is not our contention that a successful learning activity design should meet the highest levels of the rubric for each learning theory. Indeed, attempting to do so would seem to be likely to lead to a contrived and over-complex learning activity. On the other hand, it would seem to be almost impossible to create any kind of learning activity that scored zero for all six theories. Any design that registered at this level would hardly deserve to be called a learning activity. We suggest, however, that for a learning activity to be well designed it should score highly (level 4 or 5) on at least one of the sections of the rubric. Our argument for this proposal is that if learning theories have value (which we believe that they do) then we should endeavour as educators to fully understand and utilise these theories in

Table 1. Learning theory rubric

Learning Theory: Behaviourism	
Level 0	The mobile activity **does not involve** measurable outcomes, testing, sequenced materials, feedback or reinforcement.
Level 1	The mobile activity **involves at least one component** of measurable outcomes, testing, sequenced materials, feedback or reinforcement.
Level 2	The mobile activity **involves measurable outcomes and sequenced materials**, and **include aspects** of testing, feedback or reinforcement.
Level 3	The mobile activity i**nvolves measurable outcomes and sequenced materials**, and also **includes significant aspects** of testing, feedback or reinforcement.
Level 4	The mobile activity is **largely designed** around measurable outcomes, testing, sequenced materials, feedback and/or reinforcement.
Level 5	The mobile activity is **wholly designed** around measurable outcomes, testing, sequenced materials, feedback and reinforcement.
Learning Theory: Constructivism	
Level 0	The mobile activity **does not involve** (inter)active construction of knowledge by learners. Learners do not have control of the learning process nor time or opportunity to reflect and develop personal meaning
Level 1	The mobile activity **involves (inter)active construction of knowledge** by learners. It may include **at least one component** of collaboration and cooperation, learners having control of the learning process, and time and opportunity to reflect and develop personal meaning.
Level 2	The mobile activity **involves (inter)active construction of knowledge** by learners. It **includes aspects** of collaboration and cooperation, learners having control of the learning process, and time and opportunity to reflect and develop personal meaning.
Level 3	The mobile activity **involves (inter)active construction of knowledge** by learners using collaboration and cooperation, and also **includes significant aspects** of learners having control of the learning process, and time and opportunity to reflect and develop personal meaning.
Level 4	The mobile activity is **largely designed** around (inter)active construction of knowledge by learners using collaboration and cooperation. Learners have control of the learning process and time and opportunity to reflect and develop personal meaning
Level 5	The mobile activity is **wholly designed** around (inter)active construction of knowledge by learners using collaboration and cooperation. Learners have control of the learning process and time and opportunity to reflect and develop personal meaning
Learning Theory: Experiential Learning	
Level 0	The mobile activity **does not involve** any cycle of experience, observation, conceptualization or experimentation. There is no transformation through reflection into new knowledge
Level 1	The mobile activity **involves a cycle of experience.** It may include **at least one component** of observation, conceptualization, and/or experimentation.
Level 2	The mobile activity **involves a cycle of experience.** It **includes aspects** of observation, conceptualization, and/or experimentation, with subsequent reflection.
Level 3	The mobile activity **involves a cycle of experience.** It **includes significant aspects of** observation, conceptualization, and experimentation, with subsequent reflection.
Level 4	The mobile activity is **largely designed** around a cycle of experience, observation, conceptualization, and experimentation, transformed through reflection into new knowledge
Level 5	The mobile activity is **wholly designed** around a cycle of experience, observation, conceptualization, and experimentation, transformed through reflection into new knowledge
Learning Theory: Situated Cognition	
Level 0	The mobile activity **does not involve** an authentic context or activities that reflect real-life application. There is no collaborative knowledge construction through coaching, expert performances, process modelling or reflection

continued on following page

Table 1. Continued

Level 1	The mobile activity **involves an authentic context**. It may include **at least one component** of real-life application or collaborative knowledge construction through coaching, expert performances, process modelling and reflection.
Level 2	The mobile activity **involves an authentic context** and activities that reflect real-life application. It **includes aspects** of collaborative knowledge construction through coaching, expert performances, process modelling and reflection.
Level 3	The mobile activity **involves an authentic context** and activities that reflect real-life application. It also **includes significant aspects** of collaborative knowledge construction through coaching, expert performances, process modelling and reflection.
Level 4	The mobile activity is **largely designed** around an authentic context and activities that reflect real-life application and support collaborative knowledge construction through coaching, expert performances, process modelling and reflection.
Level 5	The mobile activity is **wholly designed** around an authentic context and activities that reflect real-life application and support collaborative knowledge construction through coaching, expert performances, process modelling and reflection.
Learning Theory: Communities of Practice	
Level 0	The mobile activity **does not involve** a community of practice. There is no shared learning and no social process of information exchange and knowledge creation
Level 1	The mobile activity **involves a unifying community of practice**. It may include **at least one component** of shared learning accompanying a social process of information exchange and knowledge creation.
Level 2	The mobile activity **involves a diverse, unifying community of practice**. It **includes aspects** of shared learning accompanying a social process of information exchange and knowledge creation.
Level 3	The mobile activity **involves a diverse, unifying community of practice** and also **includes significant aspects** of shared learning accompanying a social process of information exchange and knowledge creation.
Level 4	The mobile activity is **largely designed** around a diverse, unifying community of practice where shared learning accompanies a social process of information exchange and knowledge creation
Level 5	The mobile activity is **wholly designed** around a diverse, unifying community of practice where shared learning accompanies a social process of information exchange and knowledge creation
Learning Theory: Connectivism	
Level 0	The mobile activity **does not involve** the creation or critical evaluation of artefacts in learning networks. It uses no collaborative technologies, diverse information sources or transferable social media skills
Level 1	The mobile activity **involves at least one component** of creation or critical evaluation of artefacts in learning networks, collaborative technologies, diverse information sources or transferable social media skills
Level 2	The mobile activity **involves the creation and critical evaluation of artefacts** in learning networks, and **includes aspects** of using collaborative technologies, diverse information sources and transferable social media skills
Level 3	The mobile activity **involves the creation and critical evaluation of artefacts** in learning networks, and also **includes significant aspects** of using collaborative technologies, diverse information sources and transferable social media skills
Level 4	The mobile activity is **largely designed** around the creation and critical evaluation of artefacts in learning networks using collaborative technologies, diverse information sources and transferable social media skills
Level 5	The mobile activity is **wholly designed** around the creation and critical evaluation of artefacts in learning networks using collaborative technologies, diverse information sources and transferable social media skills

our teaching and learning design. To only half-heartedly embrace a particular learning theory would seem to be deliberately missing out on its potential value to our students. We would also suggest that the exercise of assessing learning activity designs against this rubric would be an opportunity to reflect on potential modifications that could be made to these activities to more fully leverage the most relevant learning theories and consider what other aspects of other learning theories could be

integrated to make a more enriched learning activity. This could suggest alternative strategies that could modify the activity, or the need to incorporate additional features that could further enhance the activity, for example one might consider enabling students to test ideas (behaviourism) or have more control over the learning process (constructivism).

Mapping the Rubric to an Indicative Mobile Learning Activity

To explore the relationship between activity design and the identified criteria of appropriate learning theories, we take an example of a mobile learning activity that was originally designed for a professional development workshop to be run for teachers to explore some specific aspects of mobile device use for learning. This particular activity was somewhat technology centric, as its original intent was to expose a group of teachers to the potential of certain hardware and software features of mobile devices.

The reason for choosing this particular activity for analysis was that it was designed with good pedagogy in mind and a general awareness of learning theory, but was not explicitly designed using the detailed analysis of learning theory that we apply in this paper. Thus, we believe it provides a helpful example of the type of learning activity that educators might develop with general ideas about what constitutes effective learning, but one that is inherently weak due to a lack of explicit analysis in terms of the theoretical underpinnings of the activity.

First, we analyse this learning activity from the perspective of its embodied learning theories. Next, we reconsider the design of the learning activity from the perspective of learning theory, and explore some options for task redesign that would maximise the pedagogical richness of the activity.

Original Task Design

The activity which is the focus of this article was based on a large group of teachers involved in a two-hour professional development workshop run across a number of different sites over several days. The activity focused on the teachers exploring the potential affordances of mobile technology and how it could be incorporated into their own classes. The activity was to undertake a geolocated outdoor learning task where the specific application to be used was created in advance by the workshop facilitator. The tool used in this workshop was ARIS (https://arisgames.org/), which allows the creation of geolocated activities using a web based design tool, with the created apps deployable to iOS devices. The application included a series of outdoor waypoints, to which the students were directed in teams by the mobile app. At each location, the teams were asked to record whatever environmental readings they were able to gather using their mobile devices. These were measures commonly available through device sensors, such as light level, sound level, elevation, humidity etc. During the activity, they were asked to record these readings on a shared cloud-based spreadsheet, and at the end of the activity they were asked to take the shared data source and analyse it to look for any interesting similarities or differences that might occur across various times and locations across the country. Further detail about this activity can be found in Parsons, Thomas & Inkila (2016).

Analysing the Original Task Against the Rubric

When analysing this learning activity with the learning theory rubric, we noted that it resonated with several theories but did not effectively address any single one in adequate depth. Despite its obvious affinity with situated cognition (being a waypoint based activity in specific outdoor locations) and with experiential learning (given the exposure to new mobile learning experiences), the activity failed to achieve a high level of alignment with the rubric even in these two areas of theory. The following sections address each of the learning theories in turn, assessing the learning activity against the rubric.

The activity revealed few behaviourist characteristics. Given the open-ended nature of the task there was no specific reinforcement. The only evident features that related to behaviorist learning theory were the sequencing of activities through the application (which led the students through a series of waypoints and gave instructions at each step) and some limited feedback (e.g. the app

indicated when sufficient readings had been taken). As a result, we assessed the activity at level 1 against the behaviourism rubric.

In terms of constructivism, the construction of knowledge was present to some extent but was insufficiently scaffolded to adequately create a zone of proximal development. The learning was active, but perhaps the meaning was not made explicit enough to guide the learners in constructing knowledge. The activity was team based, and also involved the sharing of gathered data, so was collaborative and cooperative. In particular, students would be sharing devices to find locations and collect the data and would then be working together on the datasheets. Learners were given some control of the learning process, but on the whole the process was dictated by the app, and data gathering options were constrained by the devices that the learners had available to them. An opportunity to reflect was provided in the data analysis phase, but was too time constrained and insufficiently guided to reach meaningful outcomes. Interaction took place but was sporadic and variable between groups because the activity did not provide enough cues to trigger interactions explicitly. Given these various weaknesses in the activity design, we assessed it at level 1 against the constructivism rubric.

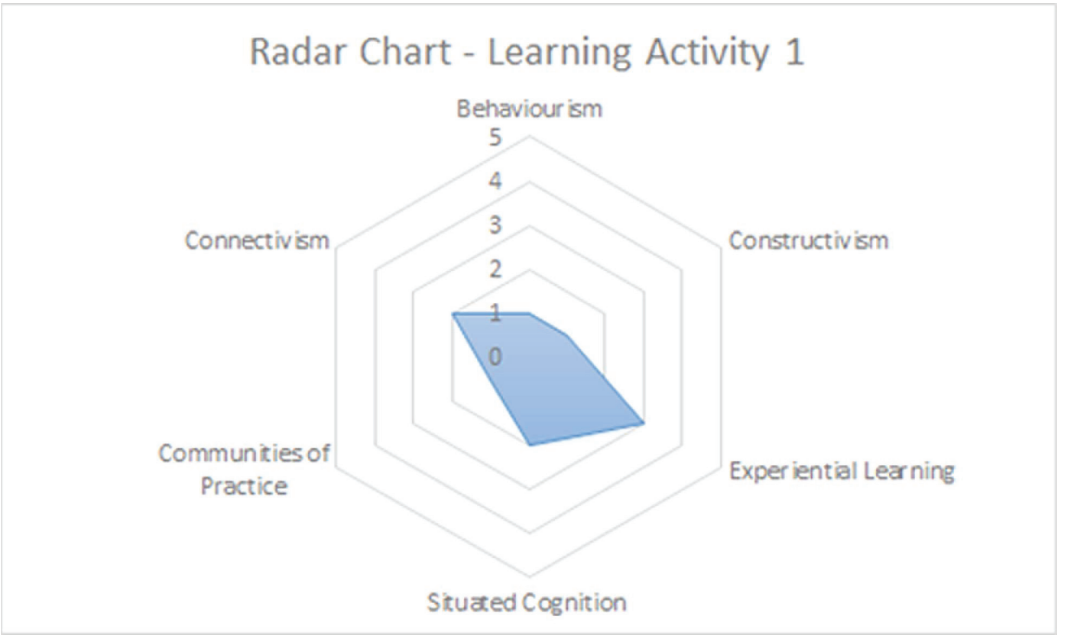
Perhaps the most important learning theory that applies to this type of open-ended discovery activity is experiential learning. The learning context was designed to provide an experience of using mobile devices in unfamiliar ways and therefore to provide new learning experiences for the students. The task design was, at least in principle, based on a cycle of concrete experience, reflective observation, abstract conceptualization and active experimentation. However, the lack of opportunity for true reflection limited the scope for the creation of new knowledge through the transformation of experience. Nevertheless, because the activity did involve observation, conceptualization and experimentation, with subsequent reflection, we assessed it at level 3 in the rubric. Unfortunately, there was insufficient evidence gathered from the activity to assert with any certainty that this reflection transformed the experience into new knowledge (level 4), though it may have done for some participants.

In principle, situated cognition would also seem to be a highly relevant theory in this context, since the key premise of using the mobile app was that environmental measures would be taken from specific situated contexts, and that these concepts would be important in collaboratively analysing the data. However, when analysing the activity from the perspective of this theory it was clear that only the authentic context was directly supportive of the learning and, as noted above, there was insufficient coaching and scaffolding. Again, as noted earlier, there was also insufficient opportunity for reflection. Nevertheless, since the contextual activities reflected real-life application, and fostered collaborative knowledge construction and at least some reflection, we assessed this activity at level 2 on the situated cognition rubric.

In terms of community of practice, this was present but mostly because the participants were already members of a community of practice and this activity operated inside this larger community. If we consider the activity on its own, it did not create any further components of a community of practice. There was some information exchange and knowledge creation, and shared learning, as the teams discussed their devices and the environmental sensors that they had available, and analysed the shared dataset. It was also hoped that learning would be an incidental outcome of the social process embedded in the activity. Unfortunately, this was not particularly evident in practice. Given that the activity leveraged an existing community of practice, but did not effectively develop it further, we assessed it at level 1 on the rubric.

There were also some elements of connectivism in the activity through the use of a shared dataset. However, interactions through the dataset were limited. Although it was intended that the activity would be a stimulating and motivating learning activity, the single artefact that was created was not linked to broader social networks, so meaningful dialogue and collaboration was not encouraged by the tools used, tools which also failed to provide much in the way of transferable skills across learning networks. The learners did use diverse information sources offline and online (for example on how to use their devices to capture and interpret the data), but perhaps the lack of scaffolding here limited their scope.

Figure 1. Radar chart of the first learning activity



Once again, the activity failed to provide adequate opportunity for critical evaluation and synthesis of concepts, opinions and perspectives. Nevertheless, despite these limitations, we assessed the activity at level 2 on the connectivism rubric, since an artefact was created and critically evaluated (at least to some extent) and the students used collaborative technologies and diverse information sources.

Figure 1 shows a radar chart of the activity, as evaluated against the rubric. It can be seen from this figure that the learning activity failed to comprehensively address any of the six learning theories represented in the rubric. The areas of relative strength are experiential learning and situated cognition, but even in these measures important components of learning as outlined in these theories are missing, so in neither case could we assess them as reaching the level of design intent (4 or 5). Overall, then, this particular learning activity design is seen to be somewhat lacking in its operationalisation of learning theory.

Applying the Rubric to Task Design

In this section of the article we move on from analysing an existing mobile learning activity to considering the design of a modified learning experience. This section attempts to take into account the theoretical weaknesses of the original task design and the potential for change suggested by the components of the evaluation rubric. As indicated earlier, there are some valuable aspects of learning theory already embedded in the original task, so it was important that these should be retained and built upon where possible, while at the same time considering a major task redesign to ensure that there was some theory-based design intent, based on the rubric.

In analysing the weaknesses of the original activity, a number of elements were clearly problematic. One of these was the lack of time allowed for reflection, which had not been adequately catered for in the original activity. Yet time constraints are an unavoidable aspect of most learning environments, so we need to design with these constraints in mind. Another limitation was a lack of evidence of outcomes, along with a lack of use of appropriate social media channels for dissemination of learning. Another evident limitation to the activity was that although there was some constructivist activity in the creation of the data artefact, this was minimal. The application used was created by

the teaching staff, as was the design of the data spreadsheet. Thus, opportunities for student agency in the construction of artefacts were very limited. With these limitations in mind, and guided by the rubric, we undertook a major redesign of the learning activity in an attempt to render it a more valuable learning experience for the students.

As indicated earlier in this article, it is not our contention that learning activity design should be based on attempting to reach the maximum level of every part of the rubric, since this would be to use the rubric as some kind of overall metric where 'more is better', which it is not intended to be. The role of the rubric is, first of all, to enable us to highlight the most relevant learning theories in an activity, and then to potentially focus on those parts of the rubric where relevant improvements could be made. As we have noted previously, there are some components that appear in multiple parts of the rubric, so addressing these particular features may impact on more than one element of the overall process. However, we believe it is helpful to address each learning theory in turn and make a judgement as to which parts of the rubric are most appropriate to pay attention to from a design perspective.

Identifying Potential Improvements to the Original Task

Our original design scored low on the behaviourism rubric. However, we did not perceive this to be a problem, since we had not intended to design an activity that focused on behaviourist principles. Rather, this particular learning process was based around an open ended exploratory experience for the students. Therefore, we did not feel it necessary to address the behaviourist aspect of the rubric in the redesign. However, from a constructivist perspective it was clear that our original task did not provide the students with an opportunity to construct their own artefacts and knowledge, nor did it give them enough time to adequately reflect, or make the activity personally meaningful. We therefore felt the need to look for opportunities to address the constructivist rubric to a greater degree.

Although our original activity scored reasonably well on the experiential learning component of the rubric, it was lacking in the facility for the students to clearly demonstrate that they had transformed their experience through reflection into new knowledge. Therefore, in the redesigned activity we hoped to address this shortcoming, at least to some degree. The original activity also scored reasonably well in terms of situated cognition, but was not structured effectively to allow collaborative knowledge construction through coaching, expert performances, process modelling and reflection. It was hope that the redesign might address this particular aspect of the rubric more effectively.

Although our activity was leveraging an existing community of practice, there were also areas where we could improve the value of this context. In particular, we needed to ensure that there was a social process of information exchange and knowledge creation. Finally, in looking at the connectivist aspect of the rubric, it was clear that the students could benefit from the creation of networked artefacts and exercise and build social media skills.

In summary, it was felt that there were a number of areas where the activity could be improved. In the next section, we describe how the redesigned task was created and analysed against the rubric.

The Redesigned Task

Given the issues identified above, the redesigned task was intended to address a number of shortcomings in the original design such that a number of aspects of appropriate learning theories could be better integrated into the learning process. One significant issue identified was the lack of time for reflection. Given that there were time constraints in the original activity, it was felt that the task should be completely rescheduled by reducing the number of activities, and maximizing the opportunities for reflection. In addition, it was clear that the original task gave little opportunity for the constructivist building of artefacts and related knowledge. As a result, the revised design allowed the students to create their own mobile learning activity rather than simply participate in one that was already built. It was also clear that we were not taking enough advantage of an existing community

of practice, which was already enabled online using social media tools, so the new activity aimed to embrace these opportunities.

The redesigned task required the students to create their own GPS enabled outdoor learning activity using a suitable tool. This meant we had to re-think our use of ARIS, since its rich feature set makes it harder to create an activity without previous experience. As a result, we chose ActionBound (https://en.actionbound.com/). Although there are a number of other similar tools available, we selected this tool based on the ease and speed with which a mobile learning activity can be created and deployed.

The students chose their own authentic context within which to create their own mobile learning implementations, and were initially given appropriate modelling through an instructional video, which they worked through at their own pace. They then collaboratively designed their own learning activities and implemented them using the recommended tool. Once the designs had been implemented, they were able to test these out in practice, then share their artefacts and reflections on social media, using the online community already established within the group. To ensure that there was adequate time for each stage of the task, it was necessary to remove some features from the original activity, in particular the use of sensors and the pooling and analysis of shared data. We chose to make this an entirely separate activity at a different time to ensure that the students were able to reflect on the constructivist process of designing, building, testing, and evaluating a meaningful product in a suitable experiential learning cycle.

When analysing the redesigned activity against the rubric, it was clear that the modifications had addressed many of the weaknesses of our original design. We did not choose to explicitly address any aspects of the behaviourism rubric and the revised activity was still assessed at level 1. However, in terms of constructivism we assessed the activity at level 4 because the learners had much greater control over the learning process, where they could create an artefact that was personally meaningful to them, and they were given the opportunity to reflect within their community of practice. The original activity had been reasonably strong in experiential learning, but we believe that the revised activity was further enhanced to level 4 of the rubric, given the opportunities that students had to transform their reflections into new knowledge, which were evidenced by their postings on social media. Although we did not formally assess the outcomes, we noted that game designs posted on social media during the class included a diverse range of imaginative ideas, including exploring a new school, a local culture walk, an investigation of check in processes at an airport and a family version of the TV series "The Amazing Race".

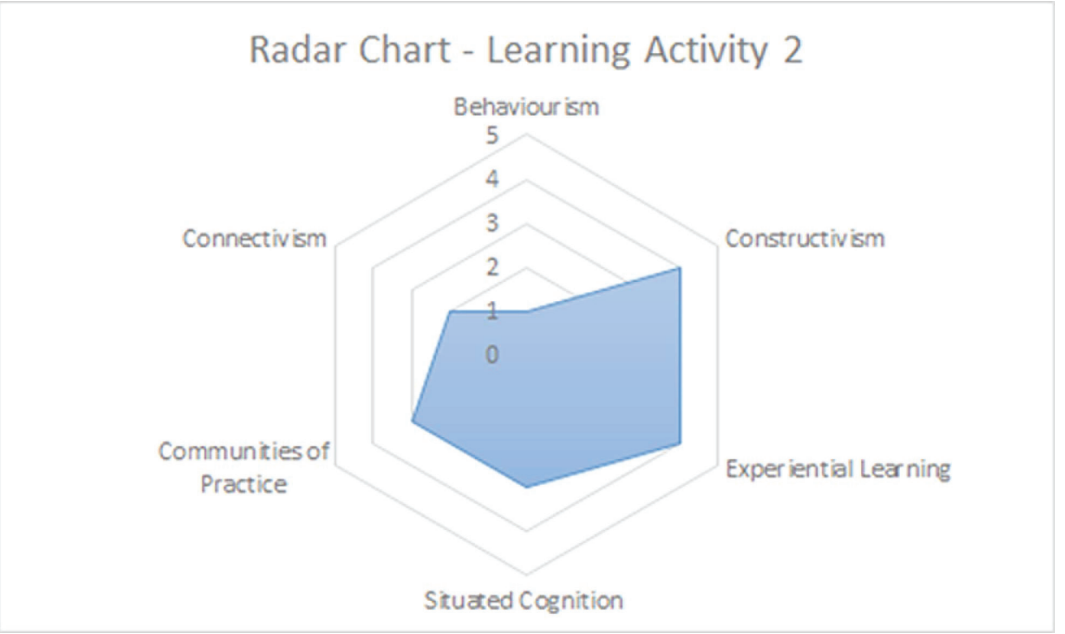
We assessed the revised activity at level 3 on the situated cognition rubric. The reason for not assessing it higher was that the levels of coaching, expert performances and process modelling were somewhat limited, being confined to a single instructional video. Against the community of practice rubric, we judged the revised activity at level 3. Although shared learning did accompany a social process of information exchange and knowledge creation, it would be somewhat excessive to claim that the activity had been designed with this at its core. From a connectivist perspective, the activity remained at level 2. Although it embraced transferable social media skills it also lost some of the connectivist aspects of the original activity, so overall remained a relatively low level task in terms of connectivism.

Figure 2 shows a radar chart of the activity, as evaluated against the rubric. Compared with Figure 1, it is clear that the revised activity is much more theory-informed than the original version.

Assessing the Revised Task

Earlier in this article we made some statements about the rubric, which we will briefly reiterate here, before assessing the outcomes of our redesign. Level zero indicates a complete absence of any evidence of a given learning theory in an activity, while level 5 indicates that the activity fully operationalises that particular learning theory. Levels 4 and 5 both indicate a design intent, whereas levels 1, 2 and 3 suggest that certain components of learning theories may be present but may not be

Figure 2. Radar chart of the modified learning activity



an integral part of the learning design. It is our suggestion, however, that for a learning activity to be well designed it should score at the 'design intent' levels (4 or 5) on at least one section of the rubric.

How, then, might we interpret the radar chart in Figure 2, which evaluates the revised learning activity against the rubric? We note that the activity reveals design intent for both constructivism and experiential learning, although neither of these are fully operationalised. Does this matter? We would suggest that it does not. The value of the rubric is in providing insights into learning activity design, and giving us opportunities to rethink how we integrate learning theories into our pedagogy. Like all rubrics, it is open to interpretation. We suggest that its value is demonstrated in this particular example by giving us the ability to take a mobile learning activity, re-evaluate it through the lens of learning theory, and be guided towards a modified activity that better embodies the features of relevant learning theory. It is also worth bearing in mind that refinement of learning activities is an ongoing process. We would expect to continuously re-think and redesign our pedagogy over time. One cycle of reflection and revision is just one step in an ongoing process of continuous improvement.

CONCLUSION

In this article, we have described a rubric for assessing the design of mobile learning activities that is based on a core set of learning theories that have previously been identified as being particularly relevant to the experience of mobile learning. We have applied this rubric to a learning activity that was originally designed without this rubric in mind. The rubric revealed that this activity was failing to incorporate the major components of any particular learning theory, although it utilised some components of several relevant theories. On reflection, this was partly a consequence of trying to do too many things in too short a time. The analysis helped us to realise that we needed to focus more clearly on fewer objectives in order to improve the activity. Based on an assumption that operationalising learning theory can improve learning experiences, we redesigned the activity using the rubric as a kind of design framework. We then assessed this revised activity against the rubric,

which revealed design intent based on two of the learning theories and stronger links to others. From this exercise, we concluded that the learning theory rubric could be a useful guide to the design or redesign of mobile learning activities.

There are a number of limitations to this study. Not least, there is no empirical analysis of outcomes from task redesign. As yet, we have no empirical data to suggest that the modified learning activity leads to any greater learning outcomes than the original version. However, rubrics in general do not assess outcomes, only performance, and their primary role is to give structure to observations (Brookhart, 2013). We have also confined the number of learning theories considered to six, and the key components of each theory have been summarised down to a few key points. Both of these factors might leads to accusations that we have oversimplified the interpretation of theory. However, these representations have been the result of a series of stages of research, and are strongly grounded in the literature.

Future work might involve further use of the rubric as a design tool, with empirical evaluation of outcomes from these designs, refinement of the rubric itself, or the development of alternative rubrics that take a different view of which learning theories should be included and how they should be represented as evaluative criteria.

REFERENCES

Ally, M. (2004). Foundations of educational theory for online learning. *Theory and practice of online learning, 2*, 15-44.

Armatas, C., Spratt, C., & Vincent, A. (2013, July). Operationalizing connectivist principles in online tertiary course design. *Paper presented at the International Conference on Information Communication Technologies in Education*, Crete. Retrieved from http://www.icicte.org/Proceedings2013/Papers%202013/03-4-Armatas.pdf

Beard, C., & Wilson, J. (2013). *Experiential Learning: A handbook for education, training and coaching* (3rd ed.). London: Kogan Page.

Brookhart, S. M. (2013). *How to Create and Use Rubrics for Formative Assessment and Grading*. Alexandria, VA: ASCD.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated Cognition and the Culture of Learning. *Educational Researcher*, *18*(1), 32–42. doi:10.3102/0013189X018001032

Bruner, J. S. (1961). The act of discovery. *Harvard Educational Review*, *31*(1), 21–32.

Dewey, J. (1933). *How we think: A restatement of the relation of reflective thinking to the educational process*. Lexington, MA: Heath.

Ertmer, P.A. & Newby, T.J. (1993). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance improvement quarterly, 6*(4), 50-72.

Harasim, L. (2012). *Learning Theory and Online Technologies*. New York, NY: Routledge.

Herrington, A., & Herrington, J. (2007). Authentic mobile learning in higher education. *Paper presented at the Australian Association for Research in Education Conference Freemantle* (pp. 1-9). Retrieved from http://www.aare.edu.au/07pap/her07131.pdf

Herrington, J., & Oliver, R. (1995, December). Critical characteristics of situated learning: Implications for the instructional design of multimedia. *Paper presented at the ASCILITE95 conference*, Melbourne, Australia. Retrieved from http://www.ascilite.org/conferences/melbourne95/smtu/papers/herrington.pdf

Kizito, R. N. (2016). Connectivism in learning activity design: Implications for pedagogically-based technology adoption in African Higher Education contexts. *The International Review of Research in Open and Distributed Learning*, *17*(2). doi:10.19173/irrodl.v17i2.2217

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice-Hall.

Lai, K. W., Pratt, K., Anderson, M., & Stigter, J. (2006). Literature review and synthesis: Online communities of practice. New Zealand: Ministry of Education. Retrieved from https://www.educationcounts.govt.nz/publications/curriculum/5795

Laurillard, D. (2007). Pedagogical forms for mobile learning: framing research questions. In N. Pachler (Ed.), *Mobile learning: Towards a research agenda*. London: WLE Centre, Institute of Education.

Laurillard, D. (2009). The pedagogical challenges to collaborative technologies. *International Journal of Computer-Supported Collaborative Learning*, *4*(1), 5–20. doi:10.1007/s11412-008-9056-2

Luis, R., & D'Cunha, T. (2014). The role, essence and contributions of educational psychology to the field of education. *International Journal of Education and Management Studies*, *4*(4), 370–372.

MacCallum, K., & Parsons, D. (2016, October). A Theory-ology of Mobile Learning: Operationalizing Learning Theories with Mobile Activities. Proceedings of the World Conference on Mobile and Contextual Learning (mLearn 2016), Sydney (pp. 173-182). Retrieved from http://iamlearn.org/wp-content/uploads/Proceedings_MLearn2016Final.pdf

Olsen, M., & Hergenhahn, B. (2013). *An Introduction to Theories of Learning* (9th ed.). Boston, Mass.: Pearson.

Parsons, D., Thomas, H., & Inkila, M. (2016, October). A Mobile Sensor Activity for Ad-Hoc Groups. *Proceedings of the 15th World Conference on Mobile and Contextual Learning (mLearn 2016)*, Sydney (pp. 210-213). Retrieved from http://iamlearn.org/wp-content/uploads/Proceedings_MLearn2016Final.pdf

Research, I. T. L. (2012). *21st Century Learning Design Rubrics*. Retrieved from https://education.microsoft.com/GetTrained/ITL-Research

Sharples, M., Taylor, J., & Vavoula, G. (2010). A Theory of Learning for the Mobile Age: Learning through Conversation and Exploration Across Contexts. In B. Bachmair (Ed.), *Medienbildung in neuen Kulturräumen VS Verlag für Sozialwissenschaften* (pp. 87–99). doi:10.1007/978-3-531-92133-4_6

Siemens, G. (2004). Connectivism: A Learning Theory for the Digital Age. *elearnspace*. Retrieved from http://www.elearnspace.org/Articles/connectivism.htm

Sobel, D. (1990, August 20). B. F. Skinner, the Champion of Behaviorism, Is Dead at 86. *New York Times*.

Tapp, J. (Ed.). (1969). *Reinforcement and Behavior*. New York, NY: Academic Press.

von Glaserfeld, E. (1982). An Interpretation of Piaget's Constructivism. *Revue Internationale de Philosophie*, *36*(4), 612–635.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Weller, M. (2006). Delivering Learning on the Net: The why, what and how of online education. In G. Conole & M. Oliver (Eds.), *Contemporary Perspectives in E-Learning Research: Themes, Methods and Impact on practice*. London: Kogan Page.

Wenger, E. (2000). Communities of Practice and Social Learning Systems. *Organization*, *7*(2), 225–246. doi:10.1177/135050840072002

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