Version of record: Lister, P. (2022), "Future–Present Learning and Teaching: A Case Study in Smart Learning", Sengupta, E. and Blessinger, P. (Ed.) *Changing the Conventional University Classroom* (*Innovations in Higher Education Teaching and Learning, Vol. 44*), Emerald Publishing Limited, Leeds, pp. 61-79. https://doi.org/10.1108/S2055-364120220000044005

Future-present learning and teaching: a case study in smart learning

Dr Pen Lister

Abstract

This chapter examines the teaching practice of the author in the Faculty of Education, University of Malta, taking sessions in smart learning as part of technology-enhanced learning (TEL) study units in Bachelors of Education and Masters in Teaching and Learning degree programmes between 2017-2019. My teaching sessions ran concurrent with undertaking separate doctoral research investigating how participants experience 'smart learning journeys'. Smart learning journeys in the research were conceptualised as real world journeys, with geo-spatially relevant points of interest forming a journey of locations related to a topic of learning, providing context-aware content via digital interactions. Research was not connected to teaching practice, though students who took TEL units also participated in the same smart learning journey activity as part of their syllabus.

Though teaching sessions were not part of my research, my classroom practice modified as a result of emerging research findings, and my teaching benefited as I gained deeper understanding about smart learning activities and the role of the learner in them. Using dialogic learning methods and techniques inspired from my research interview methodology, class sessions became noticeably more effective as students engaged directly in discovering their own learning from having participated in the smart learning journey.

Keywords: smart learning; pedagogy; reflection; smart learning environments; dialogic learning; phenomenography

Introduction

This chapter attempts to describe how my classroom sessions teaching smart learning pedagogies to young educators changed as a result of applying techniques and understanding derived from my separate concurrent research about smart learning. The context of my classroom practice focuses on students who were studying education degrees at University of Malta at undergraduate final year and postgraduate level. As part of their classwork studying technology-enhanced learning, students were asked to participate in 'Malta Democracy', a smart learning journey located in Republic Street, the main thoroughfare through the centre of Valletta, Malta. This smart learning journey activity had been developed as part of my doctoral research at the University of Malta, investigating smart learning activities conceptualised as real world journeys. The classroom teaching and associated student cohorts were not part of the research itself, though students participated in the same activity that I was separately researching with other participant groups.

The 'Malta Democracy' smart learning journey activity manifested as a smart learning environment of authentic real-world locations augmented by digital interactions, using free mobile apps and online open source digital knowledge content. Considering connectivist inspired learning activities as most relevant to this type of learning (Lister, 2018, p. 3), emphasis was placed on autonomous, creative, participatory and collaborative learning rather than specific learning designs. This permitted the hybrid, permanent beta of these learning scenarios to embrace the flexibility associated with a post web 2.0 mobile data society[1] (Gros, 2016; Garnett & Ecclesfield, 2011, p. 13; Cochrane & Antonczak, 2014, p. 360). Green's (2019) 'smart enough' smart cities describe our current ad-hoc technologically enhanced environments that offer future-present (Ireland & Johnson, 1995) opportunities for learning in today's growing culture of learning cities to "promote lifelong learning opportunities for all", part of UNESCO Sustainable Development Goal 4[2] (SDG4). This is additionally relevant within a context of citizen digital literacy support and the European Commission 2017 Digital Competence Framework for Citizens (Carretero, Vuorikari & Punie, 2017; Lister, 2020).

Insights arising from my research outlined concepts of pedagogical structures of relevance and experience variation for designing these kinds of smart learning activities, gained from analysing participant interviews using a phenomenographic structure of awareness framework (Cope, 2004). It is these pedagogical insights that I further discuss here relating to how they might be taught to future educators, to support teaching practice approaches for this type of 'ubiquitous computing immersive learning' (Dunleavy, Dede & Mitchell, 2009, p. 8).

[1] Data society https://datasociety.net
[2] UNESCO Sustainable Development Goal Four (https://tiny.cc/ffi64y)

The methodology of phenomenography employed in the research used semi-scripted, emergent and responsive interviews, encouraging participants to uncover their own experiences and reflect on them. I explored these techniques further in my non-research related classroom sessions to foster a process of learning through self-discovery, emphasising reflection and discussion to help make sense of experiences together. This chapter reflects on how these classroom dialogic learning techniques, in the context of previous active participation in a smart learning journey, can bring about a consciousness in the participant learner towards their own act of learning (Marton & Svensson, 1979, pp. 473-474). It may be that this approach can assist in making future-facing learning activities more 'real' to those who are learning about them.

Definitions and clarifications

It is useful to establish definitions of terms and concepts for context and meaning in this chapter. I also clarify the nature of the smart learning journey activity that students participated in.

Smart learning, smart environments and smart learning journeys

Smart learning is closely aligned with smart learning environments, the two might be considered intertwined, with key texts nominated here to outline these concepts for the purposes of discussion in this paper. Spector's (2014) description of a smart learning environment that "might include features to promote engagement, effectiveness and efficiency" (p. 2) of learning is a useful benchmark, without associating specific technological implementation to it. Spector describes further aspects concerning collaboration, knowledge and learning, the importance of place and the role of technology that together form elements of the smart learning environment. Dron (2018) emphasises the purpose of smart learning environments to learn and teach effectively, discussing how intrinsic and extrinsic motivation (p. 11) play a crucial role in any learning participation. Motivation is further investigated here as part of a pedagogical 'structure of relevance' (Marton & Booth, 1997) for smart learning, in light of the experiences of participants in smart learning journeys and the engagement of young educators towards smart learning as a concept. Motivational relevance is argued as potentially integral to any connectivist inspired pedagogical autonomy in smart learning design and planning (Siemens, 2006, p. 8; Lister, 2021c).

A smart learning journey is a learning activity designed to mainly take place *outside* in the real world. Employing digital augmented reality technology to augment specific features of locations, context-aware learning content, participative learning tasks and opportunity for location-based face-to-face and digitally mediated interactions can be effectively provided to

the learner at that time and place. In the doctoral research, two smart learning journeys were created to investigate smart learning. 'Literary London' was located around St Paul's Cathedral and the City of London, UK, and 'Malta Democracy' located along Republic Street in Valletta, Malta. Students who were attending classes with me at University of Malta, who were not part of the research, also participated in the 'Malta Democracy' smart learning journey as an aspect of their studies.

Concepts of smart learning

The concept of learning in the research referred to in this chapter was not to make assumptions about results of planned learning outcomes, learning design requirements or assessment strategies, though these may all have relevance to observations and discussion. Rather, learning was regarded in terms of broad interpretations, considering the reported reflections of the participants in the research interviews for what they might regard as learning or perceive as an effective learning experience. Within this framing, smart learning is best summed up by Liu, Huang & Wosinski's (2017, p. 209) definition of "learning to learn, learning to do and learning to self realisation". Dron describes learning in smart environments as "a complex conversational process that can and usually does lead to much that is of value beyond what is planned", (2018, p. 3). This asks us to reflect on what effective learning is within contexts of smart learning, and what might be involved in teaching pedagogical approaches to facilitate that learning.

Augmented reality

Augmented reality can be defined in various ways within educational discourse (e.g. Dunleavy & Dede, 2014, p. 735; Dron, 2018, pp. 2-3; Chen, Liu, Cheng & Huang, 2017, p. 13). Wu, Lee, Chang & Liang (2013) provide a useful analysis, citing Klopfer & Squire (2008), who offer a description of "the idea of augmented reality - how handheld computers can supplement real world interactions, relying on context sensitivity and social interaction to create compelling new media" (p. 209). This reflects in this chapter, where augmented reality is defined as enabling a 'ubiquitous computing' model, where "mediated immersion infuses digital resources throughout the real world, augmenting students' experiences and interactions" (Dunleavy et al., 2009).

Teaching with a smart learning journey activity

Independently of my research I was teaching classes with students studying technology-enhanced learning at University of Malta. A component of their syllabus was to participate in the 'Malta Democracy' smart learning journey. This gave them the role of learners in a real-world example of smart learning, experiencing a direct, creative and critical participation within an autonomous activity largely controlled by themselves. Participation in the activity

attempted to provide to them the smart learning that Dron describes, where smartness is "an emergent consequence of dynamic interactions between the environment's constituent parts, including those of its human inhabitants and the artefacts and structures they wittingly or unwittingly create" (2018, p. 3). Taking part was autonomous in that students could decide when, where and how much of the journey they participated in. Tasks involved were informal, using a creative participatory pedagogy to encourage full interactivity at time and place if desired, as well as afterwards or even before going on the journey. Students were requested to create content – photographs or videos, comments or reflections – and post them in an Edmodo[5] class area, relevant to tasks and locations. None of the participation or content was formally assessed in any way.

Background

In this chapter I examine my teaching practice for enabling young educators to understand and facilitate smart learning in their own future teaching careers. Parallel to my teaching classes I was also researching smart learning journey activities with separate participant groups. The research that I refer to in following sections contributed to my teaching by developing understanding of smart learning pedagogies, and as findings emerged this understanding impacted my classroom practice for ways of teaching the concepts and pedagogies of smart learning to young educators studying 'future-facing' technology-enhanced learning.

My doctoral research investigating experiencing smart learning began in April 2016 (concluding September 2020) as a complementary pedagogical investigation to the COST funded CyberParks[3] research project (Bonanno, Klichowski & Lister, 2019). In order to respond to research questions orientated toward investigating the role and significance of connectivist principles in smart learning, a 'connectivist-inspired' learning strategy was considered most useful to the development of learning activities (Lister, 2018, p. 3). Technological solutions that complemented this connectivist-inspired approach were therefore adopted. Apps utilised were HP Reveal[4], Edmodo[5] and Google MyMaps[6] to digitally mediate learning interactions and a route of locations that together formed the journey. Learning content was hyperlinked from knowledge sources such as Wikipedia[7], WikiMedia Commons[8] or specialist websites, with some content created by tutors and

[3] CyberParks project http://cyberparks-project.eu
[4] HP Reveal https://hpreveal.com (now defunct)
[5] Edmodo https://edmodo.com
[6] Google MyMaps https://www.google.co.uk/maps/
[7] Wikipedia https://www.wikipedia.org/
[8] Wikimedia Commons https://commons.wikimedia.org/

hosted on independent webpages[9]. As described earlier, two smart learning journeys were created, Literary London, in the UK, and Malta Democracy, in Valetta, Malta.

Summary of research

Broad findings of the research outcomes outlined here may offer insights for pedagogical approaches for design and development of smart learning activities (see also Lister, 2021a, 2021b). This unfolding understanding may additionally highlight aspects for consideration in how to teach these potential approaches to young educators. Subsequent discussion reflects on what may be of pedagogical significance for smart learning activities and the environments they are situated in. Further discussion in this chapter then focuses on these considerations and approaches for teaching of smart learning in my classroom sessions (independent of the research itself), and how my teaching changed as a result of the emergent observations of the research.

Methodology

Phenomenography (Marton, 1981; Marton & Booth, 1997) was chosen as the methodology of the doctoral research, as was qualitative research work somewhat related to relevant fields of inquiry that benefited from selecting phenomenography as a methodological approach. Studies involving learning with technology and studies in user experience have increasingly looked to phenomenography to understand more about what users and learners do and why they do it. For example, Souleles, Savva, Watters, Annesley & Bull (2014) examined art and design student experiences of using iPads in their studies, describing the phenomenographic approach as allowing for a "bottom-up investigation, ie, from the perspective of learners". Kaapu & Tiainen (2010) investigated experiences of consumers and their understanding of virtual product prototypes, "to get an idea of users' subjective experience", aiming to "support customers' participation in product design process". The aims of these studies seemed to somewhat reflect in the aims of my own research, therefore phenomenography was considered to be a 'good fit' for investigating user (learner) experiences of smart learning activities. These activities were a hybrid mix of digital application interactions and experiences of understanding, both in learning and in wider contexts of expectations and interpretations. Using a bottom-up approach to obtain learners' subjective experience so that it might input into smart learning design pedagogical considerations seemed a useful idea.

Phenomenography analyses learner experience at collective level, looking at the experience variation itself rather than the individual context, though context is retained. Drawing on Gurwitsch's (1964, 2010) ideas about theme, thematic field and margin, experience is analysed using a 'structure of awareness' analytical framework (Cope, 2004). Known as a

[9] Smart Learning research website http://smartlearning.netfarms.eu/

second order perspective (Marton, 1981, p. 2; Marton, 1996, p. 183; Sjöström & Dahlgren, 2002, p. 340), phenomenography is non-dualist (Marton, 1996) in nature, making an epistemological assumption that there is only one world as experienced by the learner, "where there is an internal relation between the inner world and the outer world" (Ireland, Tambyah, Neofa & Harding, 2009). Here we are not concerned with ontological discussions of reality, or of the essence of a phenomenon (Marton & Booth, 1997, p. 117), but rather only the reality concerning phenomena of interest to the research as experienced by individuals being researched.

Sampling

The sample of research participants was purposive and convenience (Reed, 2006, p. 6; Edwards, 2005, p. 22; Souleles et al., 2014, p.4), recruiting undergraduate and postgraduate students on a voluntary basis between 2017-2019. Student cohorts were drawn from Education degrees and an Adult Education International Masters Erasmus programme based at University of Malta, plus an additional cohort from London Metropolitan University studying English Literature and Creative Writing. Phenomenography does not require large amounts of data, only sufficient to permit the widest possible (or likely) variation of experience to be found (Yates, Partridge & Bruce, 2012, p. 8). Taking into account practical limitations as well as iterative estimation for different variations to emerge, twenty-four participants were considered sufficient, giving a snapshot of variation (Trigwell, 2000; Åkerland, Bowden & Green, 2005) that included different demographics and subject disciplines. A possible limitation was gender representation, with nineteen females and six males.

Analysis

Adopting a phenomenographic analysis approach, categories of 'experience complexity' variation emerged to form an outcome space (e.g. Marton & Pong, 2005; Reed, 2006, p. 8; Larsson & Holmström, 2007, p. 56) for 'experiencing the smart learning journey'. This was achieved by discovering units of meaning (Reed, 2006; Marton & Pong, 2005) in a structure of awareness for the activity, noting commonalities and difference variations across the utterances at collective level in the interview transcripts. The outcome space 'experiencing the smart learning journey' was formed of four categories with four levels of experience complexity. These were somewhat relational, partially inclusive and may have some hierarchical relationship to each other (Lister, 2021a). Analysis was then reviewed by a co-judge (Booth, 1992, p. 68) to further review the analysis perspective and establish its communicability and interpretive awareness (Cope, 2004; Sandberg, 1997).

Exploring categories of experience variation

Categories of experience variation for the smart learning journey shown in Tables 1 and 2 are Tasks & Obligations, Discussing, Being There and Knowledge & Place as Value (Lister, 2021a, 2021b). Table 1 shows the structure of awareness variations that a participant may experience, Table 2 shows potential levels of complexity of this structure of awareness that may be present in varying combinations concurrently at the same time for the same participant. Noting that this data interpretation may be considered a snapshot of participant experience variation for a given activity at a given time and place (e.g. Trigwell, 2000, p. 80; Åkerland et al, 2005, p. 81), some observations can be made.

Table 1 describes the 'referential' and the 'structural' aspects of this structure of awareness. The referential is the meaning, derived from the internal horizon close up focus of the awareness (Cope, 2004), and the structural are the aspects that can be thought of as descriptive and functional, the structure that gives rise to the meaning, and extends out to the external horizon, the outer edge of perceptual boundary (e.g. Bruce, Pham & Stoodley, 2004). These structure of awareness variations hint at an idea that a participant (learner) is not perhaps only 'one type of learner', and can have a variety of complexity going on as aspects of awareness in their participation. This can be considered in two ways: structures of relevance that are of importance to the participant, and aspects of the object of learning (Marton & Tsui, 2004, pp. 4-5) that might be 'of vital interest' to the learner (Greeno & Engeström, 2014, p. 134). These two ways are likely not separate, but rather are intertwined in the mind and interactions of the learner. Examining the structural and referential aspects within each category, relevance structures (Marton & Booth, 1997, chapter 7) become evident. These range from those closely related to coursework requirements of the study unit, extending towards future teaching practice, levels of personal interest, motivation and relevance to topic area of study. Additional potentially co-existing social and collaborative factors that are sometimes disconnected from study also act as interpretive influencers. Focus on some 'global aspects of learning' (Marton & Booth, 1997, p. 141) might be issues such as the role or direct impact in assigned and assessed coursework, and relevance to future professional practice. Other factors emerge across the transcripts such as interest in the topics of the journey, the significance of place, time available to participate and perception of the activity itself for personal or social value.

CATEGORY OF DESCRIPTION	STRUCTURE OF AWARENESS		
	Referential: *meaning, reasoning, focus (theme)*	***Internal Horizon:*** *theme; 'near' thematic field*	***External Horizon:*** *further thematic field into the margin*
Category A - Tasks & Obligations	Doing the tasks; 'what we had to do'; what is required	Questions, tasks, obligations, requirements,	Relevance to own work, grading, 'being marked', usefulness, reason to

Tasks Obligations Requirements		own assignment or coursework	do it, time needed or set aside (available), purpose
Category B - Discussing Discussing Helping Working together Being social	Discussing tasks, discussing things associated with tasks, discussing other things about the location	Working together to help each other, discussing the technology, working out 'who was going to do what', sharing technology	Thinking about collaboration as a help to learning, other social aspects, getting to know each other, other passers by, fun and enjoyment with friends
Category C - Being There Being there Being in the place Being there at that time	Being 'in the place', it 'being real', 'living it', 'living in the picture', walking in their shoes, at that time, in that moment	Seeing the close context, media and knowledge 'immediately' at the place, not wasting time, 'doing it now', not being like a book or online, technology mediation for discovery of place, feeling a place	Mood and atmosphere of place, weather, light, sounds, wider context of surroundings, knowing the locations on a map (the route), being like a tourist, taking notice of surroundings, inspiration, *imagination, visiting/ exploring other locations for learning and/or inspiration*
Category D - Knowledge & Place as Value Knowledge, place for own sake Knowledge/place as gaining benefit	Personal research, motivation, own experience of the journey, the journey being of benefit, the journey as value for learning,	Personal reasoning, imagination, creativity, curiosity, own interest in topic(s), inspiration, learning something new	Potential use or purpose, for future practice, preparedness, prior or post research, additional knowledge construction or discovery, vi*siting/exploring other locations for learning and/or inspiration*

Table 1 The outcome space 'Experiencing the smart learning journey', structure of awareness draft category descriptions

Table 2 outlines the different levels of complexity that can be described for each of the experience variation categories of description, and we can see that for level 1, the simplest descriptions are observed - doing the task, discussing who does the tasks, going to a location, not having much (or any) engagement with value of knowledge in relation to place. These levels increase upwards in complexity in terms of what may be spoken about as of significance to an interviewee, and types of complexity can vary somewhat, yet retain inclusion in a category within a perceptual boundary horizon. It was noted that for some participants, category level 1 as well as level 4 utterances were observed as present in the same person, depending on what might have been the topic of the interview at a given point.

	Category A **Doing the tasks**	**Category B** **Discussing**	**Category C** **Being there**	**Category D** **Knowledge and place as value**
Level 4	Research tasks and topic beforehand, take time doing and reflecting on tasks	Share tasks and content, do additional learning, discuss related experience and knowledge	Live it, being in the picture, live the atmosphere, take more time, seeing the whole and related parts	Knowing and seeing knowledge and place as valuable, personal experience, deeper engagement and 'possibilities'
Level 3	Tasks indirectly related to coursework or assessment	Discuss tasks and topic in relation to time and place	Experience in the place relating to other people, aspects and memories. Make connections	Engage further with knowledge in topics, create upload content for tasks and at locations

			between places and knowledge	
Level 2	Do the tasks of interest, directly related to coursework or assessment	Discuss the tasks, help each other with tasks and tech	Locations are of some interest, potential for learning, creativity or inspiration	Click a few content links, save links 'for later', make screenshots of augmentations or tasks
Level 1	Do the tasks, go home	Discuss who does the tasks, how technology works	Go to locations, do tasks, go home	No engagement with content or knowledge, don't create or upload content

Table 2 Understanding experience complexity of a smart learning journey

The emerging awareness of these categories of experience variation, levels of complexity and related structures of relevance shed light on how an activity might be 'pitched' to learners, for example how it could be positioned within a study unit for its relationship to assessment, wider value and possible relevance further afield from the study unit or even the degree programme. These were all significant aspects to consider from pedagogical perspectives when planning or designing smart learning activities. They additionally provided possible context for how and what to teach as 'smart learning pedagogy' to young student educators.

Situating smart learning in structures of relevance

In terms of participation for the quality and value of engagement, motivation may be a key factor of experiential and pedagogical relevance in smart learning (Lister, 2021c). The interest and motivation of the learner in a learning activity, perhaps especially an autonomous one, begin well before the activity itself takes place, as learning is situated within a wider structure of relevance and global aspects of learning. Lorenzo & Gallon contest that "(i)t is difficult to understand the personal mechanisms that incentivise engagement and motivation, as they are tightly connected to individual learning interests, styles, and priorities…" (2019, p. 54), going on to describe 'smart learning spaces' as a useful element in this (data-driven) personalized approach. Yet Dron (2018) declares that "(t)he first problem of traditional teaching is that it embeds and reinforces the power of the teacher to control everything that happens in a classroom […]. Self-determination theory demonstrates that intrinsic motivation cannot emerge unless a person has a sense of autonomy (Ryan & Deci, 2006), against which the traditional classroom model thus actively militates." (Dron, 2018, p. 11). It is worth noting again here that the learner's 'object of vital interest" (Greeno & Engeström, 2014, p. 134) may be a potent driver for incentivising motivation and engagement. Additional aspects of relevance structure may be associated with more cultural associations such as where locations might be situated and what they represent (e.g. Buell, 2005), or practical aspects such as the preparedness of the learner to participate in the activity (Goodyear & Carvalho, 2012), bearing in mind it is autonomous and may not be obligatory.

Learners may be ill equipped to participate in autonomous learning activities, however in contexts of connectivist-inspired learning, autonomous motivation and empowerment of the learner are implicit in activity participation. Whether or not learning is assessed, mandatory, formative or supplementary may potentially all be powerful mitigators in the mind of the learner to initiate and sustain participation in learning. Marton & Booth's (1997) concept of relevance structures and the global aspects of learning into which a smart learning journey activity is situated may determine how the phenomenon of the smart learning journey might be experienced. In their structure of awareness, the focus of the learner may be as much on these hidden learning agendas as on any aspect of the journey itself, whether in close focus or in peripheral awareness.

Part of the understanding of pedagogies for smart learning is to acknowledge these considerations, adopting an approach that learning activity situated-ness (in a variety of interpretations) is of prime importance, and that the empowerment and engagement of the learner begin well before participation in a learning activity. This emerging understanding of experience variation, relevance, autonomy and motivation provided pragmatic insight for contexts of teaching 'smart learning pedagogy' to young student educators, explicitly acknowledging these factors as relevance structures in pedagogical guidance for planning and creating smarter learning environments and activities (Lister, 2020b). So began the process of rethinking how to teach this developing pedagogy of relevance and experience complexity for smart learning to my students.

Future-present pedagogy for smarter learning and teaching

The emerging findings of the research began to impact on my general approach to teaching the topic of smart learning to young educators, both in what to teach, and how to teach it. Bearing in mind that the research participant cohorts were not the same students as those who were attending my classes, I experimented with applying aspects of the early findings to practical scenarios of my every-day teaching. I thought this might provide potential anecdotal evidence for confirmation of findings, but might also prove of benefit to the students, improving their learning.

In terms of the smart learning journeys that the research investigated, the categories of description for experience complexity and pedagogical structures of relevance appeared to manifest in layers, depending on aspects of activity. For example, positioning for activity topic relevance, purpose, autonomy for implicit and explicit motivation, as well as interactions such as discussing and interacting with place. Connectivist-inspired participatory pedagogies are well positioned to support this kind of flexible learning through connection, creativity and interactions. This articulation of how different emphasis can be placed on

activities in a connected environment shows an emergence of a potential pedagogical guide for smart learning. This is what I felt needed to be 'taught' to young educators, and demonstrated to them in practical ways.

My teaching practice steadily changed as a result of the growing understanding gained from these research findings, moving from a lecture content delivery model to an open dialogic learning approach that supported post-activity reflections by the learners after they had participated in a smart learning journey. Following sections reflect on how I attempted to teach these aspects of experience variation and pedagogical approaches to young educators, by permitting the students to experience for themselves the experience complexity and relevance structures in a smart learning journey, and how these might influence interpretations for a participant learner.

Teaching smart learning pedagogies

Students in my classes were studying 'smart learning' as an element of their technology-enhanced learning study unit, part of education related studies in emerging pedagogies. Smart learning was a topic covered usually over a period of four weekly two-hour sessions. The challenge of teaching smart learning was in how to capture the imagination of the young educators to see the potential of smart learning *in the future*, to create and engage in the idea of these ubiquitous computing (Dunleavy et al., 2009, p. 8) smart learning environments.

Early class procedure

Initially my teaching practice introduced smart learning sessions with a lecture on the concept of smart learning as authentic real-world learning spaces supported by digital and human interactions, also covering some key theoretical perspectives of smart learning activities. The second lecture described various associated technologies and types of digital functionality and interactions that could support delivery of context-aware learning content for this type of learning. Students usually participated in the learning journey itself in the third week, with a concluding session to sum up advantages and pitfalls the following week. Sessions consisted of formal lectures using slides and lecture notes, followed by simple practical periods where students could test out the technologies on their own phones and laptops.

Developing dialogic classes

Over a period of three semesters my class procedures changed considerably. As findings and understanding began to emerge from my research, my teaching practice of smart learning as a topic steadily adapted, with structure of each class and schedule for the weekly series of sessions modifying to adopt a process of learning through self-discovery by the students. Where previously I had begun with theoretical concepts and pedagogies, I now introduced

smart learning as an informal idea, with examples of how it might be used, and then asked students to participate in the smart learning journey in their own time during the second week (class time being allocated). This was followed up by long class discussions in following sessions, discussing the role of theory when it 'came up', that is, seemed relevant. Sometimes, some practical tasks were introduced in these classes, such as peer review of ideas in groups.

Emphasis was placed on discussion using a phenomenography-inspired focus group approach, adapting the interview technique I had slowly perfected during the research interviews, and this introduced a very emergent learning approach to the classroom. These unfolding open discussions permitted students to 'unpack' their own smart learning journey experiences and discover for themselves what they had learned. The resulting awareness of their own learning produced naturally evident aspects of what was being learned, why and how (and even where it might have happened). Problems encountered, challenges that were overcome as a group, feelings and positive aspects of the experience became clear, as they were remembered and reflected on, together. This is referred to in Marton (1981, pp. 184, 186) and Marton & Booth as 'figure ground reversal' (1997, p. 49) and brings about a real understanding for the learner of their taking on knowledge and the relevance of it to them. The consciousness of the participant learner is alerted towards their own act of learning itself (Marton & Svensson, 1979, pp. 473-474).

The most significant differences took shape in the last semester. In many of these class sessions, group emergent discussions situated the learning within students' own teaching topic areas (such as chemistry, history, physical education and so forth), centering on how they might use smart learning in their future practice. Levels of engagement in the smart learning journey itself and in classroom activities afterwards noticeably improved, sometimes making use of online participation in Edmodo as well as classroom peer discussions. Student group interplay became far more effective, and the atmosphere was dynamic and much more energised. Change was particularly noticeable with a postgraduate cohort who were already working in education roles as early career professionals, for example primary school tutors or learning assistants supporting those with additional learning needs. This group fully benefited from my instigating an immersive phenomenography style group discussion in a class session, following their participation in the smart learning journey. My role was at the side, only making occasional probing interventions, encouraging them into deeper self-reflections and uncovering further depth and understanding. They produced their own set of group notes, listing out the aspects that they were reflecting on as they progressed in their discussion. These notes (shown in Figure 1) provided ample opportunity to then discuss pedagogical and experience related aspects of smart learning that they themselves had uncovered.

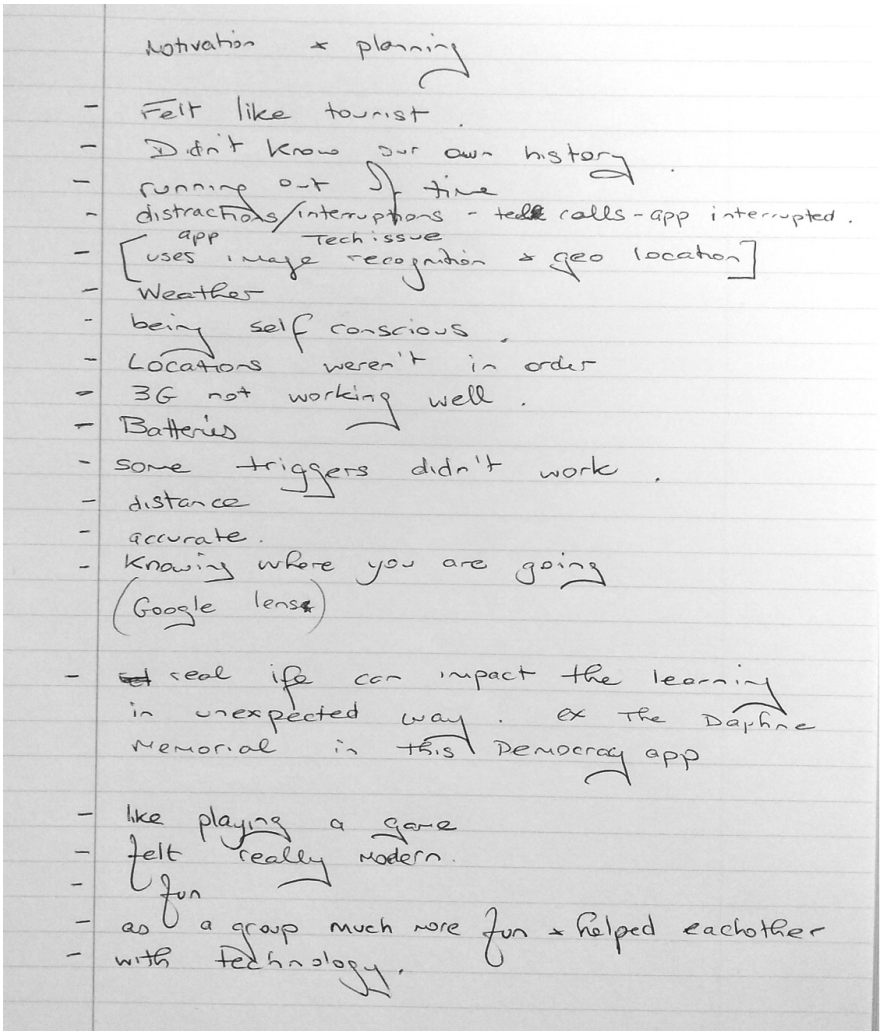

Figure 1 Post graduate student notes made in class during emergent group discussion on experience of the 'Malta Democracy' smart learning journey

Similar sets of notes made by students in the other class cohort groups used spaces in Edmodo that permitted each group to share their notes in class using the classroom projector. This seeded fruitful further discussion with everyone in the class and between groups, promoting an engaged peer critique and review. Sometimes groups even argued with each other about particular planning or thinking, and overall a lot of open discussion ensued. This immersed the students in their reflections and learning design deliberations, achieving an authentic and involved learning experience, where even theoretical aspects could be discussed as part of pragmatic considerations. It was during these last semester class sessions that using emergent focus group discussions for post-activity participation reflections came to be seen as significant in the learning process of a smart learning activity. In the teaching class sessions it meant that pedagogy and theory came to have real relevance for students. Likewise, the separate group of research participants' individual reflective conversational interviews had also shown the significance of this process for uncovering potential learning awareness.

By the last semester of teaching, I myself had gained further understanding of what was taking place, both through the research and through the class sessions I had undertaken. While some detail is omitted for sake of brevity, Table 3 provides an overview summary of teaching approaches and changes over time.

Semester /cohort	Teaching structure and approach
2017 Autumn Undergraduate Bachelors in Education.	Theory, pedagogies, technical considerations, no class discussion sessions. Participate in smart learning journey towards the end of the four-week smart learning study unit programme.
2018 Autumn & Spring Undergraduate Bachelors in Education; postgraduate Masters in Teaching & Learning.	Some theory, pedagogies, technical considerations, modest class discussion but not supported by class activities. Participate in smart learning journey towards the end of the four-week smart learning study unit programme.
2019 Autumn & Spring Undergraduate Bachelors in Education; postgraduate Masters in Teaching & Learning.	Becoming significantly more dialogic. Semester two became completely emergent and open in class approach. Class activities took notice of peer notes and emergent observations using the presenter screen to focus attention, between periods of student discussion, tutor role only to listen and gently probe occasionally to encourage deeper reflection. Participate in smart learning journey in the second week of the three/four week smart learning study unit programme.

Table 3 Overview of teaching approaches and changes across semesters and academic years

The changes to my teaching approach were gradual as at the outset I had either not yet collected data in the earliest semester, or once I had, I had not yet related engagement in the smart learning journey activity directly with my non-research related classroom teaching contexts. This was particularly in relation to how participants benefited from unpacking their own experiences as part of learning, in the figure-ground reversal way that Marton & Booth describe (1997, p. 49). As I analysed experience variation from interview transcripts it became clear that participation in the activity and reflection afterwards on it were potentially closely connected, at least for many learners. This has led to further understanding about the power and significance of emergent group and individual reflection as a potentially important aspect of smart learning activity design (Lister, 2021b, 2021c).

Conclusions

This chapter has discussed my teaching practice and how it changed as a result of my parallel research findings and understanding, contributing to a much more dialogic learning approach in my class sessions, orientated in active participation of a smart learning journey activity. Though the research was separate to my scheduled teaching classes, it had direct impact on them for how to teach smart learning pedagogy in effective ways to young future educators. The changes in my classroom teaching demonstrated to me the potentially significant benefits of adopting phenomenography style emergent focus group discussions to assist learners in the discovery of their own learning in relevant and practical ways.

Smart learning journeys are a part of future learning activities and as such may be difficult to grasp as 'real', until they are participated in and then unpacked for what happened during that participation. By employing a phenomenographic approach to discussion, learners actively engage in their own self-discovery, socially co-constituting (Sandberg, 2005) their understanding together for how the activity affected them. Value is recognised, frustrations are acknowledged and practical issues are noted. Future-facing technology-enhanced learning activities become real to the participant learner, and therefore become more accepted as potential teaching strategies for future practice of young educators in their professional working lives.

A key outcome of the research itself was in developing a pedagogical guide for smart learning, a four-tier model of considerations known as the Pedagogy of Experience Complexity for Smart Learning (PECSL), further outlined in Lister (2021b). The PECSL acknowledges the further understanding gained from the non-research related teaching practice discussed in this chapter, referring to my classroom sessions as pragmatic illustrations of dialogic 'figure-ground reversal' to bring about learners' self-awareness of their own learning in smart environments and activities. These sessions highlighted the potential significance of reflection in relation to structures of relevance based in pedagogical aspects and learner experience variation. Though using combinations of activity participation outside the classroom and dialogic, emergent discussion techniques in the classroom are not in themselves new, in the context of strategies for teaching 'future-present' pedagogies, they bring to life what otherwise may be difficult concepts to impart. In conjunction with the further understanding that the research itself provided, they are powerful and rewarding ways to ignite the imaginations of student educators about what may be possible in their own future educational practice.

References

Åkerlind, G., Bowden, J., & Green, P. (2005). Learning to do Phenomenography: A reflective discussion. In Bowden, J., & Green, P. (Eds.), *Doing Developmental Phenomenography* (pp. 74-100). RMIT University Press.

Buell, L. (2005). Space, Place, and Imagination from Local to Global. In Buell, L (Ed.), *The future of environmental criticism: environmental crisis and literary imaginatio*n (pp. 62-96). Blackwell.

Booth, S. (1992). *Learning to Program: A Phenomenographic Perspective*. Goteborg Studies in Educational Sciences, Vol. 89. Acta Univesitatis Gothoburgenis.

Bonanno, P., Klichowski, M., & Lister P. (2019). A Pedagogical Model for CyberParks. In Smaniotto Costa C. et al. (Eds.), *CyberParks -The Interface Between People, Places and*

Technology. Lecture Notes in Computer Science, vol 11380. Springer, Cham. https://doi.org/10.1007/978-3-030-13417-4_23

Bruce, C., Pham, B., & Stoodley, I. (2004b). Constituting the significance and value of research: views from information technology academics and industry professionals. Studies in Higher Education, 29(2), 219-238. https://doi.org/10.1080/0307507042000190804

Carretero, S., Vuorikari, R., & Punie, Y. (2017). *Digital competence framework for citizens (DigComp 2.1). European Commission*. Luxembourg: Publications Office of the European Union. https://doi.org/10.2760/38842

Chen P., Liu X., Cheng W., Huang, R. (2017). A review of using Augmented Reality in Education from 2011 to 2016. In Popescu, E., Kinshuk, Khribi, M. K., Huang, R., Jemni, M., Chen, N-S., & Sampson, D. G. (Eds.), *Innovations in Smart Learning*. Lecture Notes in Educational Technology (pp. 13-18). Springer. https://doi.org/10.1007/978-981-10-2419-1_2

Cochrane, T., & Antonczak, L. (2014). Implementing a Mobile Social Media Framework for Designing Creative Pedagogies. *Social Sciences* 2014, 3, 359–377. https://doi.org/10.3390/socsci3030359

Cope, C. (2004). Ensuring Validity and Reliability in Phenomenographic Research Using the Analytical Framework of a Structure of Awareness. *Qualitative Research Journal*, 4(2), 5-18. Retrieved from http://search.informit.com.au/documentSummary;dn=133094720910488;res=IELHSS

Dron, J. (2018). Smart learning environments, and not so smart learning environments: a systems view. Smart Learning Environments. Springer Open, 5:25. https://doi.org/10.1186/s40561-018-0075-9

Dunleavy M., & Dede, C. (2014). Augmented Reality Teaching and Learning. In Spector, J., Merrill, M., Elen, J., & Bishop, M. (Eds.), *Handbook of Research on Educational Communications and Technology* (pp. 735-745). Springer. https://doi.org/10.1007/978-1-4614-3185-5_59

Dunleavy, M., Dede, C., & Mitchell, R. (2009). Affordances and limitations of immersive participatory augmented reality simulations for teaching and learning. *Journal of Science Education and Technology*, 18(1), 7–22. doi 10.1007/s10956-008-9119-1

Edwards, S. (2005). *Panning for Gold: Influencing the experience of web-based information searching*. (Doctoral Dissertation). Queensland University of Technology. Retrieved from https://eprints.qut.edu.au/16168/

Garnett, F., & Ecclesfield, N. (2011). Towards a framework for co-creating Open Scholarship. *ALT-C 2011 Conference Proceedings*. Association for Learning Technology. https://doi.org/10.3402/rlt.v19s1/7795

Goodyear, P., & Carvalho, L. (2012). The Analysis of Complex Learning. In Beetham, H., & Sharpe, R. (Eds.), *Rethinking Pedagogy for a Digital Age: Designing for 21st Century Learning* (2nd ed., pp. 49-63). Routledge.

Green, B. (2019). *The Smart Enough City, Putting Technology in Its Place to Reclaim Our Urban Future*. Strong Ideas. MIT Press. Retrieved from https://mitpress.mit.edu/books/smart-enough-city

Greeno, J. G., & Engeström, Y. (2014). Learning in Activity. In Sawyer, R. K., (Ed.), *The Cambridge Handbook of the Learning Sciences* (2nd ed., pp. 128-147). Cambridge University Press.

Gros, B. (2016). The design of smart educational environments. *Smart Learning Environments*. Springer Open. https://doi.org/10.1186/s40561-016-0039-x

Gurwitsch, A. (1964). *The field of consciousness*. Pittsburgh: Duquense University Press.

Gurwitsch, A. (2010). The collected works of Aron Gurwitsch (1901-1973). Volume III, The field of consciousness: theme, thematic field, and margin. (Zaner R., Ed.). Springer. https://doi.org/10.1007/978-90-481-2942-3

Ireland, C., & Johnson, B. (1995). Exploring the FUTURE in the PRESENT. *Design Management Institute Review*, 6(2), pp. 57-64. https://doi.org/10.1111/j.1948-7169.1995.tb00436.x.

Ireland, J., Tambyah, M., M., Neofa, Z., & Harding, T. (2009). The tale of four researchers: trials and triumphs from the phenomenographic research specialization. In *AARE 2008 International Education Conference, Changing Climates, Education for Sustainable Futures*, 2008, Queensland University of Technology, Brisbane.

Kaapu, T., & Tiainen, T. (2010). User Experience: Consumer Understandings of Virtual Product Prototypes. In Kautz, K., & Nielsen, P., A. (Eds.), *Scandinavian Information Systems Research. Proceedings of the First Scandinavian Conference on Information Systems*, SCIS 2010 Rebild, Denmark, pp. 18-33.

Klopfer, E., & Squire, K. (2008). Environmental Detectives - the development of an augmented reality platform for environmental simulations. *Educational Technology Research and Development*, 56, 203–228. https://doi.org/10.1007/s11423-007-9037-6

Larsson, J., & Holmström, I. (2007). Phenomenographic or phenomenological analysis: does it matter? Examples from a study on anaesthesiologists' work. *International Journal of Qualitative Studies on Health and Well-being*, 2(1), 55-64. https://doi.org/10.1080/17482620601068105

Lister, P. (2018). A Smarter Knowledge Commons for Smart Learning. *Smart Learning Environments* (2018) 5:8. Springer Open. https://doi.org/10.1186/s40561-018-0056-z

Lister, P. (2020). Smart Learning in the Community: Supporting Citizen Digital Skills and Literacies. In: Streitz N., Konomi S. (Eds.), *Distributed, Ambient and Pervasive*

Interactions. HCII 2020. Lecture Notes in Computer Science (pp. 533-547). Springer Cham. https://doi.org/10.1007/978-3-030-50344-4_38

Lister, P. (2021a). Understanding experience complexity in a smart learning journey. *S N Social Sciences 1*, 42. Springer. https://doi.org/10.1007/s43545-020-00055-9

Lister, P. (2021b). The pedagogy of experience complexity for smart learning: considerations for designing urban digital citizen learning activities. *Smart Learning Environments 8*, 8. Springer Open. https://doi.org/10.1186/s40561-021-00154-x

Lister, P. (2021c). What are we supposed to be learning? Motivation and Autonomy in smart learning environments. In Streitz, N., & Konomi, S. (Eds.), *Distributed, Ambient and Pervasive Interactions*. *HCII 2021*. Lecture Notes in Computer Science 12782, (pp. 1–15). Springer. In press. https://doi.org/10.1007/978-3-030-77015-0_17.

Liu D., Huang, R., & Wosinski, M. (2017). Future Trends in Smart Learning: Chinese Perspective. In: *Smart Learning in Smart Cities*. *Lecture Notes in Educational Technology*. Springer Singapore.

Lorenzo, N., & Ray Gallon, R. (2019). Smart Pedagogy for Smart Learning. In Daniela, L. (Ed), *Didactics of Smart Pedagogy: Smart Pedagogy for Technology Enhanced Learning*. Springer Nature, Switzerland AG. Https://doi.org/10.1007/978-3-030-01551-0

Marton, F. (1981). Phenomenography - Describing Conceptions of the World Around Us. *Instructional Science 10* (1981), 177-200.

Marton, F. (1996). Cognoso ergo sum – Reflections on reflections. In G. Dall'Alba & B. Hasselgren (Eds.) *Reflections on phenomenography: Toward a methodology?* (pp. 163-187). Acta Universitatis Gothoburgensis.

Marton, F., & Booth, S. (1997). *Learning and Awareness*. Mahwah, NJ: Lawrence Erlbaum Associates.

Marton, F., & Pong, W. P. (2005). On the unit of description in phenomenography. *Higher Education Research & Development*, 24(4), 335–348.

Marton F., & Svensson, L. (1979). Conceptions Of Research In Student Learning. *Higher Education, 8,* 471-486. https://doi.org/10.1007/BF01680537

Marton, F., & Tsui, A. (Eds.). (2004). *Classroom discourse and the space of learning.* Mahwah, NJ: Lawrence Erlbaum Associates.

Reed, B. (2006). Phenomenography as a way to research the understanding by students of technical concepts. *Núcleo de Pesquisa em Tecnologia da Arquitetura e Urbanismo (NUTAU): Technological Innovation and Sustainability*. Sao Paulo, Brazil, 1-11.

Ryan, R. M., & Deci, E. L. (2006). Self-regulation and the problem of human autonomy: Does psychology need choice, self-determination, and will? *Journal of Personality,* 74(6), 1557–1585.

Sandberg, J. (1997). Are Phenomenographic Results Reliable? *Higher Education Research & Development*, 16(2), 203-212. https://doi.org/10.1080/0729436970160207

Sandberg, J. (2005). How Do We Justify Knowledge Produced Within Interpretive Approaches? *Organizational Research Methods*, 8(1), 41-68). https://doi.org/10.1177/1094428104272000

Siemens, G. (2006). Connectivism: Learning and knowledge today. [Paper presentation]. *Global Summit 2006: Technology Connected Features, Sydney, Australia*. Retrieved from http://www.mmiweb.org.uk/egyptianteachers/site/downloads/Siemens_2006.pdf

Sjöström, B., & Dahlgren L. O. (2002). Nursing theory and concept development or analysis. Applying phenomenography in nursing research. *Journal of Advanced Nursing* 40(3), 339-345.

Souleles, N., Savva, S., Watters, H., Annesley, A., & Bull, B. (2014). A phenomenographic investigation on the use of iPads among undergraduate art and design students. *British Journal of Educational Technology* (2014). https://doi.org/10.1111/bjet.12132

Spector, J. M. (2014). Conceptualizing the emerging field of smart learning environments. *Smart Learning Environments*, 1, 2. https://doi.org/10.1186/s40561-014-0002-7

Trigwell, K. (2000). A phenomenographic interview on phenomenography. In Bowden, J. A., & Walsh, E. (Eds.), *Phenomenography*, pp. 62-82. Qualitative Research Methods series Series. Melbourne. RMIT University Press.

Wu, H.-K., Lee, S. W.-Y., Chang, H.-Y., & Liang, J.-C. (2013). Current status, opportunities and challenges of augmented reality in education. *Computers & Education*, 62, 41–49. https://doi.org/10.1016/j.compedu.2012.10.024

Yates, C, Partridge, H & Bruce, C. (2012). Exploring information experiences through phenomenography. *Library and Information Research Volume 36* Number 11.