What are we supposed to be learning? Motivation and autonomy in smart learning environments

Pen Lister[1[0000-0002-1071-693X]]

[1] University of Malta, Msida MSD 2080, Malta.
Email pen.lister@penworks.net

Abstract. This paper responds to participant interview comments made in the author's research into experiencing smart learning from pedagogical analysis perspectives. Interviewees remarked on what was supposed to be learned as oppose to what they might have actually been interested in, motivated by or simply doing in the smart learning journey activities being investigated. Through analysis of data, it appeared that structures of relevance formed strong reasoning in the minds of learners that subsequently substantially affected their depth and type of experience, beginning before they participated in an activity. This paper explores and develops thinking around pedagogical approaches to enhance and support some significant motivating factors for autonomous participation in smart learning activities.

Just-in-time learning forms part of the ambient and pervasive interactions 'ubiquitous computing' landscape of digitally connected learning cities, already a future-present representation of what may become commonplace in ad-hoc 'smart enough' cities in the near future. Smart learning environments can only be considered smart if effective learning can take place, therefore designing learning activities for smart environments requires considerable reflection of intended aims and measurement of what may constitute learning effectiveness. Understanding potential for learning in these contexts can enhance pedagogical design and approach to support engaging and effective smart learning activities within this unfolding future learning terrain.

Keywords: Motivation, autonomy, digital skills, smart learning, smart learning environments, smart pedagogy

1 Introduction

This paper discusses concepts of pedagogical approach to support motivation and autonomy in smart learning activities. For the purposes of discussion in this paper, smart learning activities are generally conceptualised as journeys in real world urbanised digitally connected spaces, formed from several hyperlocal locations [9] related by topic of activity, with digitally mediated participant interactions.

Smart learning activities are often intended as autonomous with voluntary participation, and learner participants may be requested to engage in them not always knowing why participation is of value or where value resides. Participant learner demographics may vary widely according to activity type and purpose, from citizen learners in informal activities through to formal learners participating in summatively assessed work. This makes planning and designing activities that have value for learning as part of desired outcomes a potentially problematic and tangled challenge. Citizen participants might not be expecting (or even desiring) to learn yet may be learning implicitly as a result of participating in an activity [30] if the activity topic is of interest to them or for other reasons that offer value such as community networking. Formal learners, for example students in undergraduate or postgraduate degrees, may not estimate value in participation of smart learning activities unless they are obligatory and formally assessed and may regard formative voluntary participation as 'not worth it'. Autonomous learning activities that request participation with no explicit reasons of value or relevance for the participant may therefore not be considered as important or worthwhile (for any type of participant), and value may be associated with aspects other than credentialised or explicitly measured learning outcomes. How the expectations of different participants might be absorbed into more flexible hybrid pedagogical approaches for these kinds of learning activities are explored and reflected on in light of findings from recent research by the author.

Using the methodology of phenomenography [36, 38], participants of two separate yet similar smart learning journey activities were interviewed using a semi-scripted responsive emergent approach. Categories of experience variation were discovered from these interviews that shed light on some of the issues surrounding autonomy, motivation and the situated relevance structures of autonomous participatory learning activities [31, 32]. In this research (and this paper) the 'ubiquitous computing' immersive learning [13] of smart learning journeys using ad-hoc mobile apps is regarded as a future-present [22, 23] representation of what may become commonplace in ad-hoc 'smart enough' [19] cities in the near future. Learning as and when need or curiosity necessitates may be part of the ambient and pervasive interactions landscape of future connected learning cities, promoting some of the lifelong learning ideals of Sustainable Development Goal 4[1] and related national policies for citizen 21st century skills and competences support [8, 7, 30]. Understanding potential learning in these contexts, if and how learning might be taking place and what that learning might actually constitute can further enable pedagogical design and approach being refined to flexibly support participant engagement more effectively in smart learning activities within this unfolding future learning terrain.

2 Smart learning and smart learning environments

Smart learning activities are generally conceptualised in this paper as journeys in real world urbanised digitally connected spaces, formed from several hyperlocal locations [9] related by topic of activity, supported by digitally mediated participant interactions. Technology forms a part of participation interaction but is not regarded as of

[1] Unesco SDG 4: https://sdgs.un.org/goals/goal4

greater significance than any face-to-face or personal reflective inter and intra-actions with place and location.

Smart learning might be a term more commonly associated with technologically mediated 'personalised' learning using artificial intelligence and detailed learner profile ontologies, e.g. [48], however the significance of citizens and their quality of life is increasingly placed at the centre of discussions about what may constitute smart cities and smart learning as a concept, e.g. [42, 55, 16]. The ongoing emphasis of the role and importance of technology in smart cities [17] may therefore be misplaced within educational paradigms of the learning city.

Smart learning environments can be considered smart if effective learning is possible [11, 54], therefore necessitates considerable reflection of what may constitute learning effectiveness. Learning effectiveness can be usefully summarised in the context of smart learning within hybrid urban settings as "learning to learn, learning to do and learning to self realisation" [34, p. 209]. By adopting this open interpretation, a flexible approach to pedagogical considerations within the design of an activity might be better achieved, with additional awareness being focused on what participants themselves may consider as learning.

3 Effective learning in smart environments

Learning to learn may be the most relevant aspect of Liu et al.'s [34, p. 209] description in context of what makes learning smart in a smart learning environment, as an integral part of the "induction into the global dialogue of humanity" in the Internet Age [57, p. 107]. To examine learning effectiveness is therefore an important debate when considering motivation, autonomy, and understanding what effective learning might be from the perspective of the learner, and what they think they are supposed to be learning, or might be learning without being consciously aware of it.

Learning to learn has been at the forefront of relevant epistemological discussion for some time, with noticeable complementary ideas and useful examples. Utilising conversation theory as a basis for cybernetic learning system design, Boyd advises to "(a)nswer *(a learner's)* questions; explain why you are answering that way" and to "(a)sk the learners why they are asking (those) questions, in order to evoke metacognitive consciousness of how they are learning to learn" [2, p. 191]. Pask, the author of conversation theory, discusses 'teaching people to learn', inducing 'learning to learn' [44, p. 139], and noting that "gaining versatility" as a general aptitude of learning, transferred from one subject matter to another, is a sign of the skill of learning. Pask asks "(c)an 'gaining versatility' be equated with 'learning to learn'? And as a practical consequence, can 'conversational experience' thus be regarded as 'training the skill of learning'?" [44, p. 144]. This somewhat echoes Wegerif's comments that 'Education for the Internet Age' is dialogic, "and characterises education as learning to learn, think and thrive in the context of working with multiple perspectives and ultimate uncertainty" [57, preface]. Learning to learn, think and play are the focus of Papert's "art of learning" [43, p. 82]. He bemoans that "school children are taught more about numbers and grammar than about thinking" [43, p. 85], then quoting his earlier work: "we tell them about numbers, grammar and the French Revolution; somehow hoping that from this disorder the really important things will emerge all by themselves…" (p. 85). Reflecting on Polya's [45] heuristic problem solving techniques, Papert particularly highlights taking time as being a key requisite to create conditions of effective learning: "spending relaxed time with a problem leads to getting to know it, and through this, to improving one's ability to deal with other problems like it" [43, p. 87]. This appears to reiterate ideas about flexibility in adapting one's learning approach to the problem at hand.

Engeström [15] cites Brown, Campione & Day's [4] idea of "metacognition as the basis of 'learning to learn'", and list the learner's own cognitive characteristics, available learning strategies, demands of various learning tasks and inherent structure of the material as being 'competing demands', that a learner must "tailor their activities finely" in order to become "flexible and effective learners" [4, pp. 16-17] in [15, p. 137]. Again this emphasises the need for versatility making for more effective learning. Brown et al. state that "students must develop some of the same insights as the psychologist into the demands of the learning situation" [15, p. 137]. This chimes with the phenomenographic 'therapeutic session' interview approach [38, p. 130], reflecting phenomenogrpahic debate regarding the learner's awareness of their own learning, that "there is a consciousness of (the learner) being conscious of "the learner's experience of the act of learning" [40, pp. 473-474]; also citing [50]. The 'demand structure' of a learning activity [38, pp. 169-170] referred to by Brown et al. as the 'demands of the learning situation' is of pertinent relevance to this paper, as relevance and demand structures as perceived by learners appear to have significant impact on any learning that might be potentially going on.

The meta-awareness of learner participants for what they might be learning or interpret as of value is further reflected on in subsequent sections in relation to surrounding context of the emergence of relevant pedagogical considerations. Further, referring to the authors own research examining smart learning activity participant experiences, it was noted that within the activities that were investigated participants expressed value and learning in a range of ways that were unintended by the instructor, perhaps indicating the need for a more flexible acknowledgement of what is possible to learn in a smart learning activity.

4 Motivation and autonomy

Tangible, substantive, explicit as well as implicit, abstract and affective motivational factors in autonomous learning contexts might all be considered as key significant aspects of an engaged participation in smart learning, e.g. [27, pp. 363-364]. Awareness and planning for the expectations, benefits and value to the participant might therefore usefully form core principles of flexible hybrid pedagogical approaches for learning and engagement.

In discussing the meta-awareness of learning to learn, it may be that factors of motivation and autonomous agency are defining influencers for how awareness about learning is perceived and interpreted by participants of smart learning activities. In light of much smart city learning literature orientating toward technologically supported personalisation of learning in one form or another, it may be logical to assume that personalised learning implies autonomy and an individual empowerment toward self-directed learning and participation. Citing Zimmerman [58], Maina & González provide a succinct summary, stating: "(a)utonomous learning supposes some forms of self-regulation. Self-regulated learning is demanding since it assumes that people are 'meta-cognitively, motivationally and behaviourally active' in their own learning process" [35, p. 89]. In this it is clear that a participant needs to be aware of what might be of interest (intrinsically motivating), possible to learn, and be positively empowered toward activities involving some kind of learning. At heart, these are the challenges of autonomous smart learning, not only in fully considering the potential hurdles manifested by absence of these factors, but in how to overcome them.

Both intrinsic and extrinsic motivation are significant in relation to smart learning activities. If an activity is obligatory for participants, perhaps it may only be valued in extrinsic reward terms, yet if an activity is not obligatory, perhaps motivation is absent to participate at all. Intrinsic motivation [48, 12] is adversely affected by extrinsic factors of reward and assessment, and may additionally be negatively impacted by other types of imposed goals. For example, assessed achievements such as badged awards, qualification credits or community tokens that act as extrinsic mechanisms for increasing motivation to participate erode intrinsic motivation due to loss of personal control. Ryan & Deci refer to this as the locus of causality, that "not only tangible rewards but also threats, deadlines, directives, pressured evaluations, and imposed goals diminish intrinsic motivation because, like tangible rewards, they conduce toward an external perceived locus of causality" [48, p. 70]. Marton & Booth refer to 'technification' as the process of over instructing in task design, giving examples of studies showing increased instructional design results in less being learned [38, p. 169] as learners feel obligated to complete what is being specifically required - to jump through the hoops. This results in a surface approach to learning in order to pass the test, rather than exploration for a deeper engagement with the topic. Dron emphasises that intrinsic motivation cannot emerge unless a person has a sense of autonomy, "against which the traditional classroom model thus actively militates" [12, p. 11]. In smart learning activities however, the classroom has been removed, and this may position these types of potential learning experiences at a greater advantage in fostering and maintaining intrinsic motivation.

Larson reflects on relevant motivational factors in his youth work research. He notes that youths 'taking part in high-quality programs' are 'super-motivated' and deeply engaged, the 'arc of work' they were involved in offered opportunity to develop purpose and that "youth in project-based programs might be voluntarily and intensely engaged in powerful processes of self-creation" [28, p. 75]. Youths said their "projects had become connected to personal goals, including to future school and work goals", and further "noble goals that are 'beyond the self'" [28, p. 75]. These goals reflect varying concepts of the "global aspects of learning" of possible futures and the individual's place in the world [38, p. 141]. Additionally, Larson notes the significance of interpersonal co-constituted meaning and purpose in being part of an activity with others, that youth were "invested not just as individuals, but often as members of teams working toward shared project goals" [28, p. 75]. Maina & González support this, stating "there is also a crucial role played by others (teachers, peers, experts, etc.) in the successful development of self-regulation" [35, p. 89]. As earlier implied by Brown et al. in Engeström [15, p. 137], self regulation requires that learners must "tailor their activities finely" in order to become "flexible and effective learners" is reiterated in this context of teamwork and shared objectives.

5 The Research

The research on which discussion in this paper has been inspired is briefly outlined here. Research was carried out to investigate two different yet similar smart learning activities conceptualised as real-world journeys, formed by several hyperlocal [9] points of interest related by topic in a locality that together formed a journey. Points of interest were augmented with digital interactions using ad-hoc free smartphone apps and technologies, to permit participant access to context aware content. Apps used were HP Reveal[2], Edmodo[3] and Google MyMaps[4]. Original knowledge content, hosted on a custom website[5], was supplemented by related WikiPedia, WikiMedia and other digital knowledge commons content. Participants additionally were requested to create their own content relating to their participation in the journey and upload to Edmodo group areas. Activity participants took part voluntarily in their own time, and did as much or as little of the journey as they chose. Often, though not always, participants took part in small groups.

5.1 Sample and Method

Twenty-four participants agreed to take part in the research, drawn from two universities in two countries, London Metropolitan University, UK and the University of Malta. The sample was purposeful and convenience [46, p. 6, 14, p. 22] as all participant interviews were voluntary. Students were studying BEd. and MA Education degrees, with one other subject discipline represented, BA English Literature & Creative Writing. A wide international demographic was represented across cohorts in both coun-

[2] https://hpreveal.com (defunct)
[3] https://edmodo.com
[4] https://google.com/mymaps
[5] https://smartlearning.netfarms.eu

tries, with age range approximately twenty to thirty five years old. A potential limit of the study was gender balance, with nineteen female and six male students represented.

5.2 Methodology

Phenomenography [36] was selected as the methodology suitable for the research as learner experience is at the heart of the investigation and phenomenography examines experience variation using an emergent interview approach. Additionally, qualitative research work related to relevant fields of technology enhanced learning use phenomenography, e.g. [53, 11], and user experience, e.g. [26, 59]. Phenomenography draws on Gurwitsch's [21] ideas about theme, thematic field and margin to analyse experience using a 'structure of awareness' analytical framework [10]. Known as a second order perspective [36, p. 2, 37, p. 183, 51, p. 340], phenomenography is non-dualist [38] 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" [24]. Here we are not concerned with ontological discussions of reality, or of the essence of a phenomenon [38, p. 117], but rather only the reality concerning phenomena of interest to the research as experienced by individuals being researched.

5.3 Analysis

Phenomenography analyses learner experience looking for experience commonality and variation at collective level rather than the individual context, though context is retained. Using an interpretation of the structure of awareness analytical framework [10], a phenomenographic outcome space (e.g. [39, 46, p. 8]) of 'experiencing a smart learning journey as a whole' was formed, with four categories of experience variation, each with four layers of complexity, see Table 1.

Table 1 Understanding experience complexity of a smart learning journey

	Category A **Doing the tasks**	Category B **Discussing**	Category C **Being There**	Category D **Knowledge & place as value**
Level 4	Research tasks and topic beforehand, take time doing and reflecting on tasks	Share tasks, 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, seeing knowledge and place as valuable, personal experience, deeper engagement, 'possibilities'
Level 3	Tasks indirectly related to coursework or assessment	Discuss tasks and topic in relation to time and place	Experience place relating to other people, aspects, memories, connections between	Engage further with knowledge in topics, create upload content for tasks and at locations

			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

Descriptive guidelines were noted to outline the emergent differentiating factors of meaning for these categories and levels of experience complexity, to assist and support interpretation of utterances in interviews. Using the descriptive guidelines summary of the table of experience complexity as a foundation, a model of pedagogical considerations for smart learning was formed that came to be known as the Pedagogy Of Experience Complexity For Smart Learning (PECSL), further outlined in Lister [31, 32]. The categories and levels of experience complexity indicated possible interpretations of intrinsic motivation and relevance, perhaps providing glimpses of how to anticipate areas of potential experience that participants may have, dependent on the nature and location of a smart learning activity.

6 Structures of experience variation

The categories and levels of experience variation discovered by the research may serve as potential signifiers of participant motivational factors from an experience perception perspective. They may further act as indicators of the significance of participant reflection (either prior to, or more especially after taking part in an activity) in relation to self-awareness and meta-cognition for learning, e.g. [33]. In the activities investigated by the research, participants referred to a wide variety of aspects in the activities that may have impacted their forming of structures of relevance for motivational factors and contexts. The categories of experience variation that the study discovered from participant interviews offered insight into how these structures of experience variation, and any wider context of awareness, together formed these relevance structures. Brief summaries of topics of conversation provided in Table 2 show aspects of significance in the activity as related by participants, demonstrating multiple topics and depth of interest. Extrinsic motivators such as 'doing the tasks' or 'doing the locations' are omitted, provided here is a glimpse of the richer, deeper scope of intrinsic motivational experience as mentioned in interviews by participants, showing areas of interest, motivation and value to them.

Table 2 Aspects of significance of the activity as related by participants (summarized by the researcher)

Personal motivation for learning and taking part
– Value of being there for creativity and authenticity in written work
– The novelty of the digital assistant
– The wow factor and sci-fi experience of using the (AR) app
– A natural sparking of interest while using the (AR) app
– Appreciating potential for SL activity in other scenarios for own future practice
Value in place and being there
– Getting to know the detail and atmosphere of a place
– Being outside away from the classroom
– Appreciating global cultural value differences
– Sharing memories related to location and topic of activity
– Learning more about local surroundings than would normally be noticed
– Becoming like a tourist in one's own locality
Being with friends and helping each other
– Being able to ask questions of each other outside of classroom pressure
– Meeting others who might usually be only online or names in another similar class
– Helping others to achieve shared goals
– Sharing (discussing) cultural differences related to topics and locations
– Comparing experiences of the activity with peers

The activity significance of 'meaning' [39] that was attributed during analysis to the experience variation quotes of participants (and formed each participant's structure of awareness), may be interpreted and understood as types and areas of intrinsic motivation. The significance of these aspects to participants are often not in connection with any perceived 'demand structure' of the instructional design, but were aspects of experience complexity that were more informally influenced by peers, friends, or for personal relationships and agency connected to places and knowledge, separate from any 'intended objects of learning' [41, pp. 4-5]. These might have been somewhat 'triggered' by general aspects of intended objects of learning but were distinct from those, existing in personal spheres of memory, observations or peer discussion, appearing to be the embodiment of learners' 'vital objects of interest' as described by Greeno & Engeström [20, p. 134]. Perhaps these vital objects of interest, being so varied and flexible in the context of a smart learning activity out in the real world are themselves forming as well as being formed by, structures of relevance as experienced by learners. These structures are continuously reconstituted as intersubjective lifeworlds [49], building reflective understanding. This can be micro or macro in scope of topic, and intra- and inter-understanding and reflection.

7 Structures of relevance

Participant learners form relevance structures related to learning activities either as explicit relevance, by making decisions about value and relevance of task for their grades or future working life, or implicitly, by making decisions about whether they are interested in a task or topic, whether it relates to other useful aspects of their lives, and how much of an activity to take part in as a result of their intrinsic interest. Much of this value estimation may occur in ways not obviously consciously aware to the learner. The 'metacognitive consciousness' of what participants interpret as of significance and value to them may highlight where areas of learning are potentially present and could be supported, either implicitly or explicitly. This may hint at support for structure making, as an aspect of learning to learn. Returning to Pask, who outlines the connotation of learning to learn as the ability to structure and make sense of disordered experience:

"The usual connotation of 'learning to learn' also comprehends an ability to structure and make sense of otherwise unordered experience. For this, more than versatility is required. What is required is the skill of building up an approximation to a personalised conversational domain. Understood in this way 'learning to learn' could have great practical value in education." [44, p. 144].

This considers each single act of learning in the context of the versatility required to move between subject domains and experiences to learn effectively, building a 'personalised conversational domain'. The personalised conversational domain might be described as internal reflections on interpretations of value and structure for making sense of an 'otherwise unordered experience' in relation to other experiences. Making connections between aspects of relevance is essential to creating useful transferrable skill and understanding. Bransford, Brown & Cocking [3] argue that relevant knowledge "helps people organize information in ways that support their abilities to remember […] to go beyond the information given and to think in problem representations, to engage in the mental work of making inferences, and to relate various kinds of information for the purpose of drawing conclusions" [3, p. 237]. This latter aspect of making inferences and relating various kinds of information to enable drawing conclusions seems especially relevant to smart learning as echoes utterances made by participants in research interviews that involved discussing cultural or social differences between participants' prior experiences and memories. These mental inferences are notably connectivist in nature, as Siemens states "the learning that happens in our heads is an internal network […]" [52, p. 29]. Perhaps these internal connections are fluid relationships being continually reconstituted, dependent on the situation that a learner finds themselves in relation to the stimuli and relevance available to them as they become aware of it in their experience.

Marton & Booth refer to relevance structures [38, pp. 143-144], demand structures [38, pp. 169-170] and global aspects of learning [38, p. 141] as all potentially impacting the structure of awareness for a learner as they participate in a learning activity, and the subsequent effectiveness of any learning in it. The relevance structure of the learning situation is discussed in terms of the immediate context of a task or action required of learners. The demand structure is a way of describing how the learning instructions and requirements might be designed (that define the relevance structure). The global aspects of learning are the wider context surrounding that which a learner may perceive as part of the learning activity.

8 Relevance structure influencing factors

A smart learning activity may or may not be considered as a learning activity by a participant in some circumstances. As the author's research with degree students indicates, sometimes in voluntary non-assessed learning the sub-conscious global aspects of learning may outweigh the direct explicit relevance and demand structure of the activity within a participants own awareness. Additionally, value and benefit for participants may not be clear within their own perceived global aspects of learning (consciously or not). The question arises, how to alert the awareness of the participant toward aspects they find of interest to develop further insight and gain greater depth of engagement and value. In turn to then reflect on this, expanding their awareness and ideally gaining useful learning that they themselves uncover and acknowledge.

8.1 Reflection with peers

Motivation is potentially fostered by active dialogue and reflection, both between tutor and learner and between peers in more social learning contexts. This is echoed in various texts and past research, for example previously cited work from Larson in youth projects [28] and Wegerif's expansion of the dialogic space, of "learning to learn, think and thrive in the context of working with multiple perspectives and ultimate uncertainty" [57]. The art of reflection then, both individually and in groups, may perhaps be key to unlocking participant motivation and awareness. Lin, Galloway & Lee outline how "action learning is performed in groups so individuals can learn from each other … there should be a task designed or assigned for action and participation (and) reflection is the end product", continuing "(f)rom reflection, they can generalise their learning to other situations. As a result, the learning cycle through experience is formed." [29, p. 55]. The author's work in classroom practice further acknowledges the power of group reflection to uncover learning and awareness in participants [33]. Marton & Booth refer to this as figure ground reversal [38, p. 149], reflection with peers brings about the consciousness of the act of learning itself [40, pp. 473-474], what the learner perceives as having been learned, or when learning took place. Further reflecting together on activities that everyone took part in fosters articulated awareness together, then creating deeper and more complex ideas and learning as conversation develops.

8.2 Context and awareness

Context can be interpreted and impact experience awareness in multiple ways. Physical and virtual presence [56, p. 197], socio-cultural contexts of place [6] and pedagogy of place [25] all play a part to influence interpretations of learning in the authentic real-world environments in which smart learning activities are often situated. The complex learning environments that are formed by these elements are described by Goodyear & Carvalho as a three architecture terrain of material, social and epistemic factors, with interactions involving fast (automatic) and slow (subjective agency) thinking [18, p. 55]. This helps to illustrate how a smart learning activity and environment can potentially impact each learner in distinct ways and is therefore useful for participants to explore these differences, highlighting to each other in emergent conversation how they have interpreted aspects of the activity. This builds individual intra-contextual [39, p. 344] interpretations, and supports a wider understanding of possible application and usefulness, encouraging transferability and hence “a personalised conversational domain” to make sense of otherwise unordered experience [44].

8.3 Twenty-first century skills, autonomy and self-directed learning

Maina & González further highlight that “distinctive characteristics of autonomy in learning are congruent with the twenty-first century competency framework, particularly those related to “self-direction, adaptability, flexibility, and collaboration” [35, p. 89]. Further, Blaschke & Hase suggest “the skills required to be an effective learner in the twenty-first century have changed dramatically, as the learner evolves from passive recipient to analyst and synthesizer” [1, p. 26]. Describing heutagogy, the learner is seen as “the major agent in their own learning, which occurs as a result of personal experiences” [1, p. 27], they are outlining what Breunig describes as “transformational learning”, that “(n)on-formal education embeds learning content in activities across an array of settings providing wide latitude for self-direction and interpretation on the part of learners” [5, p. 3]. Smart learning should seek for learning strategies to be in the hands of the learners themselves, to find and construct learning either individually or in groups, building total immersion and engagement with knowledge and associated relationships to place [32].

9 Conclusions

Autonomous self-directed learning in complex learning environments is impacted by motivation, and motivation is impacted by perceived experience and awareness. Understanding more about participant experience structures of awareness and factors defining relevance and significance of activity as perceived by learners themselves can aid in supporting the design of smart learning activities and environments to offer more adaptable, flexible, efficient and effective learning opportunities. By considering experience possibilities as a multilayered context of relevance and awareness, the significance of motivational factors and impact of peer reflection can be emphasised, enabling self-directed learners to foster “metacognitive consciousness of how they are learning to learn" [2]. This can bring about the 'personal conversational domain' [44] that Wegerif describes as learning to learn, think and thrive for learning in the Internet Age [57].

References

1. Blaschke, L. M., Hase, S.: Heutagogy: A Holistic Framework for Creating Twenty-First-Century Self-determined Learners. In: Gros, B., Kinshuk & Marcelo, M. (eds.) The Future of Ubiquitous Learning*,* pp. 25-40. LNET, Springer-Verlag Berlin Heidelberg (2016).
2. Boyd, G. M.: Conversation Theory. In: D. H. Jonassen (Ed.), Handbook of Research on Educational Communications and Technology. 2nd ed., pp. 179-197. Lawrence Erlbaum Mahwah, NJ (2004).
3. Bransford, J. D., Brown, A. L., Cocking, R. R. (eds.).: How people learn, Brain, Mind, Experience and School (Expanded Edition). National Academy Press, Washington, DC (2004).
4. Brown, A. L., Campione, J. C., Day, J. D.: Learning to Learn: On Training Students to Learn from Texts. Educational Researcher, 10(2), 14-21 (1981).
5. Breunig, M.: Experientially Learning and Teaching in a Student-Directed Classroom. Journal of Experiential Education, 40(3), 213-230 (2017).
6. Buell, L.: Space, Place, and Imagination from Local to Global. In: Buell, L (Ed.), The future of environmental criticism: environmental crisis and literary imagination, pp. 62-96. Blackwell, Malden, MA (2005).
7. Bughin, J., Hazan, E., Lund, S., Dählström, P., Wiesinger, A., Subramaniam, A.: Skill Shift: Automation and the Future of the Workforce. McKinsey, (2018).
8. Carretero, S., Vuorikari, R., Punie, Y.: DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use. European Commission, Publications Office of the European Union (2017).
9. Carroll, J. M., Shih, P. C., Kropczynski, J., Cai, G., Rosson, M. B., Han, K.: The Internet of Places at Community-Scale: Design Scenarios for Hyperlocal Neighborhood. In: Konomi, S., Roussos, G. (eds.) Enriching Urban Spaces with Ambient Computing, the Internet of Things, and Smart City Design*,* pp. 1-24, IGI Global (2017).
10. Cope, C.: Ensuring Validity and Reliability in Phenomenographic Research Using the Analytical Framework of a Structure of Awareness. Qualitative Research Journal, 4(2), 5-18 (2004).
11. Cutajar, M.: The student experience of learning using networked technologies: an emergent progression of expanding awareness. Technology, Pedagogy and Education, 26(4), 485-499 (2017).
12. Dron, J.: Smart learning environments, and not so smart learning environments: a systems view. Smart Learning Environments, (5)25. Springer Open (2018).
13. Dunleavy, M., Dede, C., Mitchell, R.: Affordances and limitations of immersive participatory augmented reality simulations for teaching and learning. Journal of Science Education and Technology, 18(1), 7–22 (2009).

14. Edwards, S.: Panning for Gold: Influencing the experience of web-based information searching. Doctoral dissertation, Queensland University of Technology. QUT ePrints, Queensland (2005).
15. Engeström.,Y.: Learning By Expanding: An Activity-Theoretical Approach To Developmental Research. Orienta-Konsultit, Helsinki (1987).
16. Giovanella, C., Martens, A., Zualkernan, I.: Grand Challenge Problem 1: People Centered Smart 'Cities' Through Smart City Learning. In: J. Eberle et al. (eds.) Grand Challenge Problems in Technology-Enhanced Learning II: MOOCs and Beyond. SpringerBriefs in Education. Springer (2016).
17. Goodspeed, R.: Smart cities: moving beyond urban cybernetics to tackle wicked problems. Cambridge Journal of Regions, Economy and Society, 8(1), 79–92 (2015).
18. Goodyear, P., Carvalho, L.: The Analysis of Complex Learning. In: Beetham, H., Sharpe, R. (eds.) Rethinking Pedagogy for a Digital Age: Designing for 21st Century Learning, pp. 49-63. 2nd edn. Routledge, New York (2012).
19. Green, B.: The Smart Enough City, Putting Technology in Its Place to Reclaim Our Urban Future. Strong Ideas. MIT Press (2019).
20. Greeno, J. G., Engeström, Y.: Learning in Activity. In: Sawyer, R. K., (ed.) The Cambridge Handbook of the Learning Sciences, pp. 128-147. 2nd edn. Cambridge University Press, Cambridge (2014).
21. Gurwitsch, A.: The field of consciousness. Duquense University Press, Pittsburgh (1964).
22. Husman, J., Lens, W. The Role of the Future in Student Motivation. Educational Psychologist (1999).
23. Ireland, C., Johnson, B.: Exploring the FUTURE in the PRESENT. Design Management Institute Review, 6(2), pp. 57-64 (1995).
24. Ireland, J., Tambyah, M. M., Neofa, Z., Harding, T.: The tale of four researchers: trials and triumphs from the phenomenographic research specialization. In: Jeffery, P. (ed.) Proceedings of the Australian Association for Research in Education (AARE) 2008 International Research Conference. Changing Climates: Education for Sustainable Futures, pp. 1-15. The Australian Association for Research in Education (2009).
25. Jayanandhan, S. R.: John Dewey And A Pedagogy Of Place. Philosophical Studies In: Education 40, 104-112. Ohio Valley Philosophy of Education Society (2009).
26. Kaapu T., Tiainen, T.: User Experience: Consumer Understandings of Virtual Product Prototypes. In: Kautz, K., & Nielsen, P., A. (eds.) Scandinavian Information Systems Research. First Scandinavian Conference on Information Systems, SCIS 2010, Proceedings, pp. 18-33. LNBIP (60). Springer Berlin, Heidelberg (2010).
27. Krivova, L., Imas, O., Moldovanova, E., Mitchell, P.J., Sulaymanova, V., Zolnikov, K.: Towards Smart Education and Lifelong Learning in Russia. In: Uskov, V., Bakken, J., Howlett, R., & Jain L. (eds.) Smart Universities. SEEL 2017. Smart Innovation, Systems and Technologies, vol 70. Springer, Cham (2018).

28. Larson, R.: Discovering the Possible: How Youth Programs Provide Apprenticeships in Purpose. In: Burrow, A. L., Hill, P. (eds.) The Ecology of Purposeful Living Across the Lifespan. Springer Nature, Switzerland AG (2020).
29. Lin, T. C. Y. W., Galloway, D., Lee, W. O.: The Effectiveness of Action Learning in the Teaching of Citizenship Education: A Hong Kong Case Study. In: Kennedy, K. J., Lee, W. O., Grossman, D. L. (eds.) Citizenship Pedagogies in Asia and the Pacific, CERC Studies in Comparative Education, pp. 53-80. Springer, Dordrecht (2011).
30. Lister, P.: Smart Learning in the Community: Supporting Citizen Digital Skills and Literacies. In: Streitz N., Konomi S. (eds.) Distributed, Ambient and Pervasive Interactions. HCII 2020. LNCS, pp. 533-547. Springer, Cham (2020).
31. Lister, P.: Understanding Experience Complexity in a Smart Learning Journey. SN Social Sciences 55. Springer Nature (2021a).
32. Lister, P.: Experiencing the Smart learning Journey: A Pedagogical Inquiry. Doctoral Dissertation, University of Malta. Malta (2021b).
33. Lister, P.: Future-present learning and teaching: a case study in smart learning. In: Sengupta, E., Blessinger, P. (eds.) Changing the Conventional Classroom, Innovations in Higher Education Teaching and Learning (IHETL). Emerald Publishing. In press. (2022).
34. Liu D., Huang, R., Wosinski, M.: Future Trends in Smart Learning: Chinese Perspective. In Smart Learning in Smart Cities. Lecture Notes in Educational Technology, pp. 185-215. Springer, Singapore (2017).
35. Maina, M. F., González, I. G.: Articulating Personal Pedagogies Through Learning Ecologies. In: Gros, B., Kinshuk, Maina, M. (eds.) The Future of Ubiquitous Learning. LNET, pp. 73-94. Springer-Verlag Berlin Heidelberg (2016).
36. Marton, F.: Phenomenography - Describing Conceptions of the World Around Us. Instructional Science 10, 177-200 (1981).
37. Marton, F.: Cognoso ergo sum – Reflections on reflections. In: Dall'Alba, G., Hasselgren, B. (eds.) Reflections on phenomenography: Toward a methodology?, pp. 163-187. Acta Universitatis Gothoburgensis, Gothenburg (1996).
38. Marton, F., Booth, S.: Learning and Awareness. Lawrence Erlbaum Associates, Mahwah, NJ (1997).
39. Marton, F., Pong, W.P.: On the unit of description in phenomenography. Higher Education Research & Development 24(4), pp. 335–348 (2005).
40. Marton F., & Svensson, L. (1979). Conceptions Of Research In: Student Learning. Higher Education, 8, 471-486.
41. Marton, F., Tsui, A.: Classroom discourse and the space of learning. Lawrence Erlbaum Associates, Mahwah, NJ (2004).
42. McKenna, H. P: Human-Smart Environment Interactions in Smart Cities: Exploring Dimensionalities of Smartness. Future Internet, 12(5), 79 (2020).
43. Papert, S.: The children’s machine: Rethinking school in the age of the computer. Basic Books, New York (1993).
44. Pask, G: Styles and strategies of learning. British Journal of Educational Psychology, 46, 128–148 (1976).

45. Polya, G.: How to solve it: A new aspect of mathematical method. Princeton University Press, Princeton, NJ (1945).
46. Reed, B.: Phenomenography as a way to research the understanding by students of technical concepts. In: Núcleo de Pesquisa em Tecnologia da Arquitetura e Urbanismo (NUTAU): Technological Innovation and Sustainability, São Paulo, Brazil, pp. 1-11 (2006).
47. Rezgui, K., Mhiri, H., Ghédira, K.: An Ontology-based Profile for Learner Representation in Learning Networks. International Journal of Emerging Technologies in Learning (iJET), 9(3) (2014).
48. Ryan, R. M., Deci, E. L.: Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American Psychologist, 55(1), 68–78 (2000).
49. Sandberg, J.: How Do We Justify Knowledge Produced Within Interpretive Approaches? Organizational Research Methods, 8(1), 41-68 (2005).
50. Säljö, R.: Learning About Learning. Higher Education, 8, 443-451 (1979).
51. Sjöström, B., Dahlgren, L. O.: Applying phenomenography in nursing research. Journal of Advanced Nursing, 40(3), 339-345 (2002).
52. Siemens, G.: Knowing Knowledge. Internet Archive (2006). https://web.archive.org/web/20061206214545/http://www.knowingknowledge.com/book.php, last accessed 20/1/21.
53. Souleles, N., Savva, S., Watters, H., Annesley, A., Bull, B.: A phenomenographic investigation on the use of iPads among undergraduate art and design students. British Journal of Educational Technology, 46(1), 131-141 (2014).
54. Spector, J. M.: Conceptualizing the emerging field of smart learning environments. Smart Learning Environments (1)2 (2014).
55. Thomas, V., Wang, D., Mullagh, L., Dunn, N.: Where's Wally? In Search of Citizen Perspectives on the Smart City. Sustainability 2016, 8(3), 207 (2016).
56. Traxler, J.: Context Reconsidered. In: Traxler, J., Kukulska-Hulme, A. (eds.) Mobile Learning: The Next Generation, pp. 190-207. Routledge (2015).
57. Wegerif, R.: Dialogic: Education for the Internet Age. Routledge (2013).
58. Zimmerman, B. J.: A social cognitive view of self-regulated academic learning. Journal of Educational Psychology, 81(3), 329–339 (1989).
59. Zoltowski, C. B., Oakes, W. C., Cardella, M. E.: Students' Ways of Experiencing Human-Centered Design. Journal of Engineering Education, 101(1), 28–59 (2012).