

Undergraduates Perception of Informal Personal Learning Environments: Affordances for Self-regulated Learning

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Abstract

Advances in technology access allow undergraduates to personalize their learning to their individual interests via the creation and use of informal personal learning environments (PLEs). A comprehensive understanding of how learning takes place in such PLEs and their affordances for self-regulated learning (SRL) is still lacking. Drawing on 20 in-depth interviews with undergraduates and mind maps of their PLEs, this paper presents preliminary findings on how PLEs support self-regulatory learning processes. The results indicate that the tools and technologies that undergraduates choose to include in their PLEs provide some significant affordances for supporting metacognitive, motivational and behavioural SRL processes. Initial findings contribute to clarifying the perceived opportunities that a user centred and managed PLE afford to its creators for engaging in SRL processes and the ongoing discussion of how best to use ubiquitous technologies for effective teaching and learning. The paper concludes with a discussion of the future research opportunities.

Keywords Personal Learning Environments, Self-Regulated Learning, Affordance

1 Introduction

Customized informal personal learning environments (PLEs) are created by present day undergraduates as a learning strategy. These PLEs are comprised of a wide range of freely available tools and services accessible on ubiquitous digital devices. Components and content of such PLEs are changed to fit individual learning needs, rarely limiting to a single technology or even device.

PLE's support learners in defining their personal learning goals and autonomously managing their learning content, tools, and peers. It is vital that learning in such PLEs is accompanied by strategies that promote, self-regulated learning (SRL), to remain attentive, motivated, and engaged in learning tasks. SRL, is regarded as an essential characteristic of the PLE (Melzer and Schoop 2015).

The investigation of these user centred and customized PLEs have gained increasing interest. However, most prior studies on PLEs employ an experimental approach where a given technology is imposed on the students, and does not investigate how their current technological portfolio being used in daily life (i.e. everyday technologies) to create customised PLE's, is influencing their SRL skills. The generalizability of the findings of studies conducted in the formal classroom to an informal PLE context is also limited. There is a need to comprehensively understand via empirical investigation the SRL processes of students engaged in the use of these customised informal PLEs.

The objective of the study described in this paper, is specifically to understand the affordances provided by such PLEs when performing self-regulated learning tasks. We conducted semi-structured interviews with 20 first year undergraduates from the Business School of a top university in the Asia-Pacific region. Mind mapping techniques were also used for collecting supportive data. Our findings will augment the knowledge of Information Systems (IS) researchers by attempting to clarify how self-regulated learning takes place in learner constructed and managed PLEs. From a practical perspective an in-depth understanding of how such environments support SRL would enable the effective and appropriate integration of informal PLEs in to formal classroom environments.

In the following section we provide a brief review of the theoretical background to this study. The research design is then presented, followed by interim results, discussion and conclusion.

2 Theoretical Background

In this study the PLE is a concept recognized as a new approach to the use of digital technologies in learning. It is not linked to a particular technology, but defined as a practical intervention relating to the organization of all the different devices, tools and technologies undergraduates use in their everyday life for learning (Attwell, 2007 ; Gallego & Gamiz, 2015). These could include desktops, mobile devices (e.g. laptops, tablets, smartphones, PDAs), Web 2.0 tools and other collaborative resources on the internet as well as any open source or commercially available software packages.

SRL, is defined in this study as the self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal learning goals (Zimmerman 2002) . It precedes the dawn of the PLE in theory. Three aspects of SRL is evident in learners who proactively and systematically engage in: (1) metacognitive processes, such as goal setting, planning, monitoring and self-evaluating learning; (2) motivational processes, such as directing and taking responsibility for their own learning, maintaining a constant interest in their own studies and a firm belief in their own abilities; and (3) behavioural processes, including structuring an optimal study environments, actively seeking information and advice and adopting context specific effective study strategies.

The term "affordance" is one that has been used frequently in literature with different meanings. The distinction in usage lies in whether or not the term encompasses usability or just utility (Bower 2008). After an extensive review of literature Hammond (2010) describes an affordance as the perception of an opportunity or constraint for action which arises because of physical and symbolic properties of hardware and software. This is the definition of affordance adopted in this study. This interpretation of affordance is perceived to be the most relevant for this study as the affordance in this case is shaped by experiences of the students in the PLE context. Moreover this definition allows for acknowledging that perception of affordances are always relative to desirable goals or strategies for performing SRL tasks via a PLE.

3 Research Methodology

The study reported in this paper is a component of a broader longitudinal mixed methods study as discussed in Perera Muthupoltotage et al. (2016). We note that this paper reports the preliminary findings of an ongoing analysis focusing mainly on the qualitative data collected for the larger study.

3.1 Data Collection

The quantitative data collected for the larger study consisted of a survey completed by 181 first year business students in a top university in the Asia Pacific region. To ensure a reliable representation of interview participants, a hierarchical clustering based on the digital skills and attitudes reported in this survey was conducted, before randomly inviting an equal number of participants from each of the four clusters which emerged for face to face interviews. 11 of the interviewees were females while the rest were males. The age range of the interviewees was 18-29 with the average age of 20.

Before starting the interview each participant was requested to spend 15 minutes on visualizing and drawing on paper, a mind map of their PLE consisting of all the physical and/or digital tools and various technologies they used to support their learning.

An interview protocol was formulated to ensure consistency in structure and format of each interview session. The protocol was organised into four main sections: 1) discussion of mind map and usage of learning resources depicted therein – to probe how the tools and technologies depicted in the mind map were being used for learning tasks by the students based on discussion of usage scenarios; 2) learner digital and learning profile – to probe the attitudes of the students towards their learning, their awareness of digital skills and how digital skills are enabling their learning; 3) learning resource acquisition and selection – to investigate how and why students chose to add the particular tools and technologies noted in their mind maps to their PLE; and 4) the past and future of the PLE – to explore how students' PLE had evolved from the time in high school to arriving and spending one/ two semesters at university, how learning strategies may have changed as a result of need, skill, usefulness and achievement and how they envisioned the future of their PLE.

With the permission of the participants, all interviews were audio-recorded. Written notes were also taken during the interviews to record participants' key responses and researcher observations. All interviews lasted for approximately an hour and were transcribed verbatim by a third party. Transcripts were emailed back to participants to ensure their agreement with the recorded data, then, coded and analysed using Nvivo 11 for sense making. Based on our interview protocol, only the first section of each interview transcript is relevant to the scope of this paper. The subsequent section describes the manner in which this data was analysed.

3.2 Data Analysis

The coding process started with the first author reading through each transcript and assigning structural codes (Saldaña 2016) based on theoretical classification indicators. These consisted of the characterization of SRL as two orthogonal sets of process and component aspects and related classification indicators as used by (Dettori and Persico 2008). The process model is based on the view of SRL as three cyclic phases of planning, execution and monitoring, and evaluation. The component model used distinguishes among the behavioural, metacognitive, motivational, and emotional aspects of SRL. Table 1 provides an overview of the indicators. Prior research indicates that the two models can meaningfully be considered both at the individual and social levels.

SRL Component	Learning context	SRL Process		
		Planning	Execution and Monitoring	Evaluation
Behavioural and meta cognitive	Individual	PCI	MCI	ECI
	Social	PCS	MCS	ECS
Motivational and Emotional	Individual	PMI	MMI	EMI
	Social	PMS	MMS	EMS

Table 1. Classification Indicators used in Structural Coding of Interviews (Dettori and Persico 2008)

This set of classification indicators is particularly useful for this study due to its strong foundation on widely adopted extant SRL related literature (Pintrich 2004; Zimmerman 2002) while being proven as reliable and well defined in prior studies investigating SRL in technology enhanced learning environments. During our interviews the participants were recounting and discussing certain actions they perform via their PLE. But, they may not be using particular expressions or constructs which could be directly associated with self-regulation. Structural coding using the above indicators would enable, data reduction and organization as well as the identification of broad topics in the interview text related to participants SRL processes. Thereafter, enabling detection of latent content which can be analysed at a semantic level. It is noted that we used structural coding as a mechanism of allowing retrieval of data relevant to the SRL processes of participants easily and quickly from the interview texts. Therefore we

refrain from providing a detailed discussion of the structural codes used and refer the reader to further details in Dettori and Persico (2008).

Structural Code and Description	Sample response from the interview transcript of participant 10	Subsequent Process Codes
PMI: Exploring one's expectations about the current learning activity. Anticipating possible emotional aspects	If I can't concentrate or I'm like bored or something, I'll probably download the flashcard app and make a flashcard and study that way because then I can study. (PMI1) I don't know, when I'm walking or outside anywhere. (PMI2)	(PMI1) Completing tasks (PMI2) Adjusting to emotional states
PMS: Discussing expectations and motivations on the current and others' learning activities. Sharing motivations for own commitment. Getting peers involved in planning.	We couldn't really meet cos everyone had so much other things to do. (PCS1) But still we kind of wanted to finish quickly (PMS1). So we just did it all on Facebook (PMS2). We would message each other, read over each other's speeches and ask to make changes, kind of thing so we could complete it properly on time. (PMS3), (MCI3)	(PCS1) Overcoming difficulties (PMS1) Wanting to finish quickly (PMS2) Adjusting to situational demands (PMS3) Working together to complete tasks (MCI3) Completing tasks on time
MCI: Enacting plans. Working consistently on the assigned task. Monitoring plan fulfilment. Making syntheses of individual work done and objectives reached	For example I had a maths test last week and when I come across a question that I'm not too sure how to, I'd go on YouTube and find a video about it. (MCI1) Because it's easier and faster to do it that way rather than reading the pages of maths. (MCI2)	(MCI1) Elaborating on information (MCI2) Completing tasks quickly and easily
MMS: Encouraging peers to express their emotions and motivations. Encouraging peers and providing them with emotional support. Taking care of group functioning by informing peers of one's intentions.	So it's just a Facebook page where we can ask questions or send funny pictures or stuff like that. (MMS1) It's pretty relaxed or like the class groups will usually send out reminders, like remember that assignment is due now (MMS2). Or this morning I got one this morning saying grades for Assignment 1 for Stats have come up now, so everyone's checked their grades. (MMS3) Otherwise I probably wouldn't have known, so it's just good to get the information.	(MMS1) Structuring a relaxed environment (MMS2) Monitoring progress (MMS3) Tracking progress

Table 2. Sample Responses and a Sample of Process codes for some Structural Codes

Emergent Theme	Examples of supporting process codes
Manage Time	Scheduling tasks, Making time, Saving time ,Wanting to finish quickly,
Organize tasks	Completing tasks, Breaking down activities in to smaller parts, Making tasks more approachable, Having everything needed in one place, Completing tasks quickly and easily, Completing tasks on time
Stay motivated	Adjusting to emotional states, Not feeling bad, Helping concentration, Not feeling bored, Feeling up to it
Manage uncertainty	Reducing anxiety , Managing risk, Providing a sense of security, Knowing what is happening
Remove Physical/ situational barriers	Overcoming difficulties, Adjusting to situational demands, Removing physical constraints
Collaboration	Working together to complete tasks, Contributing to a large task

Table 3. Some Emergent themes of Affordances of a PLE for Supporting SRL

Process coding (Saldaña 2016) is being used to further analyse each sentence of the structural codes. New codes were created to represent actions indicated in the data (Bogdan and Biklen 2007). Signifying the processes of participant actions in this manner, would enable the identification and labelling of the affordances of the PLE, supporting particular SRL processes and components. Table 2, above illustrates our coding process by providing a single sample response coded at a particular structural code and the process codes which were subsequently identified for one participant.

Further thematic analysis of process codes enabled the identification of emerging themes for affordances of a PLE for facilitating SRL. Some emergent themes based on our analysis thus far, are listed in Table 3 below, supported by applicable process codes. (We note that the analysis of the data is at this stage still ongoing).

4 Discussion of Preliminary Results

4.1 Components of a PLE

The focus of this paper is to elaborate on affordances of a PLE for supporting self-regulation, and not an in-depth discussion of the components of the PLEs. We refrain, therefore, from providing a lengthy discussion of the specific tools used in PLEs, rationale for their use and its implications. Our discussion is limited to an overview of frequency of usage and some indicative comments.



Figure 1. Word Cloud of Frequently Mentioned Tools in Participant Mind Maps

All the participants made extensive use of personal digital devices with many of them owning at least 3 devices. Lap tops and smartphones were being used in approximately equal proportions. 4 participants reported using tablets/iPads. The majority of participant's (80%) spent between 7-12 hours per day using these devices, which formed the basis of their PLEs. Figure 1 above, illustrates a word cloud generated based on frequency counts for the various tools depicted in the 20 participants mind maps to provide the reader with a brief overview of the components of the participants PLEs.

All participants considered Word processors, spread sheets and presentation software, the university learning management system (Canvas), social networks (Facebook), search tools (Google) and video sharing website YouTube as components of their PLE. Between 85% (N=17) to 55% (N=11) of the participants included Piazza, One note, Wikipedia, S-Planner, Media Player and Photoshop within their PLE. Snapchat and LinkedIn was mentioned by 40 % (N=8) of the participants. Email, Google drive and End note were mentioned by 30% (N= 6) and Quizlet, Skype, Sticky Note and Reddit by 25% (N= 5). All other tools depicted in the word cloud were mentioned by only 1, 2 or 3 of the participants.

4.2 Affordances for Metacognitive SRL Processes

4.2.1 Manage Time

Multiple participants (15) acknowledged that the tools within PLEs offer the ability to manage time. Conventional tools such as Calendar applications enable time management via scheduling, setting reminders etc., as practiced by many participants. Moreover, the PLE enables the users to move beyond the acknowledged educational affordance of a tool to supporting self-regulation. For example while social software such as Facebook is acknowledged to afford collaborative information discovery and sharing (McLoughlin and Lee 2010), 9 participants indicated that working on their assignments using

a group Facebook page afforded the ability to save time. Participant 3 stated that working with others on Facebook enabled *“making time”* for all of the tasks that needed completion. Time management is essential for self-regulated learners to plan learning activities and the participant responses indicate that PLE tools can afford the opportunity to do accomplish this.

4.2.2 Organize tasks

For a number of participants (5) the tools integrated in to their PLE enabled them to make their learning tasks simpler and more approachable. The note taking application OneNote was used by 15 of the participants to create digital notes for study purposes. The reasons why this was used appeared to go beyond its direct affordance of writing down study notes, to providing the ability to organize study tasks by ensuring that all material needed for study was included in one place and making the task more approachable. Participant 6 described his digital notes as *“a way for me to know for certain that all the lecture notes, my notes, links to anything else anywhere like a YouTube video or whatever and even the notes my friends sometimes make is all in one place and when I study it's all I need, I don't have to look at anything else”*. Participant 13 preferred digital notes on OneNote to notes made on paper because *“it's not like having a big book or anything, its small, so when I start studying I can keep saying it's not much I can do this”*.

Moreover, YouTube, which was a component of all participant's PLEs, was described by participant 10 (Table 2) as a means of completing study tasks easily and quickly. The capability of YouTube to support learning procedurally (Lee and Lehto 2013) appears to enable the learners to regulate the amount of time and effort spent on understanding content and thereby manage the complexity of the learning task at hand. Participant 16 mentioned *“I like YouTube because, sometimes in the class when lecturers are talking everything seems kind of difficult like, but when I watch a video and everything is kind of step by step so it isn't so difficult after all”*.

4.3 Affordances for Motivational SRL Processes

4.3.1 Manage uncertainty

Prior studies have documented in detail the technological and pedagogical affordances of using instant messaging in education (Tang and Hew 2017). However, a number of participants indicated that using instant messaging applications such as WhatsApp, Facebook Messenger and Skype for maintaining a constructionist dialog and a helpline was a way of managing risk with learning tasks. Participant 11 admitted to searching on Google and messaging her friends on WhatsApp, in parallel when she did not know the answers to certain questions and checking to see *“if those answers match”* to reduce uncertainty.

Moreover, Participant 15 admitted to using the Piazza forums for all her courses *“all the time”*. But she had not asked nor answered any questions herself. She professed that Piazza was an important part of her learning environment because she could *“go on there and just read the posts”* to know that she had *“nothing to worry about”*. Participant 10 and 2 admitted to the same passive presence on Piazza and described it as a means of just *“knowing what's going on”* (mentioned by participant 2) so that they could reduce any uncertainty. Peer engagement via online forums such as Piazza, is seen to be a way of promoting engagement in learning and providing a sense of connection and growth (Willis et al. 2012). However, for participant 2, 10 and 15 online forums, were providing a sense of security indicative of a conscious effort to manage uncertainty in learning tasks and direct their own learning.

4.3.2 Stay Motivated

The PLE enabled some of the participants to adjust their learning activities to changing emotional states. Participant 10 spoke about using an application (Quizlet) on her phone regularly to create summary notes of important points. This helped her to complete her study while *“walking or outside anywhere”*, in situations where she found it hard to *“concentrate”* or felt uninterested. Participant 8 relied on OneNote application heavily for taking notes in class. What particularly appealed to him about this application was the ability it provided to synchronize his notes between his laptop and phone. He could *“still study”* even if he was *“just too bored and couldn't be bothered opening the laptop”*.

Participant 17, described himself as a *“funny video guy”* who considered YouTube to be a very important part of his learning environment. However, he also spoke of himself as a person who *“liked to read and understand things rather than have it explained”*, giving this as the reason for not using YouTube for instructional videos as done by most others. Instead he used YouTube as a means of rewarding himself after a study session saying *“If I have just submitted an assignment that I was working on and I'm like I need a break before I get on to the next one I'd go watch YouTube so I won't be like really tired and*

can't go on sort of, and I can get to the next thing feeling up to it". For this participant integrating YouTube in to his PLE enabled him to generate and maintain positive feelings towards his learning.

4.4 Affordances for Behavioural SRL Processes

4.4.1 Remove Physical/ situational barriers

Self-regulated learners are expected to use multiple context specific learning strategies to maximise learning. Participant 1, was a full time student who also worked for three days of the week. Integrating Google drive as a component of his PLE, enabled him to consciously adjust his learning strategies to situational demands arising from his circumstances. He was storing all of his study material on Google Drive so that he could *"refer, lookup, work on assignments and such"* whenever he needed to, *"even at work"*. He acknowledged that Google Drive could make sure that he was *"not constrained by anything"*. Similarly, participant 7, found herself working on a group assignment with other group member who had very different time tables, and found it difficult to meet face to face. But they completed the assignment *"all on Facebook"*. This is very similar to the experiences of Participant 10 (Table 2 above). These participants were using the technical affordances of availability, sharing and collaboration provided by Google Drive (Brown and Hocutt 2015) and Facebook's pedagogical ability to promote collaborative learning (Idris and Wang 2009) to enable them to overcome physical and situational barriers to their learning.

4.4.2 Collaboration

Collaboration itself is a theme which emerges with regard to the actions of multiple participants. For example participant 4 described how she completed a group assignment saying *"We would just read what everyone else was doing and just put things together, everyone was changing what everyone else was writing so it was a bit messy, but at one point it was all done and we could just finish it all on time"*, by using Google Drive. These actions were very similar to those reported by participant 7 and 10 previously with regard to Facebook usage. When participant 20 did not know the answer to a question she would *"first of all just go on Facebook and see who's online and see who's doing the same course as me and ask, hey, did you do this question and are you able to help me?"* These comment indicate that the PLEs enable students to actively seek information and advice from their peers, in directing their own as well as group learning.

Furthermore, Collaboration is acknowledged to be an important aspect of self-regulated learning in recently developed SRL models. (Hadwin and Oshige 2011) proposed the existence of three modes of regulation in collaborative settings: self-regulation (SRL), co-regulation (CoRL), and shared regulation (SSRL), referring to the individual learner, the interaction with other learners and the behaviour of the group. In view of this model the comments of participant 4 and 7 are indicative of SSRL practices, while participant 20 is regulating her own learning using a collaborative setting by seeking assistance and monitoring her performance. While no conclusions can be drawn from our evidence, as the focus of our investigation is the individual actions within a PLE, this provides an interesting avenue for future research to investigate the socially shared regulated learning model (Hadwin et al. 2013) within PLEs.

In conclusion, we have uncovered some results that are consistent with the existing literature as well as some surprising new insights. First, the mind maps indicate that undergraduates do not integrate a very large number of tools in to their PLEs. The main components of PLEs appear to be the tools that students are required to use by the institution (i.e. Canvas, Piazza), tools that aid the students to obtain information via the internet (i.e. Google Search), online video (i.e. You Tube) and the mandatory tools to produce the deliverables required for their courses (i.e. Word, Excel, PowerPoint). These findings are consistent with the findings of Dabbagh and Fake (2017) who investigated undergraduate and graduate student blog posts to identify student perceptions of PLEs using a larger sample. This potentially highlights that the integration of tools on to individuals PLE is obligatory and warranted by immediate need to produce artefacts as well as discover new information. An in depth analysis of sections 3 and 4 of the interview scripts as per our interview protocol would enable us to draw further conclusions in this regard. This analysis is currently underway and results forth coming. Moreover, Facebook is perceived as a learning tool and integral component of their PLE by the participants. This reinforces the findings of existing research which discusses the appropriation of social software as educational tools in informal learning contexts (for example Pimmer et al. 2012) and indicates that further research should be conducted on the pedagogical affordances of social networks.

Next, our investigation of affordances offers some new insights on how self-regulated learning takes place within PLEs. Previous research focusing specifically on using social media for PLEs uncovered that students engage in the metacognitive processes of goal setting, task strategies, self-monitoring and self-

evaluation, while developing their PLEs (Dabbagh et al. 2015). However, affordances of PLEs for supporting these and other SRL processes have not been investigated in detail thus far. Our findings reinforce that students certainly are engaging in the processes of planning and goal setting. Furthermore, we are now able to clarify how, not only social media but other PLE tools as well, enable these metacognitive SRL processes. For example our results show that PLEs enable their users to manage time and manage the complexity of tasks, which would enhance the self-regulated learner's ability to plan and achieve goals. Moreover, via our structural coding process we have identified that using their PLEs, students engage in motivational and behavioural SRL processes as well as metacognitive SRL processes. We found that PLEs afford the ability for students to manage uncertainty in learning tasks and keep themselves motivated to focus on their learning. Self-regulated learners engage in specific behaviours to create optimal learning environments and seek information from other learners (Said 2013). Our findings show that the tools of the students PLEs offer them the ability to remove physical and situational barriers when creating their learning environments and also actively seek information via collaboration. As the analysis is not yet completed, we hope to share further insights on SRL affordances of PLEs at the conference.

5 Contribution and Future Work

The significance of this study lies in addressing a gap in existing PLE research and contributing to the understanding of SRL within PLEs. While most PLE research focusses on specifically created technological platforms imposed on students or specific types of technology such as social media, we focus on the user centred and managed PLEs created by students by using and adapting a mixture of everyday digital tools. A further contribution is in explaining how such PLEs can offer explicit affordances for supporting SRL processes. Moreover, there is a conception that teaching students to become effective self-regulated learners may help them acquire skills that are essential for creating, managing and sustaining PLEs (Kitsantas and Dabbagh 2011). This study, however, indicates that students may already possess these requisite skills and what remains is to appropriate the affordances of PLEs in formal classroom environments such that skills may be fostered and utilized effectively to enhance learning.

Moving forward, we will continue our analysis to identify other affordances supporting SRL processes. We have also obtained quantitative data on the individual SRL skill levels, and academic performance levels of our sample and would be able to triangulate this quantitative and qualitative data to provide more advanced theoretical and practical contributions at the conference.

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