

11-29-2018

RULES GOVERNING THE USE OF PERSONAL LEARNING ENVIRONMENTS FOR SELF-REGULATED LEARNING: AN ACTIVITY THEORY APPROACH

Udayangi Muthupoltotage
University of Auckland, u.muthupoltotage@auckland.ac.nz

Lesley A. Gardner
University of Auckland, lgardner@auckland.ac.nz

Follow this and additional works at: https://aisel.aisnet.org/ecis2018_rip

Recommended Citation

Muthupoltotage, Udayangi and Gardner, Lesley A., "RULES GOVERNING THE USE OF PERSONAL LEARNING ENVIRONMENTS FOR SELF-REGULATED LEARNING: AN ACTIVITY THEORY APPROACH" (2018). *Research-in-Progress Papers*. 20.

https://aisel.aisnet.org/ecis2018_rip/20

This material is brought to you by the ECIS 2018 Proceedings at AIS Electronic Library (AISeL). It has been accepted for inclusion in Research-in-Progress Papers by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

RULES GOVERNING THE USE OF PERSONAL LEARNING ENVIRONMENTS FOR SELF-REGULATED LEARNING: AN ACTIVITY THEORY APPROACH

Research in Progress

Perera Muthupoltotage, Udayangi, University of Auckland, Auckland, New Zealand, u.muthupoltotage@auckland.ac.nz

Gardner, Lesley, University of Auckland, Auckland, New Zealand, l.gardner@auckland.ac.nz

Abstract

Advances in technology access allow learners to personalize their learning to their individual interests via the creation and use of informal personal learning environments (PLEs). A comprehensive understanding of how self-regulated learning (SRL) occurs in such PLEs and the implicit and explicit rules which govern the learners' interaction with the learning community is still lacking. Activity Theory (AT) is used to conceptually and methodologically frame this study. The paper draws on 20 in-depth interviews with undergraduates, to present preliminary findings elaborating the norms, conventions, and values which mediate the SRL processes of PLE users. The results indicate that trust, agency and a concern for safety governs the metacognitive, motivational and behavioral SRL processes of PLE users. Initial findings contribute to clarifying SRL processes within PLEs while addressing a gap in existing PLE literature. This paper adds further perspective to the ongoing academic discussion on the effective use of personal technologies and how best to utilize such technologies for teaching and learning. The paper concludes with a discussion of the future research opportunities.

Keywords: Personal learning environments, Self-regulated learning, Activity Theory, Rule - mediation

1 Introduction

Integrating a wide range of freely available tools and services, accessible on ubiquitous digital devices to create customized, self-managed, informal personal learning environments (PLEs), is a prevalent practice among contemporary learners. Components and content of such PLEs are changed to fit individual learning needs, rarely limiting to a single personal technology or even device (Espinosa, Castañeda, Gutiérrez, and del Mar Román, 2016).

PLEs are categorized as an emancipatory approach to technology-enhanced learning (TEL). They stress the shift of control and ownership to the learner, where the learners make decisions and have a choice on the content, the sequence of learning steps, and most importantly, the learning tools and use of these tools to support individual learning (Buchem, Tur, and Hoelterhof, 2014). It is vital that learning within such learner-oriented environments be accompanied by strategies that promote self-regulated learning (SRL), to remain attentive, motivated, and engaged in learning tasks (Bartolomé and Steffens, 2011).

Some literature exists on understanding SRL in technology-enhanced learning environments (TELEs). However, in a recent review of literature (Bernacki, Aguilar, and Byrnes, 2011) indicated that most prior studies focus on three particular structures of learning environments, 1) didactic TELEs specifically designed to encourage SRL through tutoring or human/technology supported scaffolds and prompts (e.g. Renzel, Klamma, Laanpere, and Nussbaumer, 2015), 2) facilitative TELEs specifically designed for self-regulation by providing tools but not prompting their use (e.g. Steiner et al., 2013) and 3) a computer-based learning environment (CBLE), using a single pre-specified technology (e.g. Bergamin, Bettoni, Ziska, and Eggs, 2011).

There is a lack of research, therefore, investigating how the current technological portfolio being used in daily life by learners (i.e. everyday technologies), is employed to create customized informal PLEs to support SRL practices. Some researchers have made attempts to explore this link conceptually (e.g. Tu, Yen, and Sujo-Montes, 2015) and others have tried to obtain learners opinions of SRL support within formal PLEs (e.g. Kravcik and Klamma, 2012). Yet, the generalizability of the findings of such conceptualizations or experimental studies conducted in the formal classroom to an informal PLE context is 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 study reported in this paper is a component of a broader longitudinal mixed methods study as discussed in Perera Muthupoltotage and Gardner (2017) with the overarching research question “*How are undergraduates using and adopting everyday technologies to perform self-regulated learning tasks within their informal PLE’s?*”. The objective of this larger study is to understand how PLEs are used when performing self-regulated learning tasks using an Activity Theory approach.

This paper reports some preliminary findings of the ongoing analysis of the qualitative data obtained from first-year undergraduates in the Business School of a top university in the Asia-Pacific region, for the aforementioned larger study. The scope of this paper is limited to elaborating on the rules which mediate learners’ activities when they use their PLEs for performing self-regulated learning tasks.

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 via empirical evidence. From a practical perspective, an in-depth understanding of how such environments support and foster SRL would enable the effective and appropriate integration of informal PLEs into formal classroom environments.

In the following sections, we provide a brief review of the theoretical background framing our larger study. We elaborate on Activity Theory and rationalize its use in this study. Then the research design is presented, followed by a discussion of the interim results as relevant to the scope of this paper. We conclude with a discussion of our contribution and avenues for future research.

2 Activity Theory

Activity Theory (AT) is generally described in IS research as a philosophical and cross-disciplinary framework for studying diverse forms of human practices, as development processes, with both individual and social levels simultaneously interlinked (Kuutti, 1995). Within IS discipline, AT affords the framing of activities from a socio-technical perspective without privileging the social over the technical or overemphasising on technology (Allen, Brown, Karanasios, and Norman, 2013).

The early model of AT, as developed by Vygotsky incorporated the triadic interaction of a human agent (the subject) and the world (the object) as mediated by tools (artefacts), to help study and explain human activities. Later Leont’ev and then Engeström further developed this framework by stressing that activities are aimed at achieving a particular outcome mediated by the use of tools and introducing the ideas of community, rules, and division of labour to arrive at ‘second generation’ AT (Dennen and Myers, 2012). This conceptualization was later refined by Engeström to arrive at ‘third generation’ AT to represent “multiple perspectives, and networks of interacting activity systems” (Engeström, 2001, p. 135).

The utility of AT to frame research lies in encouraging the researcher to address the full context in which an activity occurs, and the relationships between different human subjects and artefacts in an activity via the concept of resource mediation. Mediation can occur within the 3 broad categories of 1) artefact-mediation, 2) rule-mediation and 3) role-mediation (Jonassen and Rohrer-Murphy, 1999).

AT has been applied as a theoretical and methodological framework in various technology-related learning contexts. In the PLE research arena, AT has been used to theoretically position PLEs as more effective than virtual learning environments (VLEs) (Mazzoni and Gaffuri, 2009). Further, Buchem, Attwell, and Torres (2011) argued that PLEs can be conceptually regarded as complex activity systems and examined using the AT framework to describe their main elements and relationships between them. After forwarding a framework for viewing PLEs as activity systems, based on an extensive literature review of PLE research, Buchem et al. (2011) called for future research to relate to a more in-depth, theoretical and empirical discovery of the core concepts related to the elements. Yet, there is a lack of empirical evidence of the application of AT to study the learning processes within PLEs.

2.1 Activity theory in this study

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 (Gallego and 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. PLEs allow for the adoption of different tools and technologies by individual learners for performing learning activities within a social learning context. 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).

Engeström (2014) suggested that in order to understand learning activities framed by AT, it is vital to understand how artefacts such as tools, rules, and responsibilities within the learning community mediate the activity within its usage context. Therefore, in light of the purpose of this research, AT enables the shift of our attention away from the analytic study of single learning variables to focus on the holistic alignment of events, activities, content, and interpersonal processes taking place in the context of a PLE. Engeström (1993) endorses the use of AT's "conceptual tools and methodological principles" (p. 97) applied in accordance with the needs and focus of each investigation. There is, however, no commonly agreed methodology and approach for applying the concepts and principles of AT (Heo and Lee, 2013).

We used AT as a theoretical lens to frame this study and inform our analysis. The conceptual framework of our study framed by AT model and informed by the PLEs as activity systems framework (Buchem et al., 2011) is depicted in Figure 1 below.

Engeström (2014) advocates that the unit of analysis in AT is the mediated activity itself. In our study, the activity is the use of informal PLE for classroom related learning tasks. Because of the inherent complexity of socio-cultural activity settings it is recommended that researchers focus on a specific level of analysis within the three planes of sociocultural analysis: the personal, the interpersonal, and the institutional-community planes. Yamagata-Lynch (2003) suggested that researchers ought to focus on one plane of analysis in their research and blur out the other two planes. The salient features of the two planes that are not being examined will be identified, to help further appreciate the complex activities that take place on the plane of analysis that is the focus. As our research question delineates, our focus will be the personal plane and individual students' use of PLEs.

Object drives the activity and analysing the object is essential to gaining an understanding of the subjects and what they do, whether alone or in groups. The object of our analysis is the individuals SRL actions/ strategies within the personal plane. Our analysis of the object will be framed by the manner in which the object is mediated by the three broad categories of the tools, rules, and roles of participants engaging in the of the SRL activity (Engeström, 2014). Thus, data collection and analysis

framed by the above model would facilitate a thorough understanding of how and why learners use an informal PLE for performing learning tasks in and outside the classroom.

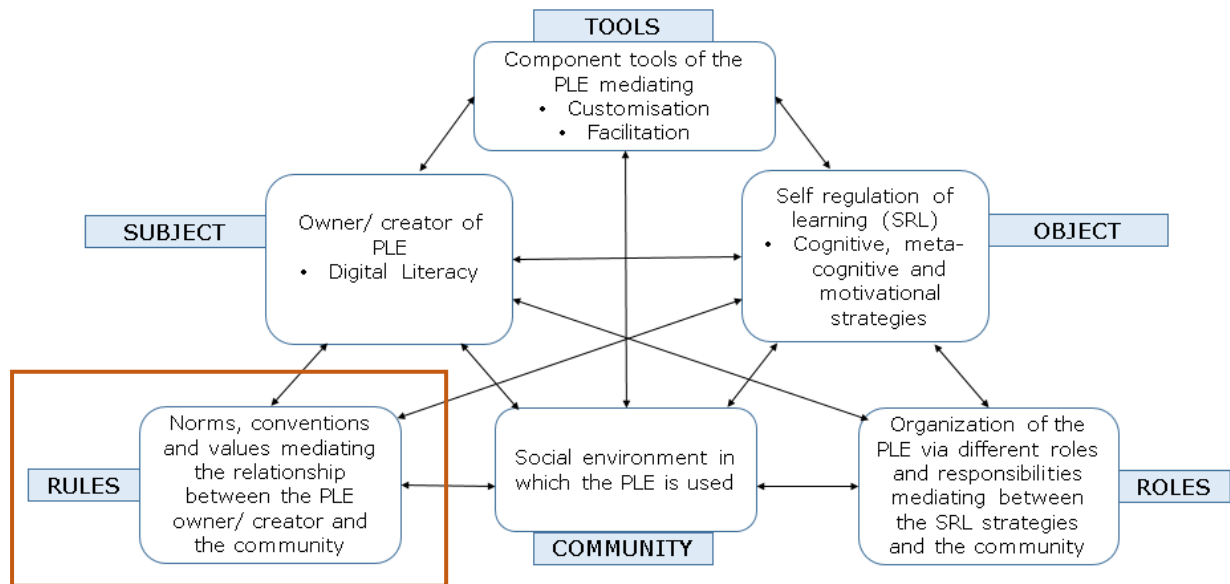


Figure 1. The conceptual framework of the study

Following this rationale, in a prior publication we elaborated the tools component of activity theory as relevant to our study from the perspective of tool affordances (Perera Muthupoltotage and Gardner, 2017). Analysis is underway to identify and understand the roles of PLE subjects and how these roles mediate community interactions. The objective of our analysis and discussion in this paper, however, is to understand the values, conventions and norms active in the form of implicit and explicit rules governing the subject’s use of their PLE, as highlighted in Figure 1 above.

3 Method

This study adopted a sequential mixed methods (Creswell, 2014) approach. In keeping, however, with the generally accepted principles for AT based studies (McAvinia, 2016) mainly qualitative methods were used for data collection while a range of data collection techniques were used, to explore different perspectives of the participants. In our larger study, interviews and focus groups were used to help provide the subject’s (undergraduate students) point of view, while mind maps of individual PLEs provided additional information about the tools and their organization within PLEs. Quantitative data gathered using an online survey was used to aid qualitative sampling, augment interview question formation and support the qualitative data. To ensure a reliable representation of interview participants, a hierarchical clustering based on the digital skills and attitudes reported in the online survey was conducted, before randomly inviting an equal number of participants from each of the four clusters which emerged for face to face interviews.

As fitting the reporting scope of this paper we will limit our discussion here onwards to the collection and analysis of interview data.

3.1 Data collection

Face to face interviews were conducted with 20 first-year students. 11 were females while the rest were males. Their age ranged from 18-29 with the average age of 20. 12 of the interviewees identified with the main ethnicity of Asian, while the rest identified with the main ethnicity of European.

The interview duration was approximately one hour. 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 over time in high school to arriving and spending one/ two semesters at university 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 were conducted in English 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, section 1 and 3 of each interview transcript is relevant to the scope of this paper. The subsequent discussion elaborates the manner in which this data was analysed.

3.2 Data analysis

During our interviews the participants were recounting and discussing certain actions they perform via their PLE. But, they may not use particular expressions or constructs which could be directly associated with self-regulation of learning. Therefore, a mechanism for identifying broad topics in the interview text related to participants SRL processes while reducing and organizing the data into meaningful activities effectively was needed.

Thus, we started the coding process with the first author reading and re-reading through each transcript and assigning structural codes (Saldaña, 2016) based on theoretical behavioural, metacognitive and motivational SRL classification indicators previously used by Dettori and Persico (2008). This set of classification indicators were deemed particularly useful for this study due to its strong foundation on widely adopted extant SRL literature (Pintrich 2004; Zimmerman 2002) while being proven as reliable and well defined in prior studies investigating SRL in TELEs. As limitations in space prevent us from elaborating on the structural codes here, we refer the reader to Perera Muthupoltotage and Gardner (2017) for a comprehensive discussion of the structural codes and coding process used in this study.

Reading and rereading the structural coded data enabled the identification of meaningful SRL activities that were prevalent throughout the multiple sources. Process and values coding (Saldaña, 2016) was used to further analyse each sentence of the structural codes.

New codes were created to represent actions indicated in the data and the participant's values and attitudes (Bogdan and Biklen, 2007). Process codes were constructed using gerunds to exclusively signify observable as well as conceptual activity. Signifying the processes of participant actions in this manner enabled the identification and labelling of the tool-mediated actions, roles, and responsibilities of the participant and the community interacting with and using the PLE. The value codes enabled signifying the underlying values, belief and attitudes governing the participants PLE interaction and use and was a particularly useful technique for exploring participants' intrapersonal experiences with technology.

Further thematic analysis of the codes enabled the identification of emerging themes. Activity theoretic nodes of tool mediation, rule mediation, and role mediation were used to reorganise the themes as per the conceptual model of the study. The emergent themes organized within the rule mediation node and preliminary findings are elaborated in the next section. We have limited our discussion here to

rule mediation themes in the form of norms and values governing the use of a PLE for SRL, in alignment with the focus of this paper as discussed previously.

4 Discussion of Preliminary Findings

Table 1 below provides a summary of some emergent themes organized under the activity theoretic node of rule mediation. A summary of emergent findings is also included.

| Emergent theme | Process and value codes within the theme | No of coded sources | Emergent findings |
|--------------------|--|---------------------|--|
| Trust | Trustworthy/ un-trustworthy tool | 16 | <ul style="list-style-type: none"> Assimilation of tools for learning tasks is based on the trust placed in the PLE tools. Subjects interaction with content and peers is mediated by trust The trust placed in oneself mediates help-seeking and self-evaluation activities of subjects |
| | Self-trust | 11 | |
| | Trusting others | 9 | |
| | Trusting the source | 10 | |
| Learner agency | Have choice | 13 | <ul style="list-style-type: none"> Conscious choices are made to mediate level and extent of interaction with the community via PLE. Subjects appreciate the role that choice plays in mediating the execution of learning activities in PLEs Choice and control motivates and empowers the subjects' interaction with the learning community |
| | Have power | 4 | |
| | Taking control | 6 | |
| Concern for safety | Keep private | 8 | <ul style="list-style-type: none"> Need for maintaining the privacy of personal content mediates what subjects share with community members via PLE Concern for personal safety mediates how subjects engage in learning task via tool selection and adoption, within their community |
| | Maintain personal safety | 5 | |

Table 1. Summary of emergent themes and findings on rules mediating the relationship between the PLE subject and the community

4.1 Trust

Trust was a theme all interview participants frequently lighted upon when discussing the manner in which they use their PLEs for SRL tasks. From a tool perspective, the assimilation/ non assimilation of component tools of the PLE for learning tasks was determined based on the trustworthiness of the tool. For example, participant 3 mentioned 'I use code academy to help practice my coding, I know it is trustworthy'. Alternatively, participant 9 mentioned, 'I don't think messenger is trustworthy, I will never use it to share any documents'. Trust is a complex topic when discussed in relation to technology (Nickel, Franssen, and Kroes, 2010) and has been studied in some detail in e-learning environments (Liu and Wu, 2010). However, this concept has not been studied in detail yet, within the context of informal PLEs. Li, Najafian-Razavi, and Gillet (2011) explored trust across the four dimensions: trustor, trustee, context and visibility in an integrated PLE environment based on a single technology. They found that trust applies to content quality as well as personalized preference within the PLE. Our findings are in tandem here, where the interview participants discuss content quality of tool in a sense of its reliability.

Trust was also indicated as a core value governing the subject's interaction with learning content and peers via their PLE. When discussing help-seeking behaviour when completing course-related assessments, participant 12 stated: "I will only contact the people I trust on Facebook to ask for help on finishing the assignment". On a similar vein Participant 7 commented on how she would not use most YouTube videos to find additional information when learning but always tried to find the information on Khan Academy because she 'trusted the source'. This is similar to the findings of Sousa, Tomberg, Lamas, and Laanpere (2011) in their investigation of blog-based learning environments where trust

affects individuals' tendency to interact, by influencing their willingness to rely on others, or their ability to believe that other's actions will eventually lead to expected results. Further, trust also applied to the individual's own ability (self-trust) in relation to help-seeking activities. Participant 5 mentioned how she had learned to "*trust her own ability*" after experimenting with a video making tool for the first time and finding that she was able to learn and apply it very soon in the required context without the help of peers. As stated by Dwyer and Marsh, (2017) self-trust is key to the success of learners specifically in digital learning environments and is akin to the concept of self-efficacy in education research. Thus, our interview participants' acknowledgment of self-trust as a core value governing self-regulation of learning within PLE contexts is thought-provoking.

4.2 Learner agency

All of the learners indicated a strong appreciation of the ability their PLEs provided to make choices and take control in relation to interaction with the learning community. We used 'Learner agency' as a priory theme (Ryan and Bernard, 2003) to categorize the large number of coded references to choice and related codes. This is based on the definition of agency as "the capability of individual human beings to make choices and act on these choices in a way that makes a difference in their lives" (Martin, 2004, p. 135).

The thing about using YouTube is you can choose the level you understand and watch that one because on any topic there will be a lot of people pitching at different levels. I feel that I know what I am doing. – Participant 14

I always bring my laptop to class, it's my choice. . I can google up what the lecturer is saying if I want to, I can watch videos, I can chat with my friends. But all to the level I want to and it's interesting for me then. – Participant 2

The above statements made by interviewees when discussing the execution of learning tasks indicate the ability that the PLE provides to make informed choices when interacting with others within the learning community. Moreover, they highlight the conscious manner in which choices are made as well as the individual's appreciation of choice.

Additionally, as indicated by the following comment of participant 19 elaborating on help-seeking behaviour, "*I don't normally ask questions in class but I like to use piazza, because I can control how much I ask questions from the lecturer and answer other people's questions as well, I like how it's more targeted*"; choice, is significant in regulating the manner and level of interaction with the larger social community of the PLE. There are also noteworthy references to motivation and sense of empowerment provided via choice. For example, Participant 8 mentioned "*I like how they give feedback online for our test on Canvas and if we want we can choose to even comment and sort of respond to what the person marking said. I have some power too*".

There are arguments that giving students a sense of control and power to affect their own learning is a great challenge of contemporary education (Pachler, 2010) but there is a surprising dearth of research on the concept of agency within the TEL arena. The work of Lindgren and McDaniel, (2012), however, did report that agency complements the process of learning and engagement on an online course. Our findings compliment those findings in highlighting the role that agency plays in SRL activities of PLE users engaging with their learning community.

4.3 Concern for safety

The third theme which emerged from our data is privacy. The normal behaviour for interaction with the larger learning community using a PLE appeared to be strictly governed by the individuals need for maintaining privacy and safety. Below are some examples of participant comments grouped within this theme.

I don't mind using messenger (Facebook) to discuss how to do our group work and all that, but only if we have met at least once as a group. We have to meet face to face first or it's not safe I think. – Participant 11

I never put anything that is personal to me, no photos or anything, on the google drive, not the one given by university even if it had unlimited space.. I use that a lot but that's only for university work and group work and stuff. I have one of my own for my own stuff. More private and safe that way. - Participant 13

I am on all the course Facebook pages, it's a good resource to know what's going on. But the most I do is just read and like something. You won't find me commenting or posting. I'm very private. If you think about it I only know maybe two or three from that whole group and I know that people can sometimes be weird on the Internet. – Participant 10

These comments suggest that interview participants were keenly aware of safety concerns when interacting with other individuals via their PLE. This extends to maintaining the privacy of personal information when sharing resources (e.g. participant 13 above) as well as maintaining personal safety when the interaction occurs with other individuals who have mainly a cyber presence (e.g. Participant 11 and 10 above). Online safety is a much-discussed topic specifically in relation to the use of Internet-based tools for learning. Recent research does indicate that learners are well aware of safety issues and also methods of staying safe in online environments (Mao, 2014) possibly due to the many educational programs and policy initiatives that work to promote youth/child Internet safety (Farrukh, Sadwick, and Villasenor, 2014). From a practical perspective, our data suggest that these initiatives have had some success in increasing the social-emotional literacy (Ng, 2012) of individuals (e.g. participant 10) and mediating their community interaction when engaging in learning tasks via the use of technology.

5 Contribution and Future Work

Our study attempted an in-depth understanding of how self-regulated learning takes place within user created and managed PLEs. This paper reported the preliminary findings of an ongoing qualitative analysis focused on the norms, conventions, and values which mediate the interaction of the learner with the larger learning community when engaging in learning tasks via an informal PLE.

Our contribution is in explaining what social norms and values influence how such PLEs are used for supporting SRL processes. While self-regulation of learning is considered to be more an individual characteristic (Zimmerman, 2000) learning communities play a vital role in any PLE (Archee, 2012). Therefore insights on what norms, attitudes and values mediate the interaction of individual learners with technology as well as the learning community is paramount in obtaining a thorough understanding of PLE use from an SRL perspective. Students use these PLEs mostly outside the classroom, but integrating PLEs within formal learning institutions would simply make learning easier. Having a comprehensive understanding of rules mediating learner actions when using PLEs for SRL processes would enable planning for more effective integration of informal PLEs for institutional use.

Trust, learner agency and concern for safety were identified as preliminary rule-mediation themes emerging from the data. Some of our findings are convergent with existing literature in the TEL arena. Moreover, as existing research has not explored the concept of trust or learner agency within informal PLEs, as is the focus of our research, our findings open an avenue for further investigation and discussion to understand the dynamics of these concepts within the PLE context.

An added 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.

Moving forward, we will continue our qualitative analysis to elaborate on rule mediation but also expand on the tool and role mediation of SRL activities performed via PLEs. We have also obtained quantitative data on the individual digital literacy and SRL skill levels of undergraduates and conducted a preliminary analysis (Perera Muthupoltotage and Gardner, 2018). Thus, once the qualitative analysis is completed, we would be able to triangulate this quantitative and qualitative data to provide more advanced theoretical and practical contributions at the conference and future publications.

References

- Allen, D. K., Brown, A., Karanasios, S. and Norman, A. (2013). "How Should Technology-mediated Organizational Change Be Explained? A Comparison of the Contributions of Critical Realism and Activity Theory." *Management Information Systems Quarterly*, 37(3), 835–854.
- Archee, R. (2012). "Reflections on Personal Learning Environments: Theory and Practice." *Procedia - Social and Behavioral Sciences*, 55, 419–428.
- Bartolomé, A. and Steffens, K. (2011). "Technologies For Self-Regulated Learning." In: *Self-Regulated Learning in Technology Enhanced Learning Environments A European Perspective*. Rotterdam; Boston: SensePublishers.
- Bergamin, P., Bettoni, M., Ziska, S. and Eggs, C. (2011). "Reference Course Model: Supporting Self-Regulated Learning by Cultivating a University-Wide Media Culture." *Igi-Global*, 334–351.
- Bernacki, M. L., Aguilar, A. C. and Byrnes, J. P. (2011). "Self-Regulated Learning and Technology-Enhanced Learning Environments: An Opportunity-Propensity Analysis." In: *Fostering Self-Regulated Learning through ICT*. IGI Global.
- Bogdan, R. and Biklen, S. K. (2007). *Qualitative research for education: an introduction to theories and methods* (5th ed.). Boston, Mass.: Pearson A and B.
- Buchem, I., Attwell, G. and Torres, R. (2011). "Understanding Personal Learning Environments: Literature review and synthesis through the Activity Theory lens." In: *The PLE Conference 2011* (pp. 1–33). Southampton, UK.
- Buchem, I., Tur, G. and Hoelterhof, T. (2014). "Learner control in Personal Learning Environments: A cross-cultural study." *Learning and Diversity in the Cities of the Future*, 13.
- Creswell, J. W. (2014). *Research design: qualitative, quantitative, and mixed methods approaches* (4th ed). Thousand Oaks: SAGE Publications.
- Dennen, V. P. and Myers, J. B. (Eds.). (2012). *Virtual Professional Development and Informal Learning via Social Networks*: IGI Global.
- Dettoni, G. and Persico, D. (2008). "Detecting Self-Regulated Learning in Online Communities by Means of Interaction Analysis." *IEEE Transactions on Learning Technologies*, 1(1), 11–19.
- Dwyer, N. and Marsh, S. (2017). "Self-trust, Self-efficacy and Digital Learning." In: *Trust Management XI* (pp. 110–115). Springer, Cham.
- Engeström, Y. (2014). "The Emergence of Learning Activity as a Historical Form of Human Learning." In: *Learning by Expanding An Activity-Theoretical Approach to Developmental Research* (2nd ed., pp. 25–108). Cambridge University Press.
- Engeström, Y. (1993). "Developmental studies of work as a test bench of activity theory: The case of primary care medical practice." In: S. Chaiklin and J. Lave (Eds.), *Understanding Practice: Perspectives on Activity and Context* (pp. 64–103). Cambridge University Press.
- Engeström, Y. (2001). "Expansive Learning at Work: Toward an activity theoretical reconceptualization." *Journal of Education and Work*, 14(1), 133–156.
- Espinosa, M. P. P., Castañeda, L., Gutiérrez, I. and del Mar Román, M. (2016). "Still far from personal learning: Key aspects and emergent topics about how future professionals PLEs are". *Digital Education Review*, (29), 15–30.
- Farrukh, A., Sadwick, R. and Villasenor, J. (2014). "Youth internet safety: Risks, responses, and research recommendations." *Center for Technology Innovation at Brookings*.
- Gallego, M. J. and Gamiz, V. M. (2015). "Personal Learning Environments (PLE) in the Academic Achievement of University Students." *Australian Educational Computing*, 29(2).
- Heo, G. M. and Lee, R. (2013). "Blogs and Social Network Sites as Activity Systems: Exploring Adult Informal Learning Process through Activity Theory Framework." *Journal of Educational Technology & Society*, 16(4), 133–145.
- Jonassen, D. H., and Rohrer-Murphy, L. (1999). "Activity theory as a framework for designing constructivist learning environments." *Educational Technology Research and Development*, 47(1), 61–79.

- Kravicik, M. and Klamma, R. (2012). "Supporting self-regulation by personal learning environments." In: *Advanced Learning Technologies (ICALT), 2012 IEEE 12th International Conference on* (pp. 710–711). IEEE.
- Kuutti, K. (1995). "Activity Theory as a potential framework for human computer interaction research." In: B. Nardi (Ed.), *Context and Consciousness: Activity Theory and Human Computer Interaction* (pp. 17–44). Cambridge, Mass: MIT Press.
- Li, N., Najafian-Razavi, M. and Gillet, D. (2011). "Exploring Trust in Personal Learning Environments." In: *The 4th International Conference on Advances in Computer-Human Interactions. Gosier*, Guadeloupe, France.
- Lindgren, R. and McDaniel, R. (2012). "Transforming online learning through narrative and student agency." *Journal of Educational Technology & Society*, 15(4), 344–366.
- Liu, Y. and Wu, Y. (2010). "A Survey on Trust and Trustworthy E-learning System." In: *2010 International Conference on Web Information Systems and Mining* (Vol. 1, pp. 118–122).
- Mao, J. (2014). "Social media for learning: A mixed methods study on high school students' technology affordances and perspectives." *Computers in Human Behavior*, 33(Supplement C), 213–223.
- Martin, J. (2004). "Self-Regulated Learning, Social Cognitive Theory, and Agency." *Educational Psychologist*, 39(2), 135–145.
- Mazzoni, E. and Gaffuri, P. (2009). "Personal learning environments for overcoming knowledge boundaries between activity systems in emerging adulthood." *E-Learning Papers*, 15(5), 1–10.
- McAvinia, C. (2016). "Activity Theory." In: *Online Learning and its Users* (pp. 59–100). Elsevier.
- Ng, W. (2012). "Can we teach digital natives digital literacy?" *Computers & Education*, 59(3), 1065–1078.
- Nickel, P. J., Franssen, M. and Kroes, P. (2010). "Can We Make Sense of the Notion of Trustworthy Technology?" *Knowledge, Technology and Policy*, 23(3–4), 429–444.
- Pachler, N. (2010). *Mobile learning: structures, agency, practices*. New York: Springer.
- Perera Muthupoltotage, U. and Gardner, L. (2018). "Analysing the Relationships between Digital Literacy and Self-Regulated Learning of Undergraduates—A Preliminary Investigation." In: N. Paspallis, M. Raspopoulos, C. Barry, M. Lang, H. Linger and C. Schneider (Eds.), *Advances in Information Systems Development* (pp. 1–16). Cham: Springer International Publishing.
- Perera Muthupoltotage, U. and Gardner, L. (2017). "Undergraduates Perception of Informal Personal Learning Environments: Affordances for Self-regulated Learning." In: *ACIS 2017 Proceedings*. Hobart, Tasmania.
- Renzel, D., Klamma, R., Laanpere, M. and Nussbaumer, A. (2015). "Tracing Self-Regulated Learning in Responsive Open Learning Environments." In: *Advances in Web-Based Learning -- ICWL 2015* (Vol. 9412). Cham: Springer International Publishing.
- Ryan, G. W. and Bernard, H. R. (2003). "Techniques to identify themes." *Field Methods*, 15(1), 85–109.
- Saldaña, J. (2016). *The coding manual for qualitative researchers* (Third edition). Los Angeles, Calif; London: SAGE 2016 ©2016.
- Sousa, S. C., Tomberg, V., Lamas, D. R. and Laanpere, M. (2011). "Interrelation between Trust and Sharing Attitudes in Distributed Personal Learning Environments: The Case Study of LePress PLE." In: *Advances in Web-Based Learning - ICWL 2011* (pp. 72–81). Springer, Berlin, Heidelberg.
- Steiner, C. M., Wesiak, G., Moore, A., Conlan, O., Dagger, D., Donohoe, G. and Albert, D. (2013). "An Investigation of Successful Self-Regulated-Learning in a Technology-Enhanced Learning Environment." In: *AIED Workshops*.
- Tu, C.-H., Yen, C.J. and Sujo-Montes, L. E. (2015). "Personal Learning Environments and Self-Regulated Learning." In: *Media Rich Instruction* (pp. 35–48). Springer, Cham.
- Yamagata-Lynch, L. C. (2003). "Using Activity Theory as an Analytic Lens for Examining Technology Professional Development in Schools." *Mind, Culture, and Activity*, 10(2), 100–119.
- Zimmerman, B. J. (2000). *Attaining Self-Regulation-Chapter 2: A Social Cognitive Perspective*. Elsevier Inc.

Zimmerman, B. J. (2002). "Becoming a Self-Regulated Learner: An Overview." *Theory In to Practice*, 41(2), 64.