

Self-directed learning in e-portfolios: Analysing students' performance and learning presence

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Abstract

E-portfolios constitute a dynamic research topic in e-learning, since they foster a new philosophy for learning and personal development, which is characterised by open, participatory, self-directed, reflective and collaborative processes. This paper presents an investigation on students' learning presence in a blended post-graduate course, designed to promote self-directed learning through e-portfolio activities. The theoretical foundations and the key dimensions of e-portfolio learning activities are outlined, i.e. students' construction, reflection and collaboration. Following are presented the organizational and the analysis framework of students' self-directed learning and constructive activities within the e-portfolio. Combining both, descriptive analysis and Social Network Analysis of the research data, we have revealed important information regarding individual performance and students' learning presence, interaction and collaboration among participants as well as the overall operation of the e-portfolio community.

Keywords: e-portfolios, e-learning, self-directed learning, learning presence social network analysis.

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1. Introduction

The rapid growth of Web technologies, during the last decade, has challenged and enabled educators and educational institutions, around the globe, to consider new ways of delivering their educational programs. Currently, e-learning is becoming more widespread in higher education while an increasing interest about the potential of on-line tools to support learner-centred and personalised forms of learning is widely acknowledged. With the increasing emphasis on learners' interaction, there is a shift in pedagogy from individual to more collaborative approaches to learning within a community of people who share the same interests and goals [10,24,35,41]. In particular, the interest about Web 2.0 technologies, like wikis, blogs, e-portfolios etc., is determined by their flexible, participatory, learner-centred, communicative and networking features. Web 2.0 applications are expected to transform learning by providing multiple opportunities for students' engagement, interaction,

reflexive dialogue, content sharing, creativity, collaborative and self-directed learning [10,16,44].

In this context, many researchers suggested that Web 2.0-based learning environments are learner-centred by nature and they provide more control to the learners, in terms of engagement, peer interaction, content creation and collaboration [17,32,38]. In addition, Web 2.0 applications offer enhanced opportunities to the educators to consider new ways of designing and delivering their educational programs by a) extending learning environments from time and space bound classroom places, b) promoting openness and dynamic emergence of the courses, which are determined by students' needs, interests and individual learning initiatives, and c) adopting new forms of pedagogy which offer authentic learning opportunities through self-directed, participatory, collaborative and social learning processes [16,24].

Among Web 2.0 tools, e-portfolios constitute a new means of enhancing e-learning in practice. They are increasingly becoming popular in tertiary education to support students' learning and personal development [2,18,9,14]. Literature review indicates that e-portfolios are dynamically used in order to embed learner-centred and reflective strategies in

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primary and secondary education [5,27], undergraduate and post-graduate education [19,20,22,39], teacher education [34] and continuing professional development [23].

Despite their promising uses in education, e-portfolios have become an important research topic only in the last few years. They constitute, on the other hand, an open research problem since they are not thoroughly studied in their multiple dimensions. A wide range of studies were directed towards students' perceptions of e-portfolios and their experiences during learning activities implemented within e-portfolios [4,6,12]. Limited research has been undertaken in relation to designing and implementing e-portfolios to support learning and personal development, and even less has considered the advantages, challenges, difficulties and support from the tutor's perspective [22,28]. On the other hand, empirical research on students' active engagement, collaboration and the consequent learning outcomes is rather limited. Given the ongoing educational growth of participatory learning environments, it is important to gain insights into how people learn in e-portfolios and to outline a profile of learners which are successfully engaged in self-directed forms of learning in e-portfolios [40].

This paper has the ambition to contribute to the literature by providing an integrated framework for designing and analysing students' learning presence in e-portfolios, which is based on the principles of self-directed learning [13,26] and social learning theory [35,41]. Consistent to existing theoretical approaches about learning portfolios [37, 46], the proposed organizational model goes beyond the notion of e-portfolio as a space for collecting and storing learning artefacts. The corner stone of the proposed model is that students' learning presence, as depicted by their construction, reflection and collaboration, is the fundamental e-portfolio feature that determines the pedagogical link between content knowledge and the e-portfolio learning space [15, 30].

The organization of the paper is as follows: The next section addresses the theoretical foundations of the conceptual/organizational model used to design the present investigation and provides a literature review with regards to e-portfolios and e-learning. Following, the methodological issues of the study are presented in detail. The forth section presents the preliminary findings of both descriptive analysis and Social Network Analysis, which depict students' learning presence through their engagement, interaction, creativity and collaboration. Finally, conclusions are drawn for future development and research in e-portfolios and self-directed learning.

2. Theoretical background and literature review

In their traditional view, learning portfolios help students to collect their assignments, to present selected artefacts and showcase examples, and to reflect on their work and achievements. Currently, an e-portfolio is a dynamic Web space maintained and created by a learner, a group of learners, participants in a course or a whole community, which

includes demonstrations, resources, accomplishments, articulated experiences, individual and collaborative creations, as well as peer feedback. By embodying Web 2.0 functionalities, e-portfolios enhance their publishing, archiving, sharing, communicative and collaborative features (for example by including tools like forums, blogging, content sharing, wikis etc.). Therefore, overcoming the constraints of time and physical space, learners' reflection on individual artefacts and the overall e-portfolio material, as well as collaboration and feedback provided by peers, are the key factors to harness the full advantages of e-portfolios [15].

In this perspective, the notion of e-portfolio is not restricted to an individual repository or an online collection of students' individual work and creations. Based on our previous theoretical approach [15], this study considers that e-portfolio learning refers to both, the product and the process of learning. As a *product*, an e-portfolio, provides a personal space where learners can collect their digital artefacts and creations that offer evidence of their experiences, achievements, and actual learning outcomes. On the other hand, as a *process*, it allows learners to move beyond what they have learned, to consider how they have learned and to understand many aspects of their learning and the connections among them, which are inherent to creative, constructive and collaborative processes.

However, it is critical to point out that the key factors to harness the full advantages of e-portfolios are a) learners' reflection on individual and peer artefacts b) feedback provided by peers sharing common interests and learning goals, and c) collaboration among participants and collaborative creation of new artefacts. Therefore, through e-portfolios, we can create effective learning environments that help students to trace their own *learning trajectories* by providing multiple opportunities to demonstrate their outcomes. In addition, students are able to enhance their educational experiences through self-directed reflection, which promotes meta-cognition, self-observation, self-evaluation and motivation.

The notion of self-directed learning is rooted in the theory of andragogy for adult learning [21,26]. According to Knowles, self-directed learning is "a process in which individuals take the initiative, with or without the help of others, to diagnose their learning needs, formulate learning goals, identify resources for learning, select and implement learning strategies, and evaluate learning outcomes". By linking online learning to the principles of self-directed learning, Garrison viewed self-directed learning as both a personal attribute and a learning process. In addition, his approach put emphasis on learners' use of *resources*, their *motivation* to learn, the *learning strategies* they follow and, particularly, on *collaboration* with other people within a given *educational context*, in order to reach their learning objectives [13]. According to his model, self-directed learning includes three mutually interacting dimensions: *self-management*, *self-monitoring*, and *motivation*. There is a dynamic interaction between self-directed learning and the context within learning is occurring. Song and Hill suggested a conceptual model towards understanding and investigating

self-directed learning in online learning environments, which is structured along three dimensions [36]: a) the learners' personal attributes, b) the learning processes elaborated (planning, monitoring, evaluating) and c) the learning context (i.e. recourses, strategies, nature of tasks).

Self-regulated learning is another important theoretical framework for describing significant aspects of learning processes, which relate the learning outcomes to learners' goals, motivations, volitions and actions. The notion of self-regulation is generally based on Zimmerman's three-phase cyclical processes of learning that includes planning (forethought), performance (monitoring and strategy use), and evaluation (reflection) [42,45]. Zimmerman suggested also that self-regulated learning is an active and constructive process, used by the students to acquire new knowledge and skills, by setting goals, selecting and deploying strategies, managing material and resources, self-monitoring their effectiveness and regulating their learning to reach specific goals [43,44]. Similarly, Pintrich proposed a model for self-regulated learning which includes three general categories of learning strategies [29]: a) *cognitive learning strategies*, b) *meta-cognitive and regulatory strategies* and c) *resource management strategies*.

In the context of self-regulated learning, Shea and Bidjerano introduced the notion of *learning presence*, which includes the phases of forethought, performance, and reflection with regards to online activities the learners are engaged to [30]. Recently, Shea et al. proposed that the learning presence is simultaneously predicated not only by individual efforts but also by the group dynamics within collaborative learning environments [33]. In this perspective, the emphasis is placed on three dimensions of regulation in on-line learning environments: a) *self-regulation*, an individual is looking after his own activities; b) *co-regulation*, an individual is scaffolding and regulating another's learning initiatives; and c) *shared regulation*, individuals are working together to regulate each other's learning.

A comprehensive review by Means et al. has shown that promoting self-reflection, self-regulation and self-monitoring in online learning environments, can lead to higher levels of engagement and learning outcomes [25]. Recent studies have identified that self-regulation is associated with successful online learning experiences and students' success in online learning environments [30,31,32]. Similarly, Cho and Shen showed that students with strong self-regulation tended to persist with challenging tasks and put more effort into achieving the desired outcomes compared to students with poor self-regulation [8]. Due to the learner-centered and self-directed nature of e-portfolio learning, careful deployment of self-regulation is considered as a critical factor for student success [1,3].

In conclusion, e-portfolios operate as participatory spaces supporting constructive and collaborative learning processes, whereby learners set their learning goals and they attempt to monitor, control, regulate and co-regulate their motivation, cognition, engagement and learning processes. Through the lens of self-directed learning, it is expected that e-portfolios

can effectively bind learning to problem solving, individual and group learning, collaboration, performance management, professional development and growth. It is expected, therefore, that the pedagogical affordances of e-portfolios can strengthen and improve reflection in a way that helps learners to achieve meaning and knowledge from their formal learning experiences, self-directed initiatives and collaborative experiences.

The theoretical foundations of designing e-portfolio-based learning initiatives and the present investigation were rooted in the ideas of experienced and reflective learning [11]. We have developed a combined pedagogical framework determined by the notions of self-directed learning [13], self-regulated learning [30,43], and community learning [35,41]. In this context, three mutually related components were identified, which afford e-portfolios as dynamic learning environments and characterize social participation as the key factor of learning and personal development processes [15]:

Construction: This dimension projects a) planning, organization and development of individual students' work and b) documentation of representative work samples (artefacts) that provide tangible evidence of students' knowledge and skills.

Reflection: Reflection is the most critical component in an e-portfolio initiative. It is a form of students' critical thinking on individual and peer work, knowledge material, artefacts and creations towards fulfilling a specific purpose or achieving the anticipated learning outcomes.

Collaboration: Meaningful reflection is best facilitated by peer collaboration, artefact co-creation, mentoring, and peer-feedback within a learning community evolving in the e-portfolio.

The three key elements (dimensions) of e-portfolios should not be considered in isolation, but rather through the complex relationships in the space they define (Figure 1). When the three learning components of e-portfolio are mutually activated, we expect that students have enhanced opportunities for personal growth and meaningful learning through reflective and self-regulated processes.

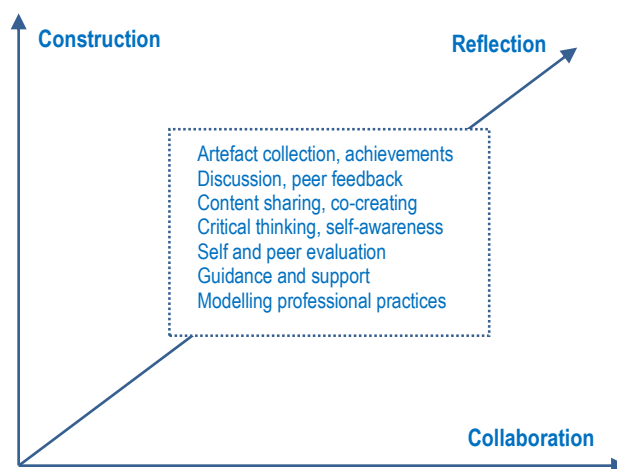


Figure 1. The three dimensions of e-portfolio learning process

3. Research method

3.1. Aim and research questions

The aim of this study is a) to extend previous research findings concerning self-directed learning in collaborative on-line learning environments, like e-portfolios, by revealing and analysing critical indicators of students' learning presence, and b) to apply a combined analysis schema using descriptive and Social Network Analysis (SNA) methods, in order to shed light into the different ways of individual contributions, social interaction, and the dynamics of the e-portfolio self-directed learning processes.

In accordance with the research objectives the following research questions were addressed:

- Can we achieve a consistent view of students' learning presence through self-directed activities in e-portfolio based learning? What are the main indicators of students' performance along individual, group and course levels?
- Can we depict an operational structure of the e-portfolio project activities? What were the different student roles in self-directed learning activities?
- To what degree the proposed framework can be applied in the design and analysis of students' self-directed learning in e-portfolios?

3.2. Context and design issues

The present intervention ran during the spring semester of 2013, in the context of a masters' degree course entitled "e-learning and ICT in education", at the Department of Social and Educational Policy, University of Peloponnese, in Greece. Twenty three students were enrolled. They all had a bachelor degree in various disciplines related to education; twenty students were in-service primary and secondary education teachers. The course was designed in a blended format, including five face-to-face classroom sessions combined with on-line collaborative work in the e-portfolio. Mahara was used as the e-portfolio hosting platform.

Students' individual and collaborative work were deeply interconnected and spread along the timeline of the initiative, which lasted 24 weeks. The instructor was acting as e-moderator by setting the context, the expectations and the processes of students' self-directed learning. An ongoing cooperation framework was shaped, based on dialogue, peer interaction and collaboration. In order to achieve the expected learning outcomes of the course, the students were encouraged a) to change ideas on theoretical and pedagogical issues, b) to contribute by writing articles on the e-portfolio journal, c) to reflect and debate on course content and peer contributions, d) to share resources, educational material and experiences, and e) to create working groups and design new educational scenarios applicable in school practice. Each student was requested to publish five articles on the e-portfolio blog and to create a WebQuest scenario.

3.3. Analysis framework

The study presented in this paper was designed with the aim to monitor, support and analyse students' repetitive and iterative activities along three mutually related levels, i.e. personal, group and course level. Therefore, a new conceptual analysis framework was designed, structured around four interrelated dimensions which reflect the complexity of students' learning presence within the e-portfolio community.

Engagement: Individuals' self-presentation and social presence, participation in general discussions and ways of attending e-portfolio activities;

Interaction-reflection: Negotiation of ideas and meaning through discussion forums, writing articles on the blog journal, engagement and interacting in peer working groups;

Creativity: Students' content contributions, creating and sharing new knowledge, co-creating new artefacts with peers in the e-portfolio community;

Cohesion: Ties between students and structure of the e-portfolio network as a whole;

Every individual student contribution was used as the analysis unit. We have captured a wide range of data, like distinct logins, postings, article publications and commentaries, content additions, student working groups etc. Therefore, three main sources and types of data analysis were used:

- Log data gathered from Mahara platform representing students' individual engagement.
- Descriptive analysis of individual contributions (i.e. publications and commentaries on the blog area, postings to discussion forum topics, suggestions for resources etc.).
- Social Network Analysis of individual contributions, with the aim to reveal members' ties and the dynamics of the e-portfolio network.

4. Results

4.1. Engagement

Engagement indicators are related to students' presence in the e-portfolio platform, i.e. participation in general discussions as well as individual actions concerning e-portfolio content view. Figure 1 shows the distribution of the students' distinct logins in the e-portfolio platform per week. The arrows indicate the dates of the course face to face sessions. Students' activities were continuous and interspersed in a balanced manner; a mean value of 133 distinct logins per week was recorded. Figure 2 gives a picture of the students' continuous learning presence, along the 24 weeks period of e-portfolio operation. We can easily identify the peaks in students' activity which, in most cases, are recorded a week after the deadline for the monthly blog article (i.e. after 9th, 12th, 15th, 19th, 22nd week).

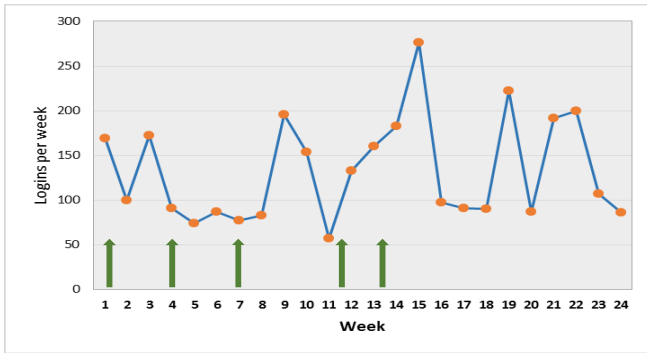


Figure 2. Students' activity distribution chart

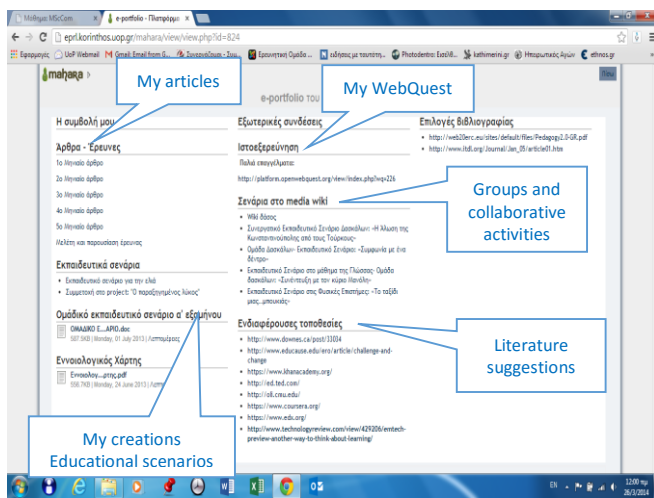


Figure 3. Main page of a typical student's e-portfolio

4.2. Creativity and reflection

Figure 3 shows the main e-portfolio page of a typical student's collection. It presents his activities and the artefacts produced during the course workflow. It is organized in four main parts projecting a) the articles/personal writings published in the blog area, b) individual creations (educational scenarios), c) groups and collaborative activities, d) suggested literature links. Many students used a similar form to organize and project their e-portfolio content to the other students and to the course tutor.

The majority of the students were very efficient members towards negotiating and sharing their ideas and knowledge through their contributions to the discussion forum and the journal (blog) area. Table 1 depicts an overall view of students' contributions and creations. A total of 135 original articles were published in Mahara's journal area with regards to theoretical and practical themes of learning and instruction with ICTs (Web 2.0 in practice, collaborative learning, educational blogging, mobile learning, game-based learning etc.). Comprehensive discussions were evolving around the blog articles, which received a total of 647 peer comments.

To organize and support their work and collaboration, the students initiated 20 discussion topics in the e-portfolio

forum, which received 206 postings. In addition, 14 working groups were spontaneously appeared as the outcome of students' self-directed initiatives. They were dynamically evolving around common student interests, with the aim to collaboratively study new educational topics and design new educational scenarios, applicable in classroom practice. In addition, 21 WebQuest scenarios were individually constructed and shared with the other students for peer-reviewing and further commenting.

Table 1. Students' creative and interaction activities

Indicators	Actions
Discussion topics	20
Forum postings	206
Article publications	135
Article Commentaries	647
Article views	10674
Working groups	14
WebQuest scenarios	21
Collaborative creations (educational scenarios)	6

4.3. Social Network Analysis

Social Network Analysis provides a set of methods (algorithms) which give insight into the various e-learning situations in terms of network structure parameters, like interactions and ties among members, information exchange and knowledge sharing, group dynamics, community structure etc. [17,32]. In this paper we present the results of *cohesion analysis*, *power (centrality) analysis* and *role analysis*.

Cohesion analysis can reveal important information regarding the architecture of the e-portfolio activity and the interrelations among students. It identifies the existence of various subgroups of students (cliques); the students within a clique tend to interact with each other and develop strong ties among them. Overall, 49 cliques were recorded. It is important to note that, the majority of the cliques (35) included a great number students, ranging from 10 to 12. In addition, 4 cliques we recorded with 9 members, 1 with 8 members, 7 with 7 students, 2 with 6 and 1 clique with 3 members. This finding is a strong indicator that the e-portfolio network was operating as a cohesive community, i.e. the students had developed strong interrelations among them and, therefore, they had enhanced opportunities for ideas interchange and collaborative construction of new knowledge.

Power (centrality) analysis is an effective SNA method to measure network activity, to reveal the operation of the e-portfolio community and to assess the impact each student had with respect to spreading information and influencing

other students [17]. In-degree centrality represents the number of interactions a student receives from other members. Accordingly, out-degree centrality is the number of connections a student has to the others in the e-portfolio. Betweenness centrality represents the capacity of a student to connecting other members, i.e. it is an indicator of individual position within the e-portfolio community.

Table 2. Power analysis data

Student	In-degree Centrality (%)	Out-degree Centrality (%)	Betweenness Centrality
S1	52.17	56.52	0.008
S2	21.74	21.74	0.002
S3	73.91	86.96	0.037
S4	69.57	56.52	0.009
S5	39.13	52.17	0.005
S6	69.57	47.83	0.007
S7	73.91	86.96	0.041
S8	65.22	60.87	0.013
S9	13.04	30.44	0.000
S10	52.17	60.87	0.017
S11	4.35	4.35	0.000
S12	34.78	4.35	0.000
S13	65.22	82.61	0.028
S14	60.87	78.26	0.029
S15	82.61	82.61	0.115
S16	47.83	56.52	0.023
S17	73.91	39.13	0.016
S18	39.13	34.78	0.008
S19	69.57	52.17	0.011
S10	65.22	56.52	0.009
S21	56.52	69.57	0.016
S22	78.26	69.57	0.067
S23	69.57	78.26	0.026
T	52.17	60.87	0.019
Average	55.40	55.40	0.021

Table 2 presents the results of the network activity and shows the power distribution among members in the course. The great majority of the students were active members, since they have interacted, at least, with 50% of their peers. The overall network activity was measured with in-degree centrality=55.40 and out-degree centrality=55.40. This means that, approximately, 55% of the students in the e-portfolio were mutually connected by both sending and receiving postings. Students S15 and S22 were the most influential members, since they received a great number of connections (postings) from their peers (82.61% and 78.26%). The students S3, S7, S13 and S15 were the most effective members towards triggering other students (they were connected to 83-87% of their peers in the course). On the other hand, students S11 and S12 had a marginal contribution to the e-portfolio network, since they were connecting, by sending postings, to only one member (4.35%).

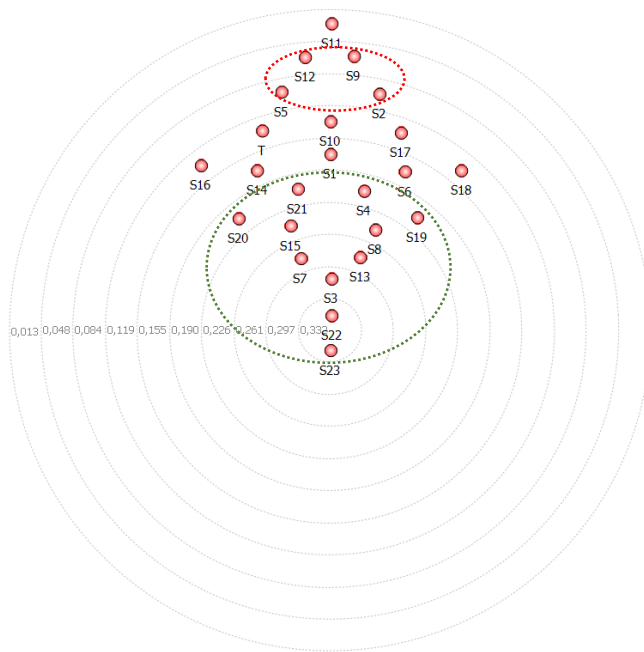


Figure 4. Eigenvector centrality map of the e-portfolio network

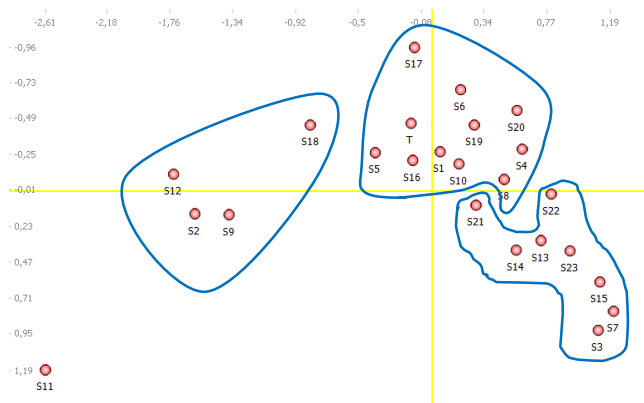


Figure 5. Role analysis graph

Figure 4 represents the eigenvector centrality map of the e-portfolio activity. The students placed at the centre were the most powerful and influential members, since they had many ties and connections to other powerful students (S22, S23, S3, S7, S13, S15, S8, S4, S19, S20 and S21). They were the most active, powerful members in the e-portfolio community and they were connected to other powerful participants. By moving to the periphery, students S11, S9, S2, and S12 are considered as the less powerful members of the e-portfolio network.

Figure 5 presents the *role analysis* diagram which identifies four classes of students which had certain social roles and performance in the e-portfolio network. The students who are members in a class are equivalent in the sense that they can replace each other with regards to their roles in the network. The first role group (i.e. the nodes placed

in the lower right side of the graph) includes eight students, which were the most active members in the whole e-portfolio activity, namely S3, S7, S13, S14, S15, S21, S22, and S23. They were members in more than 20 cliques and triggered others' contribution by expressing ideas and writing articles, posing questions, giving responses or uploading comments. In addition, they were the most influential members, since they were connected (by sending and received postings) to more than 60% of their peers in the course.

The second role group (i.e. upper right side) is consisted of ten students, i.e. S8, S10, S4, S20, S6, S19, S1, S16, S17 and S5. The tutor T is also placed therein. Comparing to the members of the first group, they had a slightly moderate influence to the network since they were involved in 8-20 cliques. However, all members in the second group had the opportunity to interact with, at least, half of their peers in the course.

The third role group included four students (i.e. S18, S9, S2, and S12) who uploaded fewer articles and postings. Most of them were members in 3-7 cliques. Finally, the student S11 had marginal presence in the e-portfolio activities while he was a member in only one clique. It can be characterized as an isolate student. His presence appeared to be restricted to reading postings and the material uploaded by the other students.

Conclusions

This paper reported on an investigation concerning the design and the implementation of a blended post-graduate course, structured around students' self-directed and collaborative activities in an e-portfolio.

The findings provided supportive evidence of an effective learning program that promoted students' engagement and self-directed learning within a dynamically evolving community. The majority of the students demonstrated enhanced motivation and they were actively engaged into the e-portfolio activities (writing articles, uploading postings, supporting dialogue and discussion topics, interchanging ideas, sharing content and resources, co-creating educational material, etc.). This non-formal, self-directed program offered promising evidence of a decentralized learning community, which was dynamically emerging and evolving around students' initiatives in the e-portfolio.

With regards to its methodological perspective, the analysis presented was addressed along three mutually related levels, i.e. individual, group and course. The proposed analysis framework, which integrates descriptive analysis and Social Network Analysis of individual student contributions, revealed valuable information which reflects the complexity of students' learning presence along four indicators, i.e. engagement, interaction-reflection, creativity and cohesion.

Confirming previous studies on e-portfolio-based learning, the findings of this study indicate that developing efficient e-portfolios is a complex and multifaceted process [7,38]. However, our results contribute to the existing knowledge and could guide both, future research as well as the design and implementation of efficient e-portfolio-based learning

programs. The main conclusion suggests that e-portfolio initiatives need to consider students' learning as the outcome of individual and collaborative work, which is further directed and regulated through self- and peer-reflection on their ideas and creations. In this context, it is expected that students can achieve higher cognitive levels through interaction, critical thinking and collaboration within an emerging community of learning.

The proposed framework could ambitiously be of value for both educators and instructional designers to adopt an open learning philosophy towards delivering efficient e-portfolio initiatives. To enhance students' learning presence a strategy promoting students' engagement, creativity, reflection, collaboration and self-regulation is necessary. A properly designed e-portfolio initiative should be rooted in the principles of self-directed learning and social constructivism with emphasis on

- students' motivation, engagement, group working, self-reflection and peer feedback
- active learning, through a process of planning, construction, collaboration and reflection
- directing and regulating individual achievements and collaborative work according to specific criteria, learning goals and developmental outcomes
- integrating personalised learning into collaborative learning practices of reflective and collaborative creation of content.

The findings of this study may not be generalizable to other contexts and types of e-learning interventions, since they are limited by the design features, the context of implementation and the specific sample. Therefore, it is possible that they are affected by students' ability to engage in critical thinking, reflective and self-directed learning processes. A systematic research is required to determine the extent to which individuals' decisions are driven by their cognitive needs, learning habits, self-directed goals, self-regulation abilities, the tutor's role and supportive actions, the wider educational context, the subject under study or other related factors that influence students' learning presence [30]. Our current efforts are addressed to combine Social Network Analysis with qualitative data extracted from students' interviews and content analysis of their contributions to the discourse in the e-portfolio. We expect thus to reveal important information concerning aspects of individual learning presence and knowledge construction, peer-reflection and influence, as well as the learner identity the students have developed during the e-portfolio evolution process, by sharing common practices and values with peers.

References

- [1] Artino, A.R., & Stephens, J. M. (2009). Academic motivation and self-regulation: A comparative analysis of undergraduate and graduate students learning online. *The Internet & Higher Education*, 12, 146-151.

- [2] Barbera, E. (2009). Mutual feedback in e-portfolio assessment: An approach to the netfolio system. *British Journal of Educational Technology*, 40(2), 342–357.
- [3] Bol, L., & Garner, J. K. (2011). Challenges in supporting self-regulation in distance education environments. *Journal of Computing in Higher Education*, 23(2-3), 104-123.
- [4] Bolliger, D.U., & Shepherd, C.E. (2010). Student perceptions of ePortfolio integration in online courses. *Distance Education*, 31(3), 295-314.
- [5] Chang, C.-C., & Tseng, K.-H. (2011). Using a Web-based portfolio assessment system to elevate project-based learning performances. *Interactive Learning Environments*, 19(3), 211-230.
- [6] Chau J., & Cheng, G. (2010). Towards understanding the potential of e-portfolios for independent learning: A qualitative study. *Australasian Journal of Educational Technology*, 26(7), 932-950.
- [7] Cheng, G., & Chau J. (2013). Exploring the relationship between students' self-regulated learning ability and their ePortfolio achievement. *The Internet & Higher Education*, 7, 9-15.
- [8] Cho, M. -H., & Shen, D. (2013). Self-regulation in online learning. *Distance Education*, 34(3), 290-301.
- [9] Cummins, P. W., & Davesne, C. (2009). Using electronic portfolios for second language assessment. *Modern Language Journal*, 93(1), 848-867.
- [10] Dede, C. (2011). Reconceptualizing technology integration to meet the challenges of educational transformation. *Journal of Curriculum and Instruction*, 5(1), 4-16.
- [11] Dewey, J. (1933). *How we think: a restatement of the relation of reflective thinking to the educative process*. Boston: D. C. Heath.
- [12] Fong, R. W., Lee, J. C., Chang, C., Zhang, Z., Ngai, A. C., Lim, C. P. (2014). Digital teaching portfolio in higher education: Examining colleagues' perceptions to inform implementation strategies. *The Internet and Higher Education*, 20, 60-68.
- [13] Garrison, D. R. (1997). Self-directed learning: Toward a comprehensive model. *Adult Education Quarterly*, 48(1), 18-33.
- [14] Hallam G. & Creagh T. (2010). ePortfolio use by university students in Australia: a review of the Australian ePortfolio Project. *Higher Education Research & Development*, 29(2), 179-193
- [15] Jimoyiannis A. (2012). Developing a pedagogical framework for the design and the implementation of e-portfolios in educational practice. *Themes in Science & Technology Education*, 5(1/2), 107-132.
- [16] Jimoyiannis A. (2015). TPACK 2.0: Towards a framework guiding Web 2.0 integration in educational practice. In Khine M.S. (Ed.), *New Directions in Technological Pedagogical Content Knowledge Research Multiple Perspectives* (pp. 83-108). Charlotte, NC: Information Age Publishing.
- [17] Jimoyiannis, A., Tsiotakis, P., & Roussinos, D. (2013). Social network analysis of students' participation and presence in a community of educational blogging. *Interactive Technology and Smart Education*, 10(1), 15-30.
- [18] JISC (2009). *e-portfolios: An overview*. Retrieved 12 November 2015, from <http://www.jisc.ac.uk/eportfolio>.
- [19] Kabilan, M. K., & Khan, M. A. (2012). Assessing pre-service English language teachers' learning using e-portfolios: Benefits, challenges and competencies gained. *Computers & Education*, 58, 1007-1020.
- [20] Klenowski, V., Askew, S., & Carnell, E. (2006). Portfolios for learning, assessment and professional development in higher education. *Assessment and Evaluation in Higher Education*, 31(3), pp. 267-286.
- [21] Knowles, M. S. (1975). *Self-directed learning*. New York: Association Press.
- [22] Lin, Q. (2008). Preservice teachers' learning experiences of constructing e-portfolios online. *The Internet and Higher Education*, 11, 194-200.
- [23] Lygo-Baker, S., & Hatzipanagos, S. (2012). Enabling professional development with e-portfolios: Creating a space for the private and public self. *International Journal of Online Pedagogy and Course Design*, 2(1), 37-52.
- [24] McLoughlin, C., & Lee, M. J. W. (2010). Personalised and self-regulated learning in the Web 2.0 era: International exemplars of innovative pedagogy using social software. *Australasian Journal of Educational Technology*, 26(1), 28-43.
- [25] Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2010). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies*. Washington, D.C.: U.S. Department of Education, Office of Planning, Evaluation, and Policy Development.
- [26] Merriam, S. B. (2001). Andragogy and self-directed learning: Pillars of adult learning theory. *New Directions for Adult and Continuing Education*, 89, 3-14.
- [27] Meyer, E., Abrami, P. C., Wade, A. C., Aslan, O, & Deault L. (2010). Improving literacy and metacognition with electronic portfolios: Teaching and learning with ePEARL. *Computers & Education*, 55, 84–91.
- [28] Peacock, S., Gordon, L., Murray, S., Morss, K., & Dunlop G. (2010). Tutor response to implementing an ePortfolio to support learning and personal development in further and higher education institutions in Scotland. *British Journal of Educational Technology*, 41(5), 827-850.
- [29] Pintrich, P.R. (1999). The role of motivation in promoting and sustaining self-regulated learning. *Journal of Educational Research*, 31(6), 459–470.
- [30] Shea, P., & Bidjerano, T. (2010). Learning presence: Towards a theory of self-efficacy, self-regulation, and the development of a communities of inquiry in online and blended learning environments. *Computers & Education*, 55, 1721–1731.
- [31] Shea, P., Hayes, S., Uzuner, S., Vickers, J., Bidjerano, T., Pickett, A., et al. (2012). Learning presence: Additional research on a new conceptual element within the community of inquiry (CoI) framework. *The Internet and Higher Education*, 15(2), 89–95.
- [32] Shea, P., Hayes, S., Uzuner-Smith, S., Vickers, J., Bidjerano, T., Gozza-Cohen, M., Jian, S.-B., Pickett, A. M., Wilde, J., & Tseng, C.-H. (2013). Online learner self-regulation: Learning presence viewed through quantitative content and social network analysis. *The International Review of Research in Open and Distance Learning*, 14(3), 427-461.
- [33] Shea, P., Hayes, S., Uzuner-Smith, S., Gozza-Cohen, M., Vickers, J., & Bidjerano, T. (2014). Reconceptualizing the community of inquiry framework: An exploratory analysis. *The Internet and Higher Education*, 23, 9-17.
- [34] Shepherd, C. E., & Skrabut, S. (2011). Rethinking electronic portfolios to promote sustainability among teachers. *TechTrends*, 55(5), 31-38.
- [35] Siemens G. (2003). *Learning Ecology, Communities, and Networks Extending the classroom*, Retrieved 10 May 2012, from http://www.elearnspace.org/Articles/learning_communities.htm

- [36] Song, L., & Hill, J. R. (2007). A conceptual model for understanding self-directed learning in online environments. *Journal of Interactive Online Learning*, 6(1), 27-42.
- [37] Stefani, L., Mason, R., & Pegler, C. (2007). *The educational potential of e-portfolios*. Routledge: London.
- [38] Tang, E., & Lam C. (2014). Building an effective online learning community (OLC) in blog-based teaching portfolios. *The Internet and Higher Education*, 20, 79-85.
- [39] von Kinsky, B. R. & Oliver, B. (2012). The iPortfolio: Measuring uptake and effective use of an institutional electronic portfolio in higher education. *Australasian Journal of Educational Technology*, 28(1), 67-90.
- [40] Wang, C.X. (2009). Comprehensive assessment of student collaboration in electronic portfolio construction. *TechTrends*, 53(1), 58–66.
- [41] Wenger, E. (2009). A social theory of learning. In K. Illeris (Ed.), *Contemporary Theories of Learning* (pp. 209-218). Abington, Oxon: Routledge.
- [42] Zimmerman, B. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. R. Pintrich & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 13-40). San Diego, California: Academic Press.
- [43] Zimmerman, B. (2008). Investigating self-regulation and motivation: Historical background, methodological developments, and future prospects. *American Educational Research Journal*, 45(1), 166–183.
- [44] Zimmerman, B. (2011). Motivational sources and outcomes of self-regulated learning and performance. In B. J. Zimmerman, & D. H. Schunk (Eds.), *Handbook of self-regulation of learning and performance* (pp. 49–64). New York: Routledge.
- [45] Zimmerman, B., & Schunk, D. (1989). *Self-regulated learning and academic achievement: Theory, research, and practice*. New York: Springer.
- [46] Zubizarreta, J. (2008). *The Learning Portfolio: A Powerful Idea for Significant Learning*. Manhattan, Kansas: The IDEA Center.