Social Presence and Interaction in Learning Environments: The Effect on Student Success

Ines Kožuh¹*, Zoran Jeremić², Andrej Sarjaš¹, Julija Lapuh Bele³, Vladan Devedžić⁴ and Matjaž Debevc¹

¹University of Maribor, Faculty of Electrical Engineering and Computer Science, Smetanova 17, 2000 Maribor, Slovenia // ²Ryerson University, Laboratory for System, Software and Semantics (LS3), Toronto, Ontario Canada // ³B2, Vocational College, Tržaška 42, 1000 Ljubljana, Slovenia // ⁴University of Belgrade, FON - School of Business Administration, POB 52, Jove Illica 154, 11000 Belgrade, Serbia // ines.kozuh@um.si // zoran.jeremic@gmail.com // andrej.sarjas@um.si // julija.bele@b2.eu // devedzic@fon.rs // matjaz.debevc@um.si

*Corresponding author

(Submitted October 2, 2013; Revised January 6, 2014; Accepted February 21, 2014)

ABSTRACT

With the increased use of social media there is a growing interest in using social interaction and social presence in education. Despite this phenomenon, no appropriate methodology was found on effective integrating of both concepts into online learning. In this study, we propose integrating two different kinds of learning tools to provide social interaction and social presence in Personal Learning Environments. We have evaluated the proposed concept in a classroom setting, using a specific social interaction tool and a specific social presence tool. The findings revealed that although the use of the social interaction tool was positively associated with students’ academic success, the perceived ease of using the social presence tool was negatively related to students’ success.

Keywords

Personal learning environment, Social interaction, Social presence, Online social presence, Academic success

Introduction

In recent years, the influence of social media has spread into various fields, including education. In particular, researchers have focused on exploring whether social media can provide pedagogical benefits for improving the academic success of students (Junco & Mastrodicasa, 2007; Junco, Heiberger, & Loken, 2010; Junco & Cotten, 2011). Additionally, they have examined the impact of using social media on non-academic skills, such as self-expression, communication and teamwork (Junco, Heiberger, & Loken, 2010), where social interaction plays a crucial role.

Lately, we have also witnessed the spread of personal learning environments (PLEs) (Attwell, 2007) that combine different tools based on social software that supports online learning and provides learners with the opportunity to adapt the learning environment to their learning needs. Chatti et al. (2010a, 2010b) define PLEs as encompassing tacit knowledge nodes, i.e. people, and explicit knowledge nodes, i.e. information.

Although social software used in PLEs contains various solutions, such as software aggregators, it mostly lacks extensibility and portability. As of now, we have not seen the systematic exchange and integration of online presence data from diverse social software tools as a part of modern PLEs (Jovanović, Gašević, & Devedžić, 2009). The main deficiency is in the lack of tight coupling between various tools that influence the online learning process. Consequently, students cannot be fully available and reached by each other whenever they want.

The study described in this paper aimed to meet this deficiency, as we developed a PLE called Online Presence for Learning (OP4L PLE). Within this system, social interaction and social presence were fostered by two communication tools: a social interaction tool and a social presence tool. The main idea was to make students aware of their peers’ online presence regardless of their availability within the PLE. We evaluated a learning strategy based on social interaction and social presence to test whether, and to what extent, learning in the PLE can be improved by utilizing tools. Our main purpose was to draw conclusions that would help us improve the system prototype and develop a successful learning strategy to support social interaction and social presence.
The paper is organized as follows. We start by providing a short background and literature review. Then we describe the systems similar to the one developed in our study and continue by presenting the OP4L PLE. Next, we explain our research questions and present the research methods, procedure and results. The paper ends with related works, conclusions and an outlook for future work.

**Background and literature review**

_Social interaction_ refers to a “reciprocal exchange between at least two actors that serves to build relational ties among the actors” (as cited in Walker, 2007, p. 34). Garrison & Anderson (2003) introduced four interactions that occur in educational processes: the interaction between (a) the teacher and learner, (b) the learner and learner, (c) the teacher and content, and (d) the learner and content. Social interaction can also be viewed as a construction of visibility, awareness, and accountability, which are characteristics of so-called _social translucence_. The idea is to “support coherent behavior by making participants and their activities visible to one another” in computer-mediated communications (Erickson & Kellogg, 2000, p.59). Similarly, the concept of _social awareness_ addresses people’s sense of other people’s social situation and their activities (Gutwin, Greenberg, & Roseman, 1996). In this regard, in computer-mediated communications, and especially within the context of interpersonal social interactions, users can perceive each other more or less “realistically.” This phenomenon is called _social presence_.

Social interaction is closely related to social presence (Tu & McIsaac, 2002). Short, Williams, & Christie (1976) were the first ones to define social presence as the “degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships” (p. 65). They emphasized the importance of interactions between users within an environment based on its qualities. Later studies (Yen & Tu, 2008) introduced the concept of online social presence as a degree of perception within online communication, as well as feeling within social context, reaction within interactivity and trustworthiness within privacy. Cooke (2007) also added a level of immediacy and intimacy. While immediacy pertains to directness and the intensity of the interaction, intimacy is conveyed through nonverbal communication, such as eye contact, physical proximity and facial expressions.

Both social interaction and social presence have been widely examined within the scope of the question of how they improve online learning. Previous studies (Picciano, 2002; Richardson & Swan, 2003; Swan & Shih, 2005; Russo & Benson, 2005) reported a positive association between perceived social presence and perceived learning, but no connections were found between social presence and grades on the final exam (Picciano, 2002). On the contrary, Liu, Gomez & Yen (2009) reported social presence as “a significant predictor of course retention and final grades in the community college online environment” (p.165). Social presence was also found to be positively related to the students’ perceived satisfaction with web-based learning environments (Richardson & Swan, 2003; Hostetter & Busch, 2006).

Despite the growing interest in using social interaction and social presence in education, no appropriate methodology was found on how they should be effectively adopted into online learning. In existing research, there have been many attempts to address social interaction and social presence in PLEs. Graasp (2013) is a collaborative work platform that supports users in “creating and sharing resources and widgets with other people in the context of space” (Bogdanov, Gillet, & Salzmann, 2013). It enables the aggregation of data and content from different social media and social networking applications. Social interaction and social presence are addressed by allowing users to collaborate and communicate with peers either using the system or external applications for online collaboration or communication. However, Graasp lacks contextualization, which facilitates social presence and is vague about where the system would capture data about users’ learning context and where it would use that data for recommendations.

In contrast, Zheng & Li (2008) introduced a three-dimensional model for facilitating online social presence through the recommendation of peers. It is based on students’ learning context defined as a result of the interaction of three elements: knowledge potential, social proximity and technical access, where account time proximity and technical media are also considered. However, it is disadvantageous not to consider the influence of students’ participation in learning activities based on the decision of whether one is competent enough to be recommended to peers (Jeremić, Miličić, Jovanović, Radulović, & Brković, 2012). In what follows, we present the OP4L PLE developed in our study.
OP4L personal learning environment

The OP4L PLE (2012) is based on both a previously developed learning framework, Design Patterns Teaching Help System (DEPTHS) (Jeremić, Jovanović, & Gašević, 2011) and the Online Presence Ontology Server (OPOS) (OPOS, n.d.). DEPTHS is a PLE that enables collaborative project-based learning and comprises the Moodle Learning Management System (LMS) (Moodle, 2013), as well as several context-aware educational services that provide users with right-in-time learning support adapted to their user profiles and current learning context (Jeremić, Jovanović, & Gašević, 2013). These services use online presence data provided by the OPOS. In addition, OP4L integrates popular social media tools, such as Facebook and Twitter, in order to provide a seamless connection with users who are not momentarily using a learning environment.

Our decision to integrate the above-mentioned tools within the OP4L is based on the popularity of Moodle LMS (integrated within DEPTHS) in educational settings and the popularity of Facebook and Twitter as social media, as well as increased interest among researchers for using social media in educational settings.

In the OP4L PLE, users can learn collaboratively by performing tasks and utilizing various tools in the system. It enables a teacher to design project-based tasks where the users’ learning is supported by social interaction and social presence. While social interaction is technically supported by the Moodle discussion forum, social presence is enabled through the use of the Peers Recommendation Service.

The front end of this service was developed as a Moodle plugin that can be integrated into any learning activity (Jeremić, Milikić, Jovanović, Radulović, & Brković, 2012). Based on the students’ current learning context, it recommends the most relevant peers for communication and resolves their social presence. The selection of peers is performed via a comparison of the learning contexts that other users have been in, as well as by matching their successes and experiences within similar learning contexts (Jeremić, Jovanović, & Gašević, 2013). More precisely, the peers’ relevance is estimated by analyzing three different kinds of knowledge: their estimated knowledge of the topic, their knowledge of similar or related problems and their knowledge of broader topics. Once the service estimates the most relevant peers, it resolves their availability in other social networks and presents this information.

Figure 1. A screenshot of the OP4L system
to the end user, so that they become aware of who could be reached by using Moodle or social networks. This module supports the use of the Moodle chat tool and Facebook messaging system. In our study, we use the term social presence tool when referring to utilizing this type of communication tool. The main advantage of integrating social presence tools into the system is providing users with immediate access to their peers, regardless of whether they are using Moodle at the moment or not. It is sufficient for the system if the peers are available on some of the most frequently used social networks. The system alone takes care that they receive the message through the channel connecting Moodle and these social networks.

Figure 1 shows a screenshot of a sample task created by the OP4L module for collaborative work on a common project. A description of the task is given in the main window area, while individual subtasks with additional information are accessible from the table below the description. The student is expected to perform each of these subtasks within the specified time frame. The left-hand side of each window provides access to the recommended peers.

In addition to the Peers Recommendation Service, the environment contains a Semantic Annotation and Indexing Service and a Resource Recommendation Service. These services enhance the learning process through the automatic semantic annotation of internal and external learning sources, such as forum posts, webpages, posted documents and their recommendations within a given learning context (Jeremić, Milikić, Jovanović, Radulović, & Brković, 2012).

The Semantic Annotation and Indexing Service (Jeremić, Jovanović, & Gašević, 2011) is used to index content at public websites and within the system. The module analyzes the text of documents, recognizes specific domain concepts defined in the domain ontology, and finds how relevant it is for a specific domain concept.

The Resource Recommendation Service (Jeremić, Jovanović, & Gašević, 2011) generates a list of recommended online resources or content published within the system, and recommends them to the users based on their current learning context within the PLE. To do this, it crawls and annotates publicly accessible learning resources, computes the relevance of each resource (i.e., Web page) available from these repositories for the student’s current learning context and selects the most relevant pages for the student. The users assess the relevance of the resources and thus improve the overall rating of the resource.

Research questions

To outline the benefit of our PLE, in this study we evaluated the users’ academic performance. The main objective was to examine whether and how social interaction and social presence are related to the learning outcome in the PLE, whereas we also considered the students’ motivational orientations and learning strategies.

Figure 2 shows the plan of our investigation with an emphasis on three main elements: social interaction, social presence, and students’ academic success. In particular, we proposed examining the intensity and quality of social interaction, and the intensity and perception of social presence. We focused on the relationships between all three main elements and also suggested the role of motivational orientations and learning strategies in the learning process.

We identified the following research questions to be examined:

**RQ1:** Is there a relationship between the intensity of social interaction and the student’s academic success in the PLE?

We expect to find a positive relationship between these variables, anticipating that the more intensive the students’ social interactions are, the better their success will be.

**RQ2:** Is there a relationship between the quality of social interaction and students’ academic success?

We expect to find a positive relationship between these variables, which reflects that as the quality of social interaction increases, students’ academic success will also improve.

**RQ3:** Is there a relationship between the intensity of social interaction and its quality in a PLE?

A positive association is also expected to be found in answer to the third research question. We assume that as the intensity of social interaction increases, its quality will also increase.
RQ4: Is there a relationship between the intensity of social presence and students’ academic success?
We anticipate a positive relationship between the intensity of social presence and students’ academic success. The intensity of social presence reflects the intensity of using the social presence tool. Thus, we anticipate that as the use of the social presence tool increases, academic success will improve.

RQ5: Is there a relationship between perceived social presence and students’ academic success?
We expect to find a positive relationship between these variables. The perceived social presence is determined by the perceived ease of use of the social presence tool. We predict that with the improvement of the perceived ease of use of the social presence tool, that academic success will improve as well.

RQ6: Are there statistically significant differences between student groups with a higher intensity of social interaction and student groups with a lower intensity of social interaction in motivational orientations?
It is expected that motivational orientations will differ between student groups according to the intensity of their social interactions. We assume that the members of a student group with a higher intensity of social interaction will report higher mean scores in motivational orientation than students with a lower intensity of social interaction.

RQ7: Are there statistically significant differences in learning strategies between student groups with a higher intensity of social interaction and student groups with a lower intensity of social interaction?
In learning strategies we expect to find statistically significant differences, where student groups with a higher intensity of social interaction will report higher mean scores than groups with a lower intensity.

![Diagram](image)

*Figure 2. Social interaction, social presence and academic success in interrelation with motivational orientations and learning strategies*

**Methods**

**Participants**

The participants in the experiment were 62 students of electrical engineering from the University of Maribor in Slovenia. All students were male, with an average age of 20 years (age range: 19–25, SD = 1.41). Student volunteers were selected based on their previous experience with the programming language C. Before the experiment, they attended a few-hour training course where the main features of the system were presented. We randomly classified
them into three groups with 8 students, two groups with 9 students and two groups with 10 students. The sizes of the groups were based on our teaching experience to assure an effective educational process.

Measures

The measuring instruments were classified into two groups: (1) questionnaires and (2) server log files and academic success. We used questionnaires to collect responses about social presence, motivational orientation, learning strategies and participants’ profiles. We also analyzed a dataset of the server log files and academic success to define the intensity and quality of social interaction. In this way the results from the questionnaires were elaborated with research findings from the server log files analysis.

Questionnaires

To obtain data about the participants’ perception of their experience with the OP4L PLE, we applied a quantitative research method (a questionnaire survey). The following questionnaires were used: (a) Social Presence Questionnaire, (b) Motivated Strategies for Learning Questionnaire, and (c) Profile Questionnaire. A questionnaire survey is available on the following address: http://medijske.um.si/doc/OP4L_questionnaire_ENG.pdf.

- Social Presence Questionnaire. The purpose of this questionnaire was to measure students’ performance when using the social presence tool and consequently to examine subjective satisfaction of the users as one of the aspects of usability (Holzinger, 2005). The questionnaire encompassed eight questions classified into two sections: (a) the intensity of using the social presence tool and (b) the students’ perceived ease of using the tool. The first section comprised two multiple-choice questions and the second section comprised six close-ended questions.

  The questions in the first section recorded the frequency of using the social presence interaction tool, regarding two communication types: student-to-student and student-to-teacher communication. The participants responded with answers ranging from 1 (never) to 5 (very regularly – I communicated every time I encountered a problem when completing a task in the OP4L PLE). The second section measured the students’ perceived ease of using the social presence tool. The participants responded with answers ranging from 1 (strongly disagree) to 5 (strongly agree). The alpha reliability coefficient (Cronbach, 1951) of the questions was .81.

- Motivated Strategies for Learning Questionnaire (MSLQ). The MSLQ questionnaire was applied to measure students’ motivational orientations and their use of learning strategies (Pintrich, Smith, Garcia, & McKeachie, 1991). We used 81 statements administered with 7-point Likert-type response categories ranging from 1 (strongly disagree) to 7 (strongly agree). Measuring motivational orientations comprised sets of questions within the following components: intrinsic and extrinsic goal orientation, task value, control of learning beliefs, self-efficacy for learning and performance, and test anxiety. Measuring learning strategies contained the following components: rehearsal, elaboration, organization, critical thinking, metacognitive self-regulation, time/study environmental management, effort regulation, peer learning and help seeking (Pintrich, Smith, Garcia, & McKeachie, 1991).

  We used the MSLQ questionnaire to identify the students’ sources of motivation and learning strategies used during the learning process, as well as to find relations with the students’ learning activities in the PLE and the students’ academic success.

- Profile Questionnaire. The Profile Questionnaire was applied to gather data about the participants’ gender, age and programming knowledge. The level of knowledge of the programming language C was measured with one 5-point Likert-type item with response categories ranging from 1 to 5. The students identified their knowledge on a scale ranging from beginners (response category 1), who had no experience in programming, to experts (response category 5), who had a solid knowledge of the programming principles in C. In addition, we asked students one open-ended question regarding their personal opinions about collaborative learning in the OP4L PLE.
We obtained data about the students’ social interactions and academic success. The OP4L PLE has a tracking mechanism that collects and stores the users’ traces in a database from which all the necessary data with respect to the aim of this study could be extracted.

- **Dataset of Social Interaction.** We measured two separate elements: the intensity and the quality of the social interaction. The intensity was measured as an average number of discussion forum posts per student in each group.

The quality of the social interaction was defined by the teacher’s assessment of students’ discussion forum posts in the OP4L PLE. The teacher assigned a mark on a scale of 0 to 5 for each post. The mark 0 was assigned if no post was published by the student and the mark 5 was assigned to an excellent post. During the assessment, two different categories of forum posts were considered. The first category included the discussion forum posts, where the students triggered a discussion via a request for assistance or additional explanation, or a question raising a dilemma, proposal or suspicion. Each post was assessed by the teacher by considering the significance of the question raised by the student, according to the difficulty of the given task and providing another possibility of the question being answered by other students and by the teacher.

The second category comprised discussion forum posts where students responded to questions raised in posts defined within the first category. The assessment of these posts was also based on the significance and technical correctness of the posts from the viewpoint of the task content; the factor of predicting how relevant the post was for its ability to guide the user to a proper solution was considered as well.

The teacher’s marks for the discussion forum posts were summed up for each group of students. The results were divided by the number of posts in the group. Then the average mark of posts per group was computed. The final results varied on a scale of 0 to 5.

- **Dataset of Students’ Academic Success.** The students’ academic success was measured in the teacher’s final grade, assessing the quality of the submitted projects. The grades were assigned on a scale of 0 to 5. The grade 0 was assigned when the project was not submitted or the quality of the submitted project was assessed as being below 50%. The grades increased proportionally with percentages. The grade 5 was assigned to submitted projects that were assessed at 91% or more.

**Procedure**

The experiment was conducted in May 2012 at the University of Maribor in Slovenia and was performed in three steps: (1) demonstration of using the system along with a training session, (2) working with the OP4L PLE, and (3) assessment of the OP4L PLE.

In the first step, we demonstrated the system’s functionalities during a training session where an example of the assignment was introduced. The participants were informed about the evaluation criteria to become aware of the teacher’s expectations regarding their activity in the OP4L PLE.

The second step included the main experiment. The teacher gave each group its own assignment. Although all members within each group received the same assignment, they were asked to submit their own solutions. The assigned task was complex and challenging, so that it could elicit a constructive learning process in students (Van Merriënboer & Paas, 2003). Learning process design in PLEs has its roots in various theories. The proposed opportunities for communication are related to the Social Learning Theory (Bandura, 1977) and collaboration (Dillenbourg, Baker, Blaye, & O’Malley, 1994), referenced together as the Social Interaction Learning Theory, where social interaction is a crucial element in learning.

The learning process encompassed three predefined sets of tasks distributed evenly over a three-week period:
1. **brainstorming and submitting an idea of the solution**, where the participants shared their ideas about a solution with other participants in the discussion forum, used recommended resources and communicated via the social presence tool,

2. **submission of the solution: programming and submitting the program**, where the participants wrote a computer program in C, discussed it on the forum, used recommended resources and finally submitted the project.

3. **evaluating each other’s submitted solution**, where the participants evaluated their own and each other’s submitted project.

In the third step, the participants filled in the questionnaires to assess the OP4L PLE regarding their learning experiences within this learning environment. Throughout the course, the teacher was fully engaged in the students’ learning process and available 24 hours a day.

### Statistical analyses

The internal consistency reliability of a set of items for one variable was checked with the Cronbach's Alpha coefficient (Cronbach, 1951). Statistical associations between variables were inspected with parametric correlation (Pearson's correlation coefficient). Statistically significant differences between independent samples were examined with a One-way Analysis of Variance (One-way ANOVA) statistical model (Howell, 2002). All analyses were performed using SPSS version 20.0 software.

### Results

#### Detailed analysis

The first three research questions address the relationships between (a) the intensity of a social interaction, (b) the quality of a social interaction, and (c) the students’ academic success. The intensity was measured by the numbers of students’ discussion forum posts in the OP4L PLE within the group; the quality was measured by the teacher's assessment of the students' forum posts and academic success was measured by the teacher’s assessment of the students’ submitted projects.

Table 1 shows the mean scores of these variables for student groups, using descriptive statistics. The students in group 6 reported the most intensive social interaction (mean \( M = 3.5 \)) and also reached the highest quality level of social interaction \( (M = 3.86, \text{ standard deviation } (SD) = .73) \). Comparing the scores of academic success, student group 2 reported better scores \( (M = 4.50, SD = .76) \) than group 6 \( (M = 4.20, SD = .63) \).

Table 1 shows the mean scores of these variables for student groups, using descriptive statistics. The students in group 6 reported the most intensive social interaction \( (mean (M) = 3.5) \) and also reached the highest quality level of social interaction \( (M = 3.86, \text{ standard deviation } (SD) = .73) \). Comparing the scores of academic success, student group 2 reported better scores \( (M = 4.50, SD = .76) \) than group 6 \( (M = 4.20, SD = .63) \).

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of students</th>
<th>Intensity of Social Interaction</th>
<th>Quality of Social Interaction</th>
<th>Students’ Academic Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>2.50</td>
<td>2.06</td>
<td>1.73</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>3.25</td>
<td>2.77</td>
<td>1.39</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>2.50</td>
<td>2.76</td>
<td>1.09</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>2.89</td>
<td>2.35</td>
<td>1.41</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
<td>1.00</td>
<td>1.44</td>
<td>1.13</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>3.50</td>
<td>3.86</td>
<td>0.73</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>3.00</td>
<td>2.71</td>
<td>1.20</td>
</tr>
</tbody>
</table>

A bivariate analysis was conducted to further investigate the first three research questions. A statistically significant positive relationship was found between the intensity and the quality of the social interaction, \( r = .37, p < .05 \). It indicates that as students were more active in discussion forum postings in the OP4L PLE, the quality of their posts improved. Likewise, a statistically significant relationship was demonstrated between the quality of social interaction and academic success, \( r = .48, p < .05 \), meaning that as the quality improved, their academic success also improved.
In addition, the intensity of the social interaction was significantly correlated with academic success, $r = .44, p < .05$. The result indicates that as the number of forum posts increased, the level of success also improved. Figure 3 shows the mean scores of the three variables in student groups.

![Graph of mean scores for (a) intensity of social interaction, (b) quality of social interaction and (c) academic success in student groups](image)

**Figure 3.** Graph of mean scores for (a) intensity of social interaction, (b) quality of social interaction and (c) academic success in student groups

Considering student groups with different levels of intensity with regard to using the social interaction tool, we conducted an analysis with one-way ANOVA to detect statistically significant differences between student groups in all three variables. The results demonstrated statistically significant differences between the groups in the variable “intensity of social interaction,” $F(6, 156) = 9.98, p < .01$. Likewise, statistically significant differences were found in the variable “quality of social interaction,” $F(6, 156) = 11.86, p < .01$, and “students’ academic success,” $F(6, 55) = 4.46, p < .01$. However, the result did not indicate whether the effect was reported within or between the groups. Thus, post hoc comparisons using the Tukey HSD test (Howell, 2002) were conducted. Statistically significant differences were found between the student groups 5 and 6 in the variables intensity, quality of social interaction and academic success.

The fourth research question asked if there was a relationship between the intensity of social presence and academic success. The results of the analysis showed no statistically significant associations, $r = -.15, p > .05$. The fifth research question pertained to the association between perceived social presence and success. The results revealed a negative relationship between these variables, $r = -.26, p < .05$, meaning that as the students’ satisfaction with utilizing a tool increased, academic success decreased.

The sixth research question asked whether there were statistically significant differences between student groups with a higher intensity of social interaction and student groups with a lower intensity of social interaction in motivational orientations. The same differences were addressed in the seventh research question for learning strategies. To find answers to both research questions, we examined the students’ motivational orientations and learning strategies. Based on a set of questions in the MSLQ questionnaire (Pintrich, Smith, Garcia, & McKeachie, 1991), we identified the motivational orientations and learning strategies that were used by the students. Figure 4 shows to what extent the motivational orientations were applied by students.

As one can see from Figure 4, among motivational orientations, the highest mean score was detected in the variable “control of learning beliefs” ($M = 5.75, SD = 0.93$). This variable illustrates the students’ beliefs that they will gain positive benefits from learning through performing a task (Pintrich, Smith, Garcia, & McKeachie, 1991, p.12). The variable “test anxiety,” defined as an unpleasant feeling or emotional state toward tests, was assessed with the lowest mean score among motivational orientations ($M = 4.05, SD = 1.22$).
Among motivational orientations, statistically significant differences were only found between student groups 5 and 6. Two types of motivational orientations reported significant results: intrinsic goal orientation and self-efficacy for learning and performance. Intrinsic goal orientation reflects the fact that students are curious about the assigned task and feel it to be a challenge. Self-efficacy illustrates how students judge and assess themselves and their abilities at performing a task (Pintrich, Smith, Garcia, & McKeachie, 1991).

Statistical differences were checked by conducting a one-way ANOVA. In intrinsic goal orientation, statistically significant differences were detected between the groups 5 and 6, $F(6, 55) = 4.13, p < .01$. The mean score for the variable “intrinsic goal orientation” was significantly lower in group 5 ($M = 5.06, SD = .75$) than in group 6 ($M = 6.35, SD = .47$). In self-efficacy, statistically significant differences were also detected between the groups 5 and 6, $F(6, 55) = 2.43, p < .05$. Likewise, the mean score for the variable “self-efficacy for learning and performance” was lower in group 5 ($M = 4.94, SD = .47$) than in group 6 ($M = 5.91, SD = .64$).

Figure 4. Graph of the mean scores for motivational orientations

Figure 5 shows that among learning strategies, the highest mean score was found in the learning strategy “organization” ($M = 5.27, SD = .93$), which pertains to students’ selection of pieces of information and connecting them into the whole to be learned (Pintrich, Smith, Garcia, & McKeachie, 1991, p. 21). The lowest mean score was
detected in the learning strategy “critical thinking” \(M = 4.31, SD = .97\). It indicates the students’ application of previously gained knowledge to the new context in order to be able to find solutions to new problems (Pintrich, Smith, Garcia, & McKeachie, 1991, p. 22). In learning strategies, no statistically significant differences between student groups were detected.

In the profile questionnaire, the students expressed their opinions about collaborative learning. The answers showed that the majority of them were satisfied with the method and organization of learning. As the main advantage that was indicated was access to different opinions in one PLE. Participants also noted their criticisms, which were primarily directed at technical issues. For instance, some participants would have preferred improvements in the user interface, a simplified communication process by using the social presence tool and improvements in overall system responsiveness.

**Summary**

Table 2 summarizes the answers to our seven research questions. The study was aimed at contributing to the field of students’ learning and communication experiences in PLEs. The purpose was to investigate how social interaction and social presence are related to students’ academic success and how motivational orientations and learning strategies interplay with them. To meet this aim, we integrated the social interaction and the social presence tool in a PLE, and conducted an experiment.

<table>
<thead>
<tr>
<th>RQ</th>
<th>Variable 1</th>
<th>Variable 2</th>
<th>Observed relationship</th>
<th>Observed difference</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ1</td>
<td>intensity of social interaction</td>
<td>academic success</td>
<td>x</td>
<td></td>
<td>(r = .44, p &lt; .05)</td>
</tr>
<tr>
<td>RQ2</td>
<td>quality of social interaction</td>
<td>academic success</td>
<td>x</td>
<td></td>
<td>(r = .48, p &lt; .05)</td>
</tr>
<tr>
<td>RQ3</td>
<td>intensity of social interaction</td>
<td>quality of social interaction</td>
<td>x</td>
<td></td>
<td>(r = .37, p &lt; .05)</td>
</tr>
<tr>
<td>RQ4</td>
<td>intensity of social presence</td>
<td>academic success</td>
<td>x</td>
<td></td>
<td>(r = − .15, p &gt; .05)</td>
</tr>
<tr>
<td>RQ5</td>
<td>perceived social presence</td>
<td>academic success</td>
<td>x</td>
<td></td>
<td>(r = − .26, p &lt; .05)</td>
</tr>
<tr>
<td>RQ6</td>
<td>higher intensity of social interaction in motivational orientations</td>
<td>lower intensity of social interaction in motivational orientations</td>
<td>x</td>
<td>intrinsic goal orientation: between the group 5 and 6, (F(6, 55) = 4.13, p &lt; .01)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>self-efficacy: between the groups 5 and 6, (F(6, 55) = 2.43, p &lt; .05)</td>
</tr>
<tr>
<td>RQ7</td>
<td>higher intensity of social interaction in learning strategies</td>
<td>lower intensity of social interaction in learning strategies</td>
<td>x</td>
<td>no statistically significant differences</td>
<td></td>
</tr>
</tbody>
</table>

**Conclusions and future work**

In this study, we found that the intensity and quality of a social interaction are connected to students’ academic success. However, no connections were found between social presence and students’ academic success. These findings are partly in alignment with the findings of Picciano (2002) who found no connection between perceived social presence and final exam grades; conversely, he found a strong relationship between social presence and students’ performance on written assignments. The reason can be in supporting social presence on a different level. In contrast to our study, Picciano (2002) supported social presence in the learning environment on a communication level, such as using names, etc., but not with a social presence communication tool, as we did. Additionally, our
findings substantiated that it is not the intensity of social presence, but rather the intensity of social interaction that is connected to students’ academic success.

Our findings provide clues as to how to carefully design and develop communication tools to ensure a positive impact on academic success, such as providing various communication tools that actively involve social media throughout the learning process. We also suggested a model to technically implement them into the learning process to support pedagogical activities. For communication tools integrated into PLEs, it is important that the designers are convinced that the users perceive the tool as easy to use, which can lead to more intense use and ultimately induce a positive relationship with the learners’ academic success. We suppose that our users experienced a lack of perceived ease of use of the social presence tool, which may have influenced the user experience.

The limitation of our study stems, first, from the particularity of the sample, including the fact that it exclusively consisted of male electrical engineering students. The results would probably differ if females and/or social science students were included in the study, as the nature of the task would be different. Second, our study was only limited to the Moodle LMS, and not Blackboard (2013), OLAT (2013), Edmodo (2013) or other e-learning platforms that might impact users’ performance when using services.

Regarding future work, there are several directions to be investigated. Firstly, the findings of this study will help us improve the system prototype and integrate an improved social interaction and social presence tool more efficiently into the PLE to ascertain the use of both tools in the field. Our prototype uses a set of tools that we believe are often used in an academic environment. However, all the tools are developed in such a way that they could be easily integrated into other e-learning systems. Our intention is to investigate and experiment with different e-learning systems, settings and social groups in order to verify the success of this approach.

Secondly, in that regard, investigating the integration of Twitter in the social presence tool might be relevant due to the distinction between Facebook as a social networking site and Twitter as a micro blog. While Facebook is more directed at social connections, Twitter is more about staying informed. Integrating both tools may thus enable researchers to compare the differences in users’ perception of using both tools in the PLE.

Acknowledgements

This study was part of the project OP4L (SEE-ERA.NET PLUS no. 115) and was supported by SEE-ERA.NET PLUS Coordination and Support Action of the European Community. The study was also supported by the Slovenian Research Agency [1000-11-310140].

References


