Exploring the Meaningful Learning of Students in Second Life

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ABSTRACT

This study reports a case study in which a pedagogical model, namely the Global Virtual Education (GloVEd) model, is developed and used to evaluate students’ meaningful learning experiences during the Global Virtual Collaboration Project (GVCP) course in spring 2009. During the course, using collaboration technologies, global student (N = 54) teams solved a creative design task. The data were collected and analyzed using various methods. The results suggest that the GVCP course supported the process characteristics of meaningful learning and its outcomes, although the individual, critical, and interactive characteristics were not fully realized. In addition, Second Life (SL) did not contribute to the realization of the goal-oriented, collaborative, conversational, and immersive characteristics. Several implications can be drawn from the results with respect to creative design.

Keywords

Meaningful learning, Teaching-studying-learning process, Pedagogical model, Creative design, Second Life

Introduction

The educational potential of virtual worlds, such as Second Life (SL, also referred to as a multi-user virtual environment), has been widely recognized and discussed among educators in recent years, although the instructional strategies in SL are still in their infancy (Edirisingha, Nie, Pluciennik, & Young, 2009; Jarmon, Traphagan, Mayrath, & Trivedi, 2009; Mayrath, Sanchez, Traphagan, Heikes, & Trivedi, 2007; Warburton, 2009). SL can be described as a three-dimensional (3D) shared place, where thousands of participants can simultaneously collaborate with each other via avatars—the students’ representations in the virtual world—in a non-competitive manner (Ondrejka, 2008; Warburton, 2009). In SL, participants can unleash their imagination and creativity by creating objects, identities, and knowledge, and by breaking physical, geographical, generational, and professional boundaries (Ondrejka, 2008). As noted, there is a new kind of educational potential in virtual worlds.

The purpose of this study is to take an educational perspective to a global virtual course in the field of engineering. The aim of this study is to develop a pedagogical model, namely the Global Virtual Education (GloVEd) model, and use it to study the students’ meaningful learning experiences in the Global Virtual Collaboration Project (GVCP) course. The model is based on the ideas of the teaching, studying, and learning (TSL) process (Kansanen, Tirri, Meri, Krokfors, Husu, & Jyrhämä, 2000; Uljens, 1997), the characteristics of meaningful learning (Ausubel, 1968; Jonassen, 1995; Löffström & Nevgi, 2007; Ruokamo & Pohjolainen, 2000), and previous pedagogical models (Hakkarainen, 2007; Tissari, Vahtivuori-Hänninen, Vaattovaara, Ruokamo, & Tella, 2005). In this research, the characteristics of meaningful learning are used to describe the study process. A pedagogical model can be viewed as “a plan or pattern that can be used to shape curriculums (long-term courses of studies), to design instructional materials, and to guide instruction in the classroom and other settings” (Joyce & Weil, 1980, p. 1). The aim of this pedagogical model is to help teachers and researchers in planning, realizing, and evaluating education to enhance students’ meaningful learning experiences.

The GVCP course was conducted at the Helsinki University of Technology (HUT, Espoo, Finland); the University of Twente (Enschede, The Netherlands); Columbia University (New York, NY, USA); and the Indian Institute of Technology Madras (Chennai, India) in spring 2009. Altogether, 54 students participated in the GVCP course. The course aims to provide students with an opportunity to learn how to collaborate on and solve real business problems in SL. During the course, multiple methods were used to collect and analyze data. An introduction to the theoretical background, the GloVEd model, research question, and the methods follow. Finally, the results are presented and discussed.
Theoretical background

Previous research on the educational use of Second Life

Several studies have argued that the value of virtual worlds lies in their ability to provide students with a greater sense of presence and belonging (Edirisingha et al., 2009; Holmberg & Huvila, 2008; Omale, Hung, Luetkehans, & Cooke-Plagwitz, 2009; Salmon, 2009; Warburton, 2009) compared to more traditional text-based learning environments, where feelings of isolation and loneliness are commonly highlighted (Löfström & Nevgi, 2007). Due to the attractive appearance, the existence of avatars, and a shared place, as well as the possibility of communicating synchronously, SL has succeeded in capturing the interest and motivation of most learners (Holmberg & Huvila, 2008; Mayrath et al., 2007; Omale et al., 2009). Sometimes we can even talk about an immersive experience (Delwiche, 2006; Edirisingha et al., 2009; Salmon, 2009). In SL, it is also possible to do things that might be difficult or even impossible to do in real life (Ondrejka, 2008; Salmon, 2009; Twining, 2009). For example, students can explore different cultures by going to locations that are otherwise elusive. As noted, SL provides great opportunities for experiential, inquiry, and authentic learning (Jarmon et al., 2009; Salmon, 2009; Warburton, 2009).

SL has also been noted as a functional environment for collaborative learning (Salmon, 2009). For instance, creating one’s own world in SL helps students learn how to collaborate and solve problems (Delwiche, 2006; Ondrejka, 2009; Warburton, 2009). Studies have also shown that students prefer working in groups in SL, and this collaborative activity may lead to the creation of a community of practice (Jarmon & Sanchez, 2008; Mayrath et al., 2007). Previous researchers have also noted that the barrier to participating in discussions in SL is lower than in real life. In addition, the interaction between students and teachers is more spontaneous and direct, since all the participants are able to be simultaneously present in the same place and see each other (Edirisingha et al., 2009; Holmberg & Huvila, 2008; Omale et al., 2009). The array of communication tools in SL also makes participating in communication easier (Jarmon et al., 2009). However, there are also contradictory results of students’ collaboration in SL. For instance, communities are not always easy to find, and participation in these communities can be difficult (Jones, Morales, & Knezek, 2005; Warburton, 2009).

There are certain issues that educators must consider while planning to use SL in education. Several authors have noted that it takes time to get acquainted with the environment (Delwiche, 2006; Mayrath et al., 2007; Ondrejka, 2008; Salmon, 2009; Warburton, 2009). Therefore, a strong scaffold and support are needed. According to Omale and associates (2009), technology was “a distraction rather than an enabler” (p. 492). The authors supposed that the participants were so overwhelmed by the environment that they were distracted from their actual learning tasks. As results have shown, learning in SL is not necessarily enhanced. Therefore, SL must be used in a pedagogically appropriate way, and students’ activities must be well structured in order to promote meaningful learning and meet learning goals.

GloVEd model

Generally, this research builds on the socio-constructivist and socio-cultural perspectives of learning (Lave & Wenger, 1991; Vygotsky, 1978). According to these views, learning is seen as a tool-dependent and social phenomenon, whereas interpersonal knowledge is seen as achieved by its social construction and use of cultural artefacts. The GloVEd model is based on the idea of the TSL process (Kansanen et al., 2000; Uljens, 1997), the characteristics of meaningful learning (Ausubel, 1968; Jonassen, 1995; Löfström & Nevgi, 2007; Ruokamo & Pohjolainen, 2000), and previous pedagogical models (Hakkarainen, 2007; Tissari et al., 2005). The special characteristics of the students, SL, and the course content are also considered. The GloVED model is presented in Figure 1.

Overall, the TSL process implies that teaching does not necessarily lead to learning, but that students’ activity is needed before learning can be attained (Kansanen et al., 2000; Uljens, 1997). Here teaching is viewed as teachers’ activities that aim to promote students’ meaningful learning by using different kind of strategies (Kansanen et al., 2000). In this research, 17 characteristics of meaningful learning are used to describe the studying in this context. These characteristics are selected from theories and results of previous research (e.g., Hakkarainen, 2007; Jonassen, 1995; Löfström & Nevgi, 2007; Ruokamo & Pohjolainen, 2000; Tissari et al., 2005). We argue that course organizers should emphasize these selected characteristics in order to promote students’ meaningful learning in SL.
However, it should be noted that these characteristics partially overlap and are interconnected (Jonassen, 1995). In the GloVEd model, learning includes the expected outcomes of the GVCP course (cf. Hakkarainen, 2007), which are elaborated in more detail in the course’s description.

![Figure 1. The GloVEd model](image)

**Teaching**
1. Provide a context where meaningful learning is possible
2. Ensure the right educational resources at the right time
3. Facilitate, guide, and evaluate the students’ learning process

**Studying**
Process characteristics:
1. Active
2. Self-directed
3. Goal-oriented
4. Purposeful
5. Individual
6. Experiential
7. Emotional
8. Immersive
9. Constructive
10. Reflective
11. Interactive
12. Conversational
13. Collaborative
14. Culture-bound
15. Contextual
16. Critical
17. Creative

**Learning**
Expected learning outcomes:
1. Collaboration, interaction, communication, and real-life business problem-solving skills in a virtual world, across cultures
2. Finnish students: group facilitation skills in a virtual environment
3. Other students: industry-relevant project-scheduling and management skills

Active and self-directed characteristics indicate that students should engage in finding, evaluating, and constructing knowledge (Jonassen, 1995), while also being responsible for planning, executing, and evaluating their own learning. Consequently, instruction involves supporting these processes. Intertwined with previous characteristics are goal-oriented and purposeful characteristics, which mean that students have a goal and purpose for their learning (Jonassen, 1995). Therefore, it is important that both the learning environment and the teachers support this student activity. Learning is also individualistic in that learners enter the learning environment with individual characteristics (De Corte, 1995; Karagiorgi & Symeou, 2005). Thus, it is important that teachers take students’ characteristics into account as well as provide individual guidance and feedback for all the students (Karagiorgi & Symeou, 2005). Experiential characteristics imply that students have the opportunity to use their own experiences as starting points in learning, as well as gain new ones, which are then used to further enhance the learning and knowledge construction (Kolb, 1984).

Emotions are always intertwined with learning (Damasio, 2001). Previous research has indicated that SL is an engaging and immersive environment, and may therefore result in greater motivation and learning (Holmberg & Huvila, 2008; Twining, 2009). However, extreme immersion may also lead to addiction, and thus students should be warned of this possibility (Delwiche, 2006). According to Jonassen (1995) constructivist characteristics mean that “learners accommodate new ideas into prior knowledge (equilibrating) in order to make sense or make meaning or reconcile a discrepancy, curiosity, or puzzlement” (p. 60). Intertwined with the constructivist characteristics is reflection, which implies that students articulate what they have learned and reflect on the process and decisions (Jonassen, 1995).

Interactive and conversational characteristics imply that when studying takes place in SL, the conversations and avatar interactions play a vital role in creating a shared understanding of the subject matter. Therefore, the orientation of the environment as well as successful communication and dialogue should be emphasized (Delwiche, 2006; Holmberg & Huvila, 2008; Mayrath et al., 2007; Ondrejka, 2008; Salmon, 2009; Warburton, 2009). Studying
collaboratively means that students work in groups in which the students exploit each other’s knowledge and skills, provide feedback and support, and model and imitate each other’s behavior (Jonassen, 1995). According to Karagiorgi and Symeou (2005), this also means that learners can develop, compare, and understand multiple perspectives on an issue. Learning is bound to the surrounding culture and its wider contexts as the culture-bound and contextual characteristics indicate (Vygotsky, 1978). Therefore, in order to promote learning transfer, learning tasks should be situated in a meaningful and real-world context or simulated through case-based or problem-based examples of the real world (Jonassen, 1995; Karagiorgi & Symeou, 2005).

In learning, students should be encouraged to critically evaluate their own learning, their acquired information, and the learning environment (Hakkarainen, 2007), as well as explain and defend their decisions (Karagiorgi & Symeou, 2005). Critical thinking is also intertwined with creative thinking. In creative learning and creative design, students should be encouraged to create novel and unexpected connections between concepts based on previous knowledge and existing ideas (Eysenck, 1994; Howard, Culley, & Dekoninck, 2008). According to Kolodner and Wills (1993), creative design involves “a process of generating and considering several alternatives, weighing their advantages and disadvantages, and sometimes incorporating pieces of one into another” (p. 95). It is also agreed that creative design process involves different kind of phases (Howard et al., 2008; Kolodner & Wills, 1993). The learning environment should also inspire creativity (Kangas, 2010). SL has been noted to enhance creativity and playfulness, for example, by letting students explore the world, create their own spaces and avatars, perform different roles, improvise as well as test different hypotheses (Jarmon et al., 2009).

Research question

Based on the theoretical background presented above, the research question of this study is as follows: From the students’ point of view, what were the process characteristics of meaningful learning that were realized during the TSL process in a virtual world?

Case: The global virtual collaboration project course

Set-up and participants

The HUT students are majoring in business process networks, whereas the students from the three other universities study civil engineering. The course took place January through May 2009. During the course, students worked in global teams to solve a real-life scheduling and management problem for a civil engineering business project, for example, construction of a bridge in New York City or a building in India. This can be seen as a collaborative creative design task. However, the task of the Finnish students differed from that of the other students: the Finnish students’ responsibility was to facilitate the creative design process of their teams, and not to take part in the actual subject-matter problem-solving. The students were divided into six teams: three had Finnish facilitators. The other three teams solved their problems without facilitators. In each team, there were two to three members from each civil engineering school, and the three facilitated teams had an additional two students from HUT.

Before the in-world activities began, participants attended lectures related to topic areas (e.g., facilitation of virtual teams and cross-cultural project management) as well as were trained how to work in SL. The teams interacted by holding weekly team meetings in SL. At the end of the course, the teams had to write an end report presenting their solution to the problem and an analysis of their teamwork process. Additionally, the Finnish students wrote a memo regarding each team meeting, as well as reflection essays in which the students analyzed their own learning. The Finnish students also held weekly face-to-face peer meeting sessions throughout the course.

Course goals

Through gaining experience in virtual interaction, the students were expected to learn methods and solutions for collaborating virtually, as well as to study the use of virtual applications and coordination of virtual teamwork. The students had also the opportunity to discover cultural differences and overcome cross-cultural challenges, and were expected to learn virtual team-building skills and how to create team spirit.
In addition to these common expected learning outcomes, the students had some task-specific expected outcomes. The Finnish students’ goal was to gain skills and knowledge concerning facilitation in a virtual context. In contrast, the civil engineering students should have learned about the interdependency of tasks in the scheduling and management of construction projects, as well as different scheduling and project management methods.

**Second Life (SL)**

After initial analysis and testing of several virtual teamwork tools such as Webex and Windows Live Meeting, SL was chosen as the platform for the student teams’ interaction, since SL was expected to enhance the collaboration between the students and the teaching staff as well as the students’ curiosity, motivation, emotional involvement, and creativity (e.g., Delwiche, 2006; Edirisingha et al., 2009; Jarmon et al., 2009; Salmon, 2009; Twining, 2009). In addition, interest in virtual worlds, especially SL, in university education (Edirisingha et al., 2009; Jarmon et al., 2009; Mayrath et al., 2007; Warburton, 2009) and in corporate life (e.g., IBM) is increasing, so the decision to use and test SL was made.

SL was used as the only interaction channel for the global teams in the course. This implies that the students were instructed to use SL for all their team communication needs, and the use of other tools, such as e-mail, was prohibited. In SL, communication occurs through voice and text chat, of which the former was considered to be the preferred form of communication during the course. However, some technical difficulties with voice chat were anticipated, which is why text chat was accepted as the reserve option.

Each student team had its own group workspace in SL. In addition to the six team rooms, the course house included an auditorium where the students could meet course staff and hold presentations. Since file-sharing is not possible in SL, the students were provided with a file-sharing tool (Windows Live Sync).

Technological resources that supported creative design and collaborative problem-solving were designed and introduced to the course’s SL learning environment. Each team room in SL had a tool called a team wall as a fixed feature. On the team wall, the groups were able to look at their team calendar and the broadcasts of each other’s computer desktops, or edit a whiteboard. Team members could broadcast their own content to the team wall using a tool called screen broadcaster. The rooms with the facilitated groups also had process screens. These were used by the Finnish students to assist their task of facilitating. Each individual student avatar was given a communicator tool to help with team interaction. In addition, students used different kinds of tools (AutoCAD, Autodesk Revit, NavisWorks) to create the design models.

**Data collection and analysis methods**

Data were collected using multiple measures from the students \(N = 54\) participating in the GVCP course. In order to answer the research question of this study, we analyzed student-reflection essays, end reports, and questionnaires. The Finnish students reviewed their learning in reflection essays \(N = 6\), and all six teams returned jointly written end reports. These were received in May 2009. Questionnaires were sent to the participating students through a web-based survey after the course in April 2009. However, only 23 students (a response rate of 43%) returned the questionnaire; therefore, the results are not generalizable. The questionnaire consisted of 54 Likert-type items (a five-point scale ranging from disagree to agree), with questions related to the process characteristics of meaningful learning and eight questions to gather the students’ background information. The process characteristics were operationalized partly by using existing operationalizations by Nevgi and Löfström (2005; see also Hakkarainen, 2007). In Table 1, the examples of the operationalizations of the process characteristics of meaningful learning are presented.

Qualitative data were analyzed using the content analysis method (Brenner, Brown, & Canter, 1985), whereas quantitative data were analyzed using SPSS 15.0 for Windows. The following phases constituted the analysis: 1) reading the students’ end reports and reflection essays, 2) closely analyzing the qualitative data, and creating tentative categories based on the first coding and reflecting the research questions of the study (the characteristics of meaningful learning comprise the main categories of this study), 3) specifying the categories based on the second coding and then comparing them with the theoretical background, and 4) analyzing the quantitative data. Because
only 23 students returned the questionnaire, there were limitations in the statistical procedures that could be performed; therefore, only descriptive data from the questionnaire have been reported. The mean age of the respondents was 26 years. Students who answered the questionnaire did not have prior experience with SL or other virtual environments.

Table 1. Examples of the operationalization of the process characteristics

<table>
<thead>
<tr>
<th>Process characteristics</th>
<th>Statement in the questionnaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active and self-directed</td>
<td>The students’ role was to actively find, evaluate, and apply information.</td>
</tr>
<tr>
<td></td>
<td>The students directed their own study process during the sessions.</td>
</tr>
<tr>
<td>Goal-oriented and purposeful</td>
<td>I was able to achieve my own personal goals.</td>
</tr>
<tr>
<td></td>
<td>Teachers oriented students toward a learning goal.</td>
</tr>
<tr>
<td>Individual and experiential</td>
<td>I felt that it was possible for me to study according to my own personal style.</td>
</tr>
<tr>
<td></td>
<td>I was able to utilize my own experiences as starting points for learning.</td>
</tr>
<tr>
<td>Emotional and immersive</td>
<td>I was emotionally involved in the studying.</td>
</tr>
<tr>
<td></td>
<td>It was fun to study with Second Life.</td>
</tr>
<tr>
<td></td>
<td>I forgot everything else while studying in Second Life.</td>
</tr>
<tr>
<td>Constructive and reflective</td>
<td>I was able to utilize my prior knowledge related to the course’s content.</td>
</tr>
<tr>
<td></td>
<td>I was able to reflect my own learning during the course.</td>
</tr>
<tr>
<td>Interactive, conversational, and collaborative</td>
<td>I was able to interact with the environment and other avatars.</td>
</tr>
<tr>
<td></td>
<td>Small group conversations helped me to learn.</td>
</tr>
<tr>
<td></td>
<td>Second Life supported interaction and communication within the group.</td>
</tr>
<tr>
<td>Culture-bound and contextual</td>
<td>The course took the students’ cultural background into account.</td>
</tr>
<tr>
<td></td>
<td>The course promoted the learning of skills needed in the real business world.</td>
</tr>
<tr>
<td>Critical and creative</td>
<td>Studying developed my critical thinking skills.</td>
</tr>
<tr>
<td></td>
<td>Studying in the course encouraged creative thinking.</td>
</tr>
</tbody>
</table>

Results

From the students’ point of view, what were the process characteristics of meaningful learning that were realized during the TSL process in a virtual world?

When students were asked whether they thought that their role was to actively find, apply, and evaluate information, 90.9% moderately agreed or agreed, while none disagreed. This is also essential in creative reasoning, since a certain quantity of knowledge must be gained in order to complete the design (Howard et al., 2008). Also crucial in creative reasoning and design are the continual interpretation and use of information for creating high-quality outcome (Howard et al., 2008; Kolodner & Wills, 1993). This was acknowledged by the non-facilitated team, which stated their model would have benefited from review by other team members: “In order to get a very high quality model, the Americans would have had to send the model back and forth for multiple iterations and ‘checks’ by the Indians” (End report, team 4). In addition, 81.8% of the students moderately agreed or agreed that they directed their own learning during the course. The activeness and self-directedness of students appeared in the determining of goals and activities, information seeking, problem-solving, solving of technical problems, modeling the construction projects, scheduling, and evaluating their teamwork process. According the students, their level of activity also depended on the class schedule, students’ readiness to use SL, and other team members’ subtasks, as this excerpt illustrates: “Due to the time needed to contact the site, get a response from the project manager and send the files, it took over 2 weeks before the US team had the schedule they needed to begin modeling in SimVision” (End report, team 4).

Students’ assignments showed that the real-life business problem aided goal-oriented and purposeful studying. In the GVCP course, students had two roles, since the Finnish students’ responsibilities included facilitating collaboration and creative problem-solving by solving conflicts and technical problems, summarizing the discussions, questioning, and ensuring that everybody had understood what was decided, as well as negotiating the working rules, overall goals, and subtasks (cf. Cross, 1997). Other students were responsible for the actual construction project, and so it was important that every team knew what to do and how to proceed. Goal follow-up usually occurred during the weekly team meetings in SL, as this team describes: “Meetings began by having each team discuss any pressing issues, followed by project updates and future work schedule” (End report, team 3). The excerpt also describes the
incremental nature of creative design well (Simina & Kolodner, 1997). Things that complicated the achievement of the learning goals were a tight schedule for the course, occasionally ambiguous project goals as well as poor usability of SL and the other tools (e.g., file sharing). This team had difficulties in particular with voice chat:

The greatest problem encountered the lack of voice communication. IIT-Madras was not able to set up this feature with their program, which forced the teams to communicate through text chat, making the meetings run slower and decrease the interaction between team members (End report, team 3).

Although students did not seem to have prior experience with virtual collaboration or the use of SL, 78.9% of the students agreed or moderately agreed that they were able to apply their own experiences during the course. In addition, gaining new experiences on how to collaborate and facilitate virtual teams in SL was important for students, as this student described: “. . . (SL) offered me a unique chance to get acquainted with a new way of working” (Reflection essay, student 4). In addition, the following team understood the idea of the global project work: “There were initial difficulties in understanding the drawings, but it helped us how a global project is supposed to be” (End report, team 5).

It has been noted that the global virtual team context raised a variety of emotions among the students. The frustration with the communication difficulties, as well as the fear and insecurity brought on by the new technology, was balanced by the joy of success and the feelings of trust and belonging. The following excerpt is a good description of the emotional roller-coaster that students experienced: “Personally, my feelings swunged from frustration and despair to exhilaration during the course. However, the course was highly motivating at all times: I was able to learn many new things as well as practice some formerly learned in a new setting” (Reflection essay, student 1). As noted, the course promoted emotional characteristics quite clearly. The questionnaires also revealed that students were quite motivated ($M = 3.59; SD = 0.908$) and studying with SL was fun ($M = 3.91; SD = 0.811$).

Constructiveness of learning appeared, for example, in the weekly team meetings in SL, where team members discussed and reconciled issues in order to adjust differing opinions and subtasks into a coherent solution, which is essential in creative design (cf. Cross, 1997; Kolodner & Wills, 1993). Reflection was encouraged by letting the Finnish students reflect upon the learning process through peer meetings and reflection essays. Other students reviewed their learning process in end reports, although deep reflection was not encouraged. Nevertheless, according to the students’ own responses, the students felt that they were able to reflect on their own learning during the course ($M = 4.50; SD = 0.512$).

The course assignments supported conversational and collaborative characteristics, since the assignments were based on collaborative effort and communication through SL. The real-life problems required constant exchanging of opinions and information, collaborative reasoning, and negotiation from the students. The questionnaires also revealed that students felt that they belonged to the group ($M = 4.50; SD = 0.816$) (cf. Holmberg & Huvila, 2008), and that conversations in these small groups helped the students learn ($M = 4.14; SD = 0.793$). However, the collaboration and teamwork experiences varied among the teams. Students acknowledged several prerequisites for successful collaboration, such as the following: careful planning and establishing of the goals and roles clearly and early enough; motivation finishing the tasks; group problem-solving; regular, well-planned meetings and intense participation; and respect and appreciation from team members among others. The following excerpt shows the experience of the facilitated team who had a successful collaboration: “Team spirit seemed to be quite high within each global team, as well as for the group as a whole. Whenever the challenge was confronted, the spirit was positive and all the teams tried to solve the challenge together” (End report, team 3). This team had adopted a very straightforward facilitation style, including discussing and solving conflicts promptly with all the team members, although they also stated that the team worked well without planned process, since all its members were motivated to finish the task. Other successful facilitation strategies included questioning, which helped to bring the quiet members into the discussion, mediating the information to all team members as well as creating an agenda for each team meeting, thus ensuring that all the points were covered. In addition, a positive attitude helped in creating team spirit.

On the other hand, there were also contradictory experiences, as the following excerpt shows: “the other team members could even not agree within their team of the work they could perform and the assumptions that should be made, which resulted in productivity losses and lengthy arguments” (End report, team 6). This non-facilitated team suffered from disagreements and a lack of communication. According to this team, a facilitator would have been beneficial. However, another team succeeded in its teamwork without a facilitator. That particular team realized the importance of goals and regular meetings early on, which may have led to the team members’ successful
collaboration: “Executing a global project required intense planning and participation of all players. To accomplish this, each individual have been assigned responsibility for separate tasks, before collaborating findings throughout the project and final report” (End report, team 5).

In addition to communication difficulties, technological problems complicated collaboration and conversation within the team. Since voice chat was unreliable, students needed to depend on text chat, which was challenging to use. In line with previous research (Edirisingha et al., 2009), the flow of conversation in text chat was difficult to follow since questions and answers were submitted to chat simultaneously, as this student described: “Typical to our chats was overlapping of speakers due to delay in responding by typing. Two or more dialogues were ongoing at the same time which made it first difficult to follow each of the simultaneous threads in the team’s dialogue” (Reflection essay, student 4). New tools (such as a communicator tool and a team wall) were developed and implemented in order to facilitate group communication in SL. However, these tools, and the additional features offered by SL, were not used very efficiently: “The avatars were not used for nonverbal communication” (End report, team 3).

The contextual characteristics of meaningful learning (Jonassen, 1995), were supported since, after the course, students felt that studying with real-life problems had prepared them for new tasks ($M = 4.43; SD = 1.089$), and that the course had promoted their learning of skills (cf. Figure 1) needed in real life ($M = 3.68; SD = 1.086$). However, there were also problems with real-world tasks, including confidentiality and viability problems. For example, some companies were not ready to reveal all the details that would be necessary in order to solve the creative design case. Learning is also culture-bound (Vygotsky, 1978), and differences were noticed among the four cultures, for example, goal and reflection orientations varied among the students as well as the differences in terminology related to the subject matter. These all posed challenges to global teamwork. However, the effect of national culture was somewhat diluted when communicating in SL: “The cultural differences weren’t as glaring in a virtual setting but they became apparent during certain situations” (End report, team 3).

SL supported the use of imagination and creativity (cf. Jarmon et al., 2009; Kangas, 2010). Students had the opportunity to decorate their global team rooms and design the appearance of their avatars: “. . . had an Iroquois hairdo and red outfit that looked like long johns” (Reflection essay, student 1). However, students also felt that their task enabled creative thinking ($M = 4.38; SD = 0.957$), since it required assessment of the tasks, design model, and information as well as knowledge co-construction in order to create consensus for the final report (cf. Cross, 1997; Howard et al., 2008). Creativity was also emphasized every time students needed to invent a new way of working when a planned tool or software did not work or when other conflicts arose: “. . . to invent new ways of document sharing” (Reflection essay, student 4).

The collaborative nature of the activities may be a factor in why student individuality was not strongly emphasized. As the characteristic implies, it would have been useful to find out students’ individual characteristics at the outset, because then it would have been easier to provide individual guidance for each student (Karagiorgi & Symeou, 2005). This was strongly acknowledged by the students: “I think that any virtual work should address the participants’ different backgrounds, and be prepared to educate the competencies needed for those less experienced” (Reflection essay, student 1). In addition, only the Finnish students had the opportunity to express their individual opinions during their peer meetings as well as in the reflection essays. However, students were able to select a real-life case based on their own interests and motivation.

Immersion into 3D virtual space in SL was not emphasized, since the teams generally met there once a week. However, the students stated that a feeling of presence was stronger in SL because of the avatars, and this may be the reason why students experienced a greater number of feelings of trust and belonging (Edirisingha et al., 2009; Holmberg & Huvila, 2008), as this team described: “It was noted that the interface of Second Life may have positive impacts on the development of trust compared to more traditional channels of virtual communication” (End report, team 3). In addition, the critical characteristic was not particularly encouraged during the course, although feedback was collected from the students and they were encouraged to analyze their collaboration processes. Despite the extensive tutorials on how to work in SL and how to use the developed software tools, the students were somewhat confused during their interaction with the environment at the beginning, and thus interactive characteristics were not emphasized enough. According to the students, both virtual and physical instruction would have been beneficial:

Maybe there could be an introduction session with the course people present both in physical and virtual, showing and explaining how the virtual environment works, allowing to practice the
interaction in a safe and encouraging environment before being in the real situation (Reflection essay, student 1).

In addition, many teams stated that weekly meetings were not enough to complete the work, and occasionally, the national teams tended to work together too much without interacting enough with the whole team.

**Discussion and conclusion**

The results suggest that the problem-based GVCP course supported the process characteristics of meaningful learning and its outcomes, although we should emphasize the individual, critical, and interactive characteristics more in a future running of the course. In addition, SL did not contribute to the realization of the goal-oriented, collaborative, conversational, and immersive characteristics.

Our results suggest several implications, which could be useful for educational practitioners, especially if they have plans to utilize virtual worlds while teaching. The students’ individual characteristics should be addressed more properly in order to provide individual guidance and scaffolding (Delwiche, 2006; Mayrath et al., 2007; Ondrejka, 2008; Salmon, 2009; Warburton, 2009). A physical and virtual orientation to the environment is important, since it helps students’ actual puzzlement with tasks later on. In addition, technological issues must be dealt before the course starts, and students should be offered enough options if the primary technology fails to work. In the future, we should also pay attention to students’ interaction with each other by stressing the importance of clear roles, rules, and objectives as well as emphasizing everyone’s responsibility for the teams’ work and the quality of the design outcome. In order to have suitable schedules to finish the tasks, it would be better if the students negotiate the meeting schedules by themselves. These suggestions are crucial for students’ meaningful learning, especially for the individual, interactive, goal-oriented, collaborative, conversational, and immersive characteristics, and also help in creative design. In addition, the critical characteristics should be addressed more effectively, for example, students should be encouraged to study practical examples within a theoretical framework, and a critical evaluation of one’s own learning would be advantageous for each student. This would have helped students to understand the solution and the process in terms of their own knowledge, and helped them to create new learning goals (Simina & Kolodner, 1997). In addition, providing enough time to review and complete the design by all the team members would have contributed to the quality of the students’ design models. However, it was not the purpose of the research to analyze the quality and creativeness of students’ work, since such a critique would have required judgment from a field expert (Howard et al., 2008).

However, this study has its limits. Our data are quite scant, since only the Finnish students wrote reflection diaries, and the quantitative analysis of questionnaires is simply descriptive. Therefore, the results of this study should be interpreted and adapted carefully. Future research is also needed. We will continue the development of the model and the GVCP course based on these research results and the design-based research method. In particular, we need to consider how we can support those characteristics that were not fully realized during this course. In the future running of the course, the development of new software and experimentation with other virtual teamwork tools will also continue.

**References**


