

Effects of Using Avatars in a Game-based Learning Environment

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Abstract: Peer reviewing is an approach often used in digital (higher) education as it represents a possibility to provide feedback to large student groups. However, especially in digital learning contexts, students feel being disconnected from the anonymous group of learners, leading to low-quality feedback. When feedback is open, and counterparts are known, this knowledge can lead to biases when commenting on each other's work. We developed a game-based learning environment called 'The Great Library' that we used to analyse the effect of avatars as game element to limit the effects of both fully anonymous and fully open feedback. Students and teachers using the new game-based learning environment were asked to provide feedback on their experiences with the learning environment and the use of avatars. The responses were compared to the same course provided without game elements. The qualitative data analysis reveals that the introduction of avatars still lacks acceptance on the side of the students, yet that they feel a sense of community in the GBL. Open and direct feedback is still used and appreciated by the students. The anonymity of the peer reviews resulting from the use of the avatars represents a challenge for the student-teacher interaction. The environment and set-up of the course in a whole still needs some adjustment in order to fully support the learning process of the students.

Keywords: game-based learning, avatar, gamification, peer feedback, peer review

1. Introduction

Online learning environments are commonly used in today's higher education. While they can provide engaging, social learning experiences, they also bear the risk that the learner gets lost in the environment or feels isolated (Johnson & Aragon, 2003). The use of graphical design, game elements or social learning activities are some examples of mechanisms that can be used to make an online learning environment attractive for the learner. In our study, we explore how avatars can be used to support the social learning process within an online learning environment that is based on a peer-review structure. Social learning is manifested through socialization, social roles, mentoring, and locus of learning. Instructors and peers serve as a model for new roles and behaviors within an educational context (Johnson & Aragon, 2003).

In higher education, peer feedback and peer review are often used to support (online) learning. Different processes have been developed for organizing peer feedback and peer review with various effects. The aim is that students learn from both commenting peer work and from their peer's comments, and that they learn to agree and disagree (Johnson & Aragon, 2003). For teachers, peer review may alleviate their task to provide feedback in large groups. They can also use peer feedback to leverage the motivation of students to engage with each other and with the learning content (Keller & Suzuki, 1988). Peer feedback addresses three interaction modes in online learning environments: learner-content, learner-learner (Moore, 1989) as well as learner-interface (Hillman, Willis, & Gunawardena, 1994). The interaction mode learner-instructor is only existent on the background, as the instructor serves as moderator, but has a rather passive role in this set-up. It is commonly agreed amongst scholars that interaction in general is a key element for learning and satisfaction in online learning environments, as the review by Wanstreet (2006) shows. In the context of peer-reviewing, interaction represents the social and psychological connection that fosters learning as problem solving in collaboration with capable peers (Vygotsky, 1978). Interaction between students themselves is one of the goals of the set-up in our study (Klopfer and Squire, 2007).

However, students can be biased or experience peer pressure. To overcome this issue, peer reviews are often performed double blind although this may come with its own disadvantages, such as students' perception of loneliness in the system (Gordijn, Broekhans, Dunn, & Ubacht, 2018), lack of moderate behavior, unobtrusive feedback, disqualified reviews and less than expected learning and improvement (Zhao, 1998). Alternatives like open peer review have their own pros and cons (Lu & Bol, 2007). Our assumption was that a game-based middle way may circumvent some cons when students are avatars in the review process. In this way students do not need to reveal their identity, can feel part of a community, show moderate and professional behavior and are incentivized to constructive arguing. This paper evaluates the experiences of students and teachers with peer reviewing as avatars, aiming at answering the research question on what the effects are on the peer review procedure when students are avatars in the GBL. Four groups of students worked as avatars in a game-based environment to prepare their assignment. They reviewed the different parts of each other's assignment during an iterative process including review, evaluation, rebuttal and assessment. The results show that students still feel the same level of sense of community as in the comparable course from earlier years. These results were compared to earlier data for the same course with double blind peer review processes.

2. Peer feedback as mechanism for social learning

Peer feedback is increasingly used as an element in online learning environments in higher education, as it aims to empower students and foster active learning (Gordijn, Broekhans, Dunn, & Ubacht, 2018). It can provide summative grading when students rate each other's performance (Li, Liu, & Steckelberg, 2010). Peer feedback is often selected as mechanism when students act as both assessors and assessed, enabling them both to learn providing constructive feedback and receiving and processing feedback from others. Peer feedback in general is seen as one approach to positively influence the learning effect in online learning environments (Li, Liu, & Steckelberg, 2010). For example, Althaus & Darnall (2001) found that the higher the quality of the feedback students gave their peers, the better they themselves performed in a study. The other way around, our own experience consolidates the findings of Li, Steckelberg & Srinivasan (2009) that students often fear poor quality of peers' feedback as a limitation to their own learning experience. For this reason, they often prefer feedback from teachers in first instance, or at least from students they know as good students to ensure valuable input. This behavior can lead to an evaluation bias, and to the undesired situation that students that perform better receive better feedback, while students with lower performance receive poorer feedback. To avoid this situation, feedback to peers can be used in an anonymous way.

2.1 Anonymous peer feedback

Researchers suggest that anonymity within the peer feedback process may encourage student participation and reduce the insecurity when giving feedback by reducing peer pressure (Vickerman 2009; van Gennip, Segers, & Tillema 2010; Raes, Vanderhoven, & Schellens 2015). This reduction of peer pressure may result in more critical feedback (Lu & Bol 2007). For example, Raes, Vanderhoven, & Schellens (2015) investigated the effects of increasing anonymity by means of emerging technology. These researchers showed that anonymous peer feedback through a digital feedback system combines the positive feelings of safety, by being anonymous, with the perceived added value of giving peer feedback. Providing peer feedback anonymously may also lead to more objective feedback, which means students are less biased by the knowledge of and relationship with the peer (Raes, Vanderhoven, & Schellens 2015). The anonymity of the feedback thus seems to influence the way the message is received and processed. However, with anonymous peer feedback there is no room for discussion between writer and reviewer (Hosack, 2004). There is a lack of sense of community as students do not know who they are reviewing. This may result in increased social loafing, meaning that students would spend less effort in the task when not being recognizable (Lu & Bol, 2007).

2.2 Open peer feedback

As stated above, the other mode to provide feedback is open feedback, as would also happen in face-to-face learning situations. This kind of peer-feedback is related to the notion of learning as collaborative activity (Lu & Bol, 2007). The social interaction during the feedback process supports constructive learning within the community of learners (Lu & Bol, 2007). Studies show that it is a method accepted by students (see e.g. Liu et al., 2001). Yet, the openness of the communication between reviewer and assessed student, resulting in high transparency, might lead to a limitation in the quality of the feedback. A study by Zhao (1998) shows that open peer feedback is less critical than the anonymous one. Students tend to give more positive feedback, which might lead to less constructive feedback and a limited learning experience (Lu & Bol, 2007).

2.3 Comparison of the two peer feedback modes

As shown, both feedback modes have advantages and disadvantages when used in education. When comparing both modalities, we can assert that the advantages of anonymous feedback is that submissions are judged more fairly, and that bias is kept out. Both submitter of feedback as well as reviewer may be protected against personal criticism. Main disadvantages are that criticism may be given more careless, meaning to be e.g. either overstated or oversimplified. Students do not have the possibility to react on the feedback, or engage in a discussion with each other. In relation to the learning experience, anonymous feedback may be taken less seriously than other feedback, yet that there is lower peer pressure. Contrary to this, the main advantages of open feedback can be summarized as process that increases transparency, resulting in encouraging accountability and moderate behavior when giving feedback, generally considered to improve the overall quality of the review and assignment. It motivates reviewers to do a thorough job, and provide constructive feedback. On the other hand, disadvantages such as a bias about quality and/or personal affinity with topic or person may occur in an open peer-review setting. There might also be a tendency to please, or reluctance to criticize work of weak or yet strong students, friends, or for any other reason. The influence on the learning experience could be that students feel that the activity is dominated by social relation and reputation. Substantial discussion/arguing can be hindered due to the above-mentioned reasons. Students might feel a high peer pressure, but also being part of a strong community. Table 1 summarizes the main aspects when comparing both modes of peer feedback.

Anonymous Peer-Feedback		Open Peer-Feedback
	Advantages	
Participation		Collaboration
Reduced Peer Pressure		Acceptance
Perceived Safety		High Transparency
Objective Feedback		
	Disadvantages	
Social Loafing		Less critical, more positive feedback
Lack of transparency		Increased peer-pressure
Lack of follow up on review		Perceived unfair judgement
Defensive reply		Selective constructive attitude
No sense of community		

Table 1: Comparison between anonymous and open peer-feedback

3. The current study: avatars as a solution

The use of digital technology to support peer feedback processes is an acknowledged method to foster the learning experience (Lu & Bol, 2007). A course based on a peer-review structure, supported by a digital learning environment, formed the basis for the development of the game-based learning (GBL) environment called 'The Great Library' (see Gordijn et al., 2018, for more details on the previous version). "The Great Library" represents a learning environment that is specifically designed to support peer-feedback processes. It represents a virtual library with different rooms the students' avatars can navigate through. Students are able to conduct different actions in different 'rooms' that can be reached using a navigation map. Within "The Great Library", students can follow up their own learning progress, can upload their own work for review, and write and distribute their reviews of other students' work. They can also access information about the whole work and review process. Teachers are able to monitor the students' progress from a teacher portal. Both students and teachers can directly interact with each other using the chat room of "The Great Library". Teachers as well as students experienced certain limitations in the technology-driven design of the previous environment. The avatars and a game-based design was aimed at increasing the motivation of the students and the quality of the feedback the students provide to and receive from the peers. Many educational concepts as well as the overall-structure were maintained in the GBL development. Yet, as in the initial course, the peer feedback was provided openly, coming along with many limitations as described in theory above, we looked for ways to improve the peer-review situation, while avoiding the drawbacks of a fully anonymous feedback situation. We propose the use of avatars as virtual representations of the students, and as mediators of the peer feedback to both avoid bias as in open peer-feedback, as well as a lonely learner feeling as in a fully anonymous situation.

3.1 Avatars as elements in online learning environments

Our study aims to investigate whether students experience less peer pressure and more sense of community when they do the peer review process as avatar instead of anonymous or open peer feedback. Students do not know each other's avatars and in this way the avatar has no past. On the other hand, the avatar does have a (fictional) identity and can be part of the learning community in the Game-based learning environment. By creating a GBL with the metaphor of a library including avatars as virtual users of this space, the students can utilize role play and narrative forms to imagine and empathize with the other students, and act in a safe, protected environment (Francis, 2006). Avatars are interactive representations of a human figure in a GBL, or other virtual space (de Freitas, 2006), and represent a game element that is tightly connected to the player's success and failure (Schmitz, Klemke, & Specht, 2012). That process fosters a strong identification of the user with the game characters (Winkler et al., 2008). It shows that role play and identification with virtual avatars are central to learning in immersive worlds, but learners need choice over which character to adopt (Annetta, Klesath, & Holmes, 2008). In our case, the avatars are meant to increase the interaction between the students in a further anonymous peer-review system. Through the avatar mediated interaction, the students would learn how to scientifically argument (Klopfer and Squire, 2007), as the avatars would enable the students to communicate and express themselves in ways that they might be unable to do in fully anonymous or fully open feedback situations. While the use of avatars in social media and entertainment contexts is well established, there is still a lack of knowledge about their effects in educational environments (de Freitas, 2006). In our study, we aim to provide an answer to this knowledge gap by answering following research question:

What are the effects on the peer review procedure when students are avatars in the GBL?

3.2 Method

In this article, we report on the qualitative results of our analysis of students' and teachers' experiences with the GBL "The Great Library", with a focus on the use of avatars to enhance the learning effect during the peer reviewing phase. The study was conducted in graduate courses at the Delft University of Technology. These courses are aimed at preparing the students for their final thesis project. The major part of the course is done online in the Great Library, and there were a few additional face-to-face meetings. At the end of the course students were invited to fill in the survey with multiple choice and open questions after submitting their final assignment, but before receiving their final grade. From the total number of 187 students that participated in the 5 pilot courses with 4 teachers until April 2019, 40 students responded to the surveys. Two of the 5 courses are still running, so there are no survey results yet, though we did interview students after the first half (see table 2 for an overview of the courses).

For the qualitative analysis, several group interviews with students and teachers were organized. In these semi-structured interviews, the researchers explored how the use of the avatars within the GBL was experienced. The interviews were performed mid-term and after finishing the course, separately with students and teachers.

Although enough students participated in the course, only very few were interested to accept our invitation to evaluate the GBL. This implies that the interview comments are not representative for the cohort.

We were able to compare the results of the surveys with the student evaluations of previous editions of the course, as the courses are based on previous versions with the same educational format, also using a digital feedback tool. However, these were without the game elements, graphical interface and avatars as provided by The Great Library.

In this article, we will discuss both the qualitative results collected with the interviews to gather a deeper understanding of how both students and teachers experienced the GBL and the use of the avatars and analyze the quantitative data specifically related to the use of the avatar.

Pilot run GBL	Period	Length in weeks	#students	#respondents survey	Interviews
1 SEN2321 Master thesis preparation	Nov-Jan 2018	10	47	33	2 x 2 Teachers, 1 Student

2	EPA2934 Preparation Master thesis	Nov-Jan 2018	10	47		1 teacher
3	SEN2321 Master thesis preparation	Feb-April 2019	10	26	7	
4	4413GRPMDY Thesis Preparation Module (2018/19 Q3)	Feb – July 2019	20	45	n/a	1x3 students
5	SEN2321 Master thesis preparation	April-july 2019	10	22	n/a	

Table 2: Courses that made use of the GBL “The Great Library” in our study

3.3 Instruments

The instruments we used in this study are threefold. Firstly, it is the design of the game-based learning environment (GBL) itself, which represents the context of our study. The participants enrolled in the course Master Thesis Preparation (also called Thesis Preparation Module and Preparation Master Thesis) could download the GBL “The Great Library”. The metaphor was used to develop a strong connection to the academic learning field, and to serve as scenario for the avatars used in the environment. The graphical design of “The Great Library” provides a visual representation of the course and all course content to avoid that students get lost or overloaded with information (Johnson & Aragon, 2003). Figure 1 shows the homepage of “The Great Library” including the avatar of one student. With this visualization, students are immediately able to recognize their virtual representation in the form of the avatar in the lower left corner. At the same time, they have an overview of the most important elements in the course, such as the current research topic to work on, the skills already achieved, their overall progress in the course, and the upcoming deadlines. The map in the lower right corner leads to further learning spaces, such as a chat room, and the area for uploading their assignments.

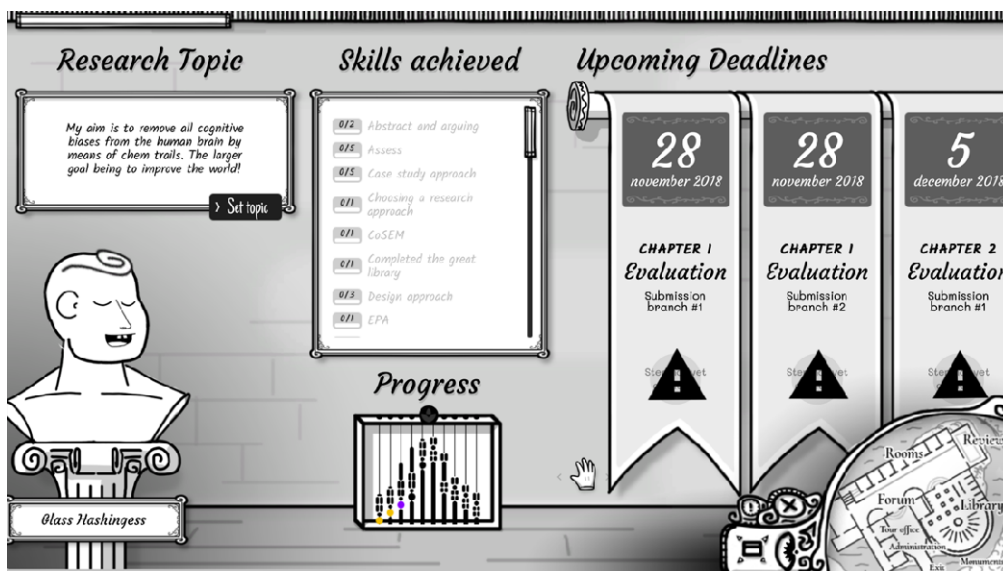


Figure 1: Student page of “The Great Library” (Orbit Games, 2018)

Secondly, the main graded assignment of the course is that the students have to individually write a master thesis proposal. Providing feedback on other students' proposals in iterative steps are compulsory and lead to bonus points. The assignments have not been changed from the previous version of the course to the GBL version.

Thirdly, we used surveys the students had to fill in as well as group interviews to analyze the perception of the students who used the GBL as well as their feedback on the learning environment. In the first four pilot runs with the GBL, interviews were held with four students and three teachers. 40 survey responses were collected, which are still to be fully analysed. The results of the qualitative analysis of the interviews together with qualitative feedback from the surveys will be discussed in the following section.

4. Results

4.1 Feedback from students

In relation to our research question focused on the effects of the avatars on the learning process, both the interviews and the survey results did not lead to a clear picture of the value of the avatar as element in the GBL. Most of the survey results as shown in table 3 were less pronounced than we had expected. This might be the result of the small group of respondents or the ambiguous nature of some of the questions. Below, we discuss the main results.

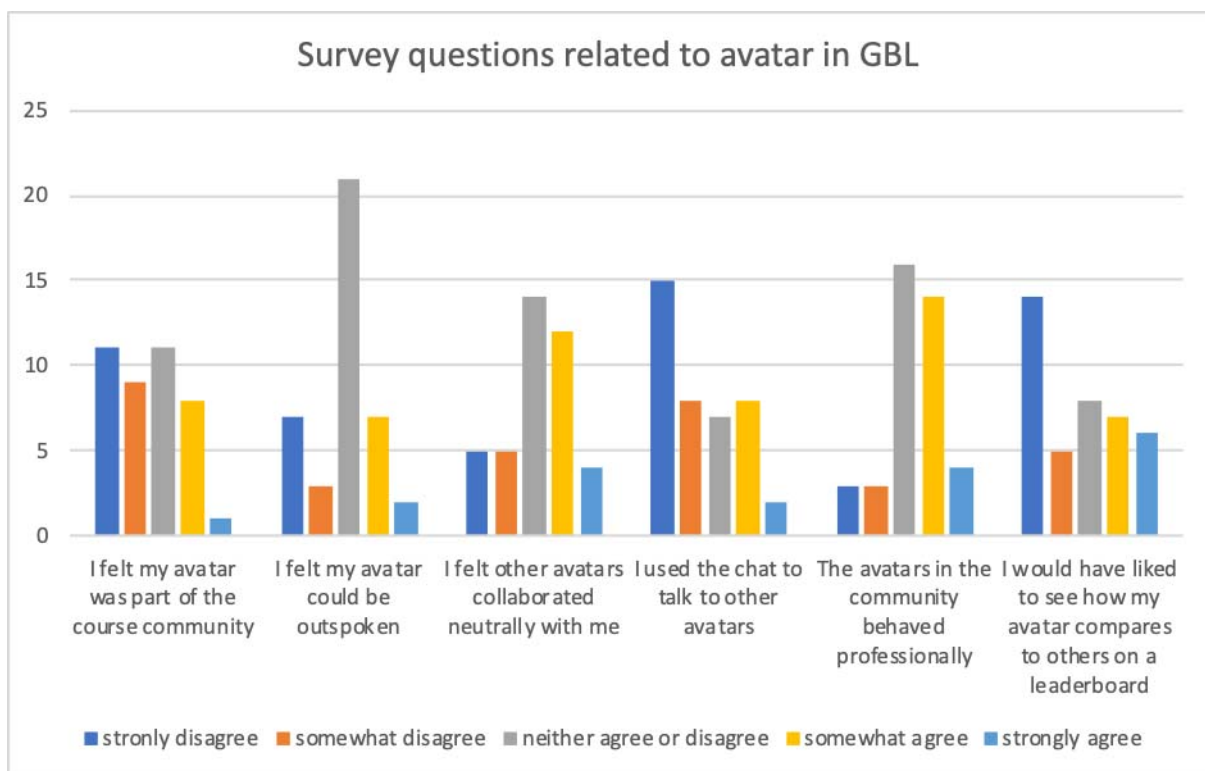


Table 3: Student feedback on the use of the avatar in the GBL “The Great Library”

1. I felt my avatar was part of the course community.
Some students appear to feel that they are part of the course community whereas others are quite neutral or do not experience this at all. This is comparable to the community feeling in the previous course editions without the avatars.

Students apparently find their own way which is also due to the current set-up of the course with face-to-face meetings beside the online GBL. We were not able to create a completely anonymous feedback situation, as students also used other communication channels to provide feedback to each other.

One student criticized the anonymous set-up of the peer review as organized in the current version of the GBL. This student would appreciate an open feedback-form.

"I would like to suggest the removal of the avatar feature as this feature prevents more elaborated discussion of the topic from happening. Yes the system allows to discuss the work of a user to a certain extent, but this could be much better if users would know each others identity. I had submitted my literature review work, but it was still far from finished. One user who had to review me recognized my paper and contacted me privately to ask if I had a more recent version, which I had. As a result of this I received more useful feedback. If the anonymity would be removed, then more of these events could occur."

2. I felt my avatar could be outspoken.

A majority of the students felt neutral about this and some students mentioned that they felt they could be critical and more honest than in open review. However, this is not a result of working with avatars but due to anonymity.

3. I felt other avatars collaborated neutrally with me.

Most students agreed with this. In the interviews students also did not mention experiencing peer pressure. This does not necessarily mean that all had a good experience

"There was one instance where an 'avatar' gave me feedback that I was very much offended with. The feedback had nothing to do with the contents of the course: it criticised me as a person/my skills. I think there could be more emphasis to only review the contents (what is asked to review). However, this avatar was the only from all avatars to behave in such a way, so I don't know if its a real issue."

4. I used the chat to talk to other students.

Students in the interview mentioned that it was nice that you can chat. It is useful that you can discuss things. On the other hand the chat function was not used by all students.

5. The avatars in the community behaved professionally

Most students feel their peers behaved professionally. With respect to the quality of the peer-reviews, the perception of the students is ambivalent. In the interviews, the students mentioned that there is a variation of quality of the feedback. Apparently, providing feedback was seen as more helpful than receiving feedback from others:

"I noticed high variation in the qualities of peer reviews I received. Sometimes, these reviews actually seemed useless, while others (me included) put serious effort in them. [...] I experienced the reviewing processes as a very good instrument for learning how to write a research proposal: you see how other people build their arguments, the literature they use, the way they identify knowledge."

"Some feedback lacked content, it was just people saying you did well."

6. I would have liked to see how my avatar compared to others on a leaderboard

From the survey it appears that most students disagree. Some mention that they would like the gamification features to be optional altogether. This student might have benefitted from a leaderboard.

"Opt-in or some sort of gamification method for the feedback system. Several of my reviewers as well as some of the papers I reviewed were basically not-participating, which is simple game theory. It's only worth half a point, the perceived cost of not participating is very low compared to the time and effort spent."

Another student proposed to improve the game elements of the GBL in a more inclusive way, being better intertwined with the pedagogical structure and the learning goals of the course:

"I think the GL is a super-cool idea and is the future of learning. However right now it just seems an interface and supplies no real depth or added elements of gamification. Leaderboards, gamified lessons using real examples and a more guided process would be nice."

Some students considered the GBLs to be childish whereas others appreciated the playfulness and its different functions such as the chat room, the progress overview, and the avatar. Yet, while the game elements are sometimes appreciated, the underlying structure and pace of the course in its current form seems to hinder unfolding the GBL's full potential.

All in all, though it was fun to create the avatar, it was not really experienced as a necessary addition. Students did appreciate the professional feedback from the other avatars in the GBL, and seemed to feel low peer pressure. Students also appreciate the visuals in the GBL with a clear lay-out with deadlines and progress, but they do not really see the need for a game-based environment. The GBL as unfamiliar learning environment that needed time to get acquainted with, opened up some discussion over the general didactical set-up of the course amongst students. As a second-order result, this is a valuable outcome helping us to understand the instructional requirements of the course better.

4.2 Feedback from teachers

In the interviews, teachers reported that the teacher portal for "The Great Library" provides is clear and helpful, as they can easily monitor the progress of the students, and have insights in the students' work. Yet, they also reported that the use of the GBL had an impact on the face-to-face meetings, compared to previous years of the course. In these meetings students rather discussed aspects of the GBL and the underlying set-up of the course as well as general instructional questions than content-related issues. The teachers had the feeling that this had an impact on the quality of the discussion. Furthermore, the teachers have the idea that the anonymous set-up of the feedback hinders the depths of the discussions, and that students do not raise questions with regard to their work in the face-to-face meetings. The teachers experience the avatar as anonymous element in the course set-up as challenging.

5. Discussion and Conclusion

We proposed a game-based online learning environment that makes use of avatars to foster the process of peer-reviewing and peer-feedback. For students, peer feedback can affect the learning process effectively, both when constructive feedback is given as well as when well written feedback is received. As organizing a peer-reviewing system requires a lot of time and effort on the teacher's side (Li, Steckelberg, & Srinivasan, 2009), we propose a graphical structure that leads the students through the course, and can address their motivation. We introduced the use of avatars in the GBL to limit the disadvantages of both anonymous and open feedback. Our qualitative analysis revealed that students experienced low peer pressure within "The Great Library". The use of the avatars may support the process of peer reviewing, and may limit the lonely-learner experience. If so, the design of this element has to relate to the expectations of the learners, to be fully accepted. Students perception of this game element was rather ambivalent, with some appreciating the game-based set-up, and some disliking it. In addition, teachers reported that they still faced the challenges of anonymity, and are unsure how to address the students behind the avatars, especially when dealing with them in face-to-face sessions that are part of the whole learning experience. They appreciated the ability to track the students process within the GBL. Students reported that they felt a sense of community in the GBL, which could underline the positive effect of the use of the avatars on the social learning experience. On the other hand, this community feeling had not increased much compared to the previous editions without the avatar. Moreover, contrary to related literature reporting on advantages of anonymous feedback, the learners in our case seem to prefer an open feedback situation, and a direct way of communication. With respect to the major limitation of our study, the limited sample size, we cannot generalize these results yet. We will continue our research with further analyses of the quantitative data, including a group of students that took the online version of the course, to assess and further improve the learning experience within "The Great Library", and to gather a deeper understanding of the effects of avatars in a game-based peer-review learning environment.

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