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Competition And Collaboration Using A Social And Gamified Online Learning Platform

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Abstract: Gamification is defined as the use of game techniques in a non-game context and has demonstrated potential impact in a wide range of subjects. Informed by the design and processes of digital gaming, gamification often exploits competition to motivate, personified by points, badges and leader boards. Success, however, seems to go beyond these basic features and rely on a concrete acknowledgement of the motivational model of the user, taking into account concepts such as situational relevance and situated motivational affordance, which can be framed under competition and/or collaboration. This paper investigates the impact of competitive and collaborative environments on summative assessment. This study bases its investigation on the StarQuest platform (http://starquest.eu/), a social and gamified collaboration application hosting a private online environment for small groups of individuals to co-curate and share digital contents. Participants were second year undergraduate students (Sport Psychology, n=94), who enrolled on a module entitled "A Fundamental Approach to Motor Learning and Control". The module ran for 11 weeks and the curriculum was delivered using a Problem-Based Learning (PBL) approach. The results highlighted a number of strengths and weaknesses of implementing a gamified online platform for team working, which will inform future design, development and deployment of gamified and learning platforms.

Keywords: Gamification, game-based learning, collaboration, competition, blended learning

1. Introduction

In recent years, digital platforms, ranging from e-learning and simulation platforms to game-based learning and mobile applications, have provided alternative means for the way learning content is being delivered. As the discipline of seamless learning merges the technological and human challenges arising from the emerging new technologies of the last decade, it is becoming clear that the ultimate learning environment will have to provide a smooth learner experience, with options to both consume and create content (E-Learning Guild, 2014) in both formal and informal settings, as well as digital and physical spaces.

User experience design has taken inspiration from game-based approaches such as gamification, which is the use of game techniques in a non-game context. Gamification has demonstrated potential impact in a wide range of subjects (see studies carried out by Hamari et al., 2014). Informed by the design and processes of digital gaming, gamification often exploits competition to motivate, personified by points, badges and leader boards. Success, however, seems to go beyond these basic features and rely on a concrete acknowledgement of the motivational model of the user, taking into account concepts such as situational relevance and situated motivational affordance, which strategy can either be framed under competition and/or collaboration (Beersma et al., 2003). Motivated by the fact that collaborative and social learning has demonstrated the nurturing of soft skills, which are an important component of 21st century skills, we piloted a gamified learning platform – the StarQuest Platform (http://starquest.eu) – that serves as a tool to help investigate competition and collaboration mechanics and their impact in team working and learning.

The remainder of the paper is structured as follows. Section 2 elaborates on the background to why gamification is considered in this study. Section 3 describes the methodology of the pilot study, followed by discussion of the findings in section 4. The paper is concluded in section 5.

2. Background

Gamification is the process of applying the design characteristics and processes of games in non-game contexts (Deterding et al., 2011) in order to increase user engagement and solve problems. Gamification has been gaining traction in various domains and applications, where Bunchball was the first company to provide gamification as a service in 2007 (Paharia, 2013). Its recent rise in traction can perhaps be associated with social factors as well as the convergences of various technologies, such as the growth of the digital games industry, increased computer processing power, the Internet, mobile devices, "web 2.0", and social media (Arnab et al., 2015). The popularity of digital games across demographics, where the average gamer is reported to be in their thirties and 47% of gamers are female (Galarneau, 2014), has also opened up opportunities for gamification to develop. The need to increase and sustain engagement of online audiences and consumers as well as employees in the workplace is the main business driver for gamification. For example, Reeves and Read (2009) argue that younger generations of employees expect work to be as engaging as the electronic games they grew up with, and that many employees are bored or frustrated with their jobs and therefore not as productive, focused or fulfilled as they could be.

The application of gamification has also seen an increase in the education sector with a strong body of evidence already being generated and the number of new publications on gamification growing daily (Hamari et al., 2014). Gamification has been used within a wide range of subjects, such as science (Rouse, 2013), maths (Goehle, 2013), foreign languages (Danowska-Florczyk & Mostowski, 2012), cultural heritage (Gordillo et al., 2013), health (Gabarron et al., 2012), computer science (Li et al., 2013), software engineering (Sheth et al., 2012), and business and logistics (Reiners et al., 2012). Gamification techniques are also employed to pursue transversal objectives, such as fostering participatory approaches and collaboration among peers (Li et al., 2013), self-guided learning (Watson et al., 2013), completion of homework assignments (Goehle, 2013), making assessment procedures easier and more effective (Moccozet et al., 2013), integration of exploratory approaches to learning (Gordillo et al., 2013), and strengthening student creativity (Barata et al., 2013). More recently, Seaborn and Fels (2015) carried out a systematic survey on the use of gamification from a human-computer studies perspective, noting the diverse meaning and contradictory uses of the term gamification, the little empirical work performed to validate gamification concepts, and incongruities within the empirical findings (Star, 2015).

A deeper analysis of the case studies related to gamification (Star, 2015) has revealed a profound lack of consistency with respect to methodologies used. Typically the failures were found to be most profound where no game designers or user experience experts were involved in the design or where the user's motivational model was no better than a Skinner's behaviourist view. Success, however seems to rely on a concrete acknowledgement of the motivational model of the user, taking into view concepts such as situational relevance, and situated motivational affordance. Furthermore, vast majority of the research measures efficacy through bespoke qualitative self-measure of motivation rather than a coherent and comparable quantitative measure of improved outputs.

3. Method and materials

The pilot study aimed to investigate the impact of online competitive and collaborative climates on summative assessment. The StarQuest online platform (Figure 1, http://starquest.eu/), a social and gamified collaboration application hosting a private online environment for small groups of individuals, was used to share and co-curate digital content. Prior to the study, the platform introduced participants to the study and participants completed informed consent forms.

3.1 Starquest platform

StarQuest facilitates collaboration between small groups of participants on collection, creation, and sharing of digital artefacts. Functionality was added to the platform to enable participants to be introduced to the study, complete and submit informed consents, and access the experiment's different conditions through manipulations of independent variables. Other functionality added was the ability to measure, collect, and store data on participant responses for later analysis.

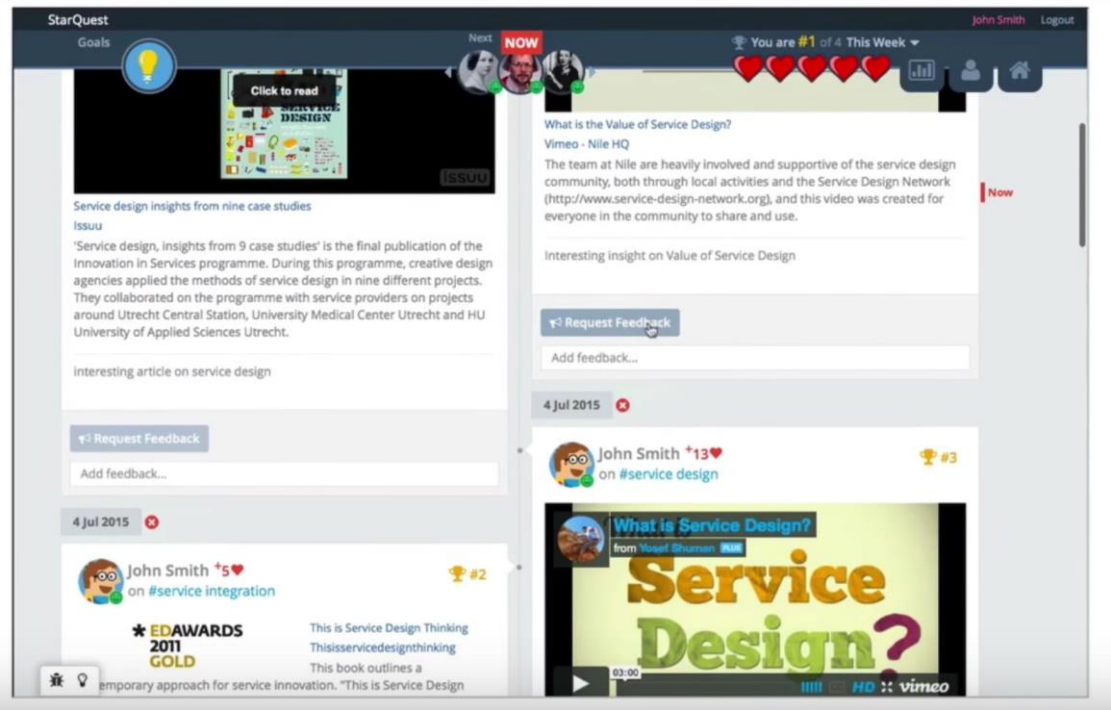

Figure 1: An example of the StarQuest interface

Starquest features gamification functionalities to scaffold co-curation activities and provide feedback based on two key modes – collaborative and competitive modes. For the study, the control group's activities were not be scaffolded by gamification mechanics. The activities related to the learners' resource co-curation based on topics selected by the tutors (such as sharing, commenting, posting, liking, goal completing, etc.) are used to inform the individual and team scoring and leaderboards (health scores and feedback– see Table 1, Figure 2 and Figure 3).

Table 1: Manipulation of StarQuest's Parameters to Frame Condition.

	Cooperative Condition	**Competitive Condition**	**Control Condition**
Points gained	Posting and commenting by any member of a group earns health points for the group.	Posting and commenting earns health points for the individual and contributes to that individual's leaderboard rank.	There is no point scoring mechanism.
Points lost	Lack of activity by any individual results in loss of health points for the whole group.	Lack of activity results in loss of health points for the individual and loss of position on the leaderboard.	There is no point scoring mechanism.

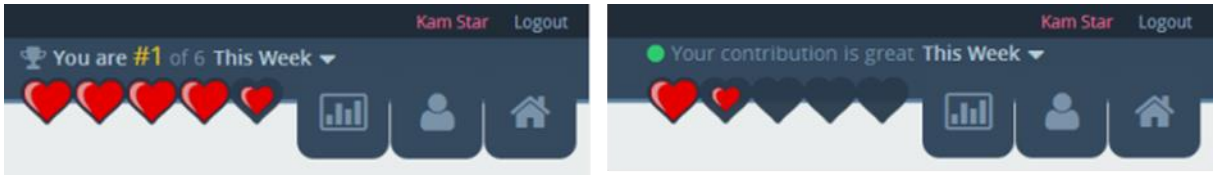

Figure 2. StarQuest's Health Bar (Competitive versus Collaborative)

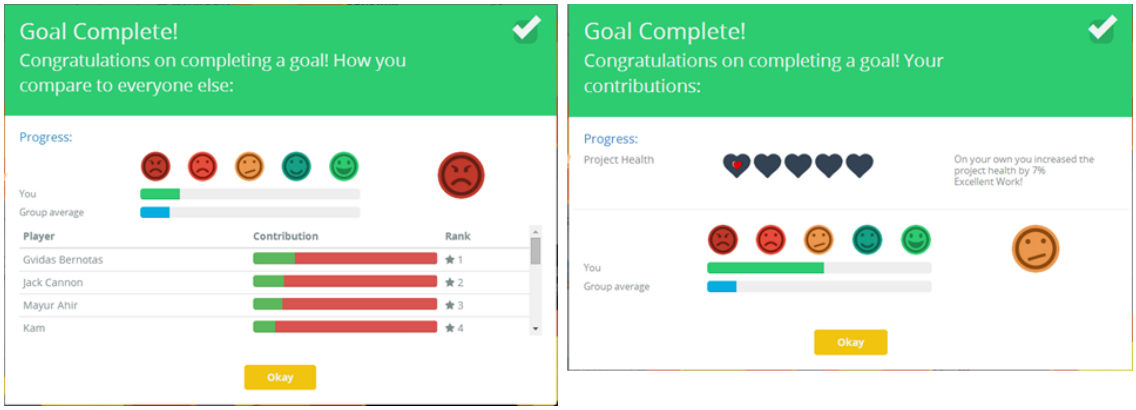

Figure 3. StarQuest's Goal Framing (Competitive versus Collaborative)

3.2 Study Design

The study was carried out using a between subjects design with three conditions (Control, Collaborative and Competitive). Those in the Control condition were not given guidance on how to engage with the material and/or others in their group. Those in the Collaborative condition were helped to work together, with the underlying principles being shared goals and progressing together. Instruction and feedback in the Competitive group was based upon comparison with others and viewing the task as an opportunity to do better than others.

3.3 Participants

Participants were second year undergraduate students (Sports Psychology) at Coventry University, UK (n=94) who enrolled on a module entitled "A Fundamental Approach to Motor Learning and Control". Data on participant genders and group allocations is presented in Table 2.

Table 2: Participant gender and group allocation

	Competitive	Collaborative	Control	Total
Male	18	20	20	58
Female	9	2	5	16
Undisclosed	7	9	4	20
Total	34	31	29	94

3.4 Procedure

The module ran for 11 weeks and the curriculum was delivered using a Problem-Based Learning (PBL) approach. Students were allocated to one of 20 tutorial groups, which consisted of approximately five students per group. There were five members of staff who acted as PBL facilitators and the curriculum was divided into four two-hour lectures, seven two-hour tutorials and three two-hour lab sessions. Problems were set from current issues in the world of sport and students had to prepare group and individual information related to providing a solution to the problem before the first tutorial. As the problems were often complex, and due to the time constraints of providing a solution within approximately two weeks, students were provided with a paper-based scaffolding tool, which was developed based on Edward de Bono's six thinking hats (Smith and Cook, 2012).

In the first lecture, the mechanics of StarQuest were introduced to the students, who were encouraged to asynchronously upload content relevant to answering the problem, which could then be used as content in their individual solution sheet, forming a sub-section of coursework 1 (CW1). This process was repeated for all four problems, which made up the content of the module. The groups were randomly allocated to the Collaborative, Competitive and Control modes. Interaction data and feedback (including number of posts, goals completed, likes, visits, time on the site and page views) from the groups were collected via the platform over the pilot duration and the modes were matched against the performance based on CW1 and CW2 and

the final module mark. The analysis examined the variation of both achievement and usage of the StarQuest platform across the three modes. In addition, qualitative data were gathered, in which participants' feedback on the experience was collected via a paper-based survey (five questions, listed below) circulated at the end of the module in order to provide some insights into the participants' experience. There were 51 respondents to the survey (out of 94 students).

- Q1 - What are your overall impressions of StarQuest?
- Q2 - Do you feel StarQuest could contribute to your teamwork? If so, how?
- Q3 - Do you feel StarQuest would lead to more sharing of ideas and discussion? If so, how?
- Q4 - If the health/ranking was visible in your version, how did you feel about it?
- Q5 - What would you add, remove or change in StarQuest?

4. Findings and Discussion

Upon analysing the interaction data, there were differences between the number of Posts, Likes and Goals completed across the three conditions. Data presented in Table 3 suggests that those in the Control condition had the greatest Goal completions along with a greater number of Posts and Likes on the platform, which is also reflected in the actual achievement. Kruskall-Wallace and follow-up Mann-Whitney tests suggest that the Competitive group posted significantly less than the Control group. Furthermore, the Control group liked significantly more comments than both the Collaborative and Competitive groups. Overall, those in the Competitive group have the least number of Posts, Likes and Goals completed. The competitive mode may have discouraged some engagement: there were some negative reactions to the competitive elements based on the responses to Q4, e.g. "I personally don't see that as a motivational point", "Annoying, felt harassed to do the work", "Didn't like it, it was too kid-ish" and "Was pointless as some people had more to write about than others therefore those peoples rankings were higher than the others". Collaborative participants contributed more than Competitive, which was probably motivated by accountability within collaborative team work. Feedback to Q2 includes mentions of the visibility of contribution and the consequent accountability, e.g. "if someone hasn't contributed it is clear to see and talk to them about it. If everyone else has, I don't want to let them down so would also post" and "Yes because it gives people a chance to step forward".

Table 3: Achievement and activity with the StarQuest platform across the three conditions

Mean scores according to Mode type	Competitive (N=34)	Collaborative (N=31)	Control (N=29)	Overall Mean (SD)
Posts	.97 (1.45)	1.74 (1.88)	2.38 (2.29)	1.66 (1.95)
Likes	.00 (.00)	.03 (.18)	.93 (2.17)	.30 (1.27)
Goals completed	.21 (.68)	.52 (1.26)	.48 (1.18)	.39 (1.06)
Coursework 1	76.66 (7.92)	67.74 (13.14)	75.35 (10.20)	73.37 (11.18)
Coursework 2	57.76 (13.09)	60.71 (8.79)	60.61 (8.15)	59.69 (10.4)
Final Mark	69.11 (8.49)	64.94 (8.81)	68.63 (9.96)	67.92 (9.16)

One of the shared attributes for all groups was the social aspect of the platform, which may explain the level of contribution and Likes of the Control and Collaborative groups compared to the Competitive group. The most popular feedback to Q2, with almost half of the responses (24 of 51), was that StarQuest made it easy to share information with the group/team, e.g. "it can make […] sharing the work amongst the group easier", "it can contribute to team work as you can share information between other members in the group". Several respondents also said that StarQuest can aid collaboration, and mentioned helping other students: "most people were […] using it as a tool to help teammates with work", "it allows others to share work and help each other". Ease of communication within StarQuest was also noted, emphasising the social aspect of the platform: "it enables the group to contact each other easy".

A series of one-way ANOVAs were conducted to examine any differences in marks for CW1, CW2 and the final module mark with group type (Competitive, Collaborative and Control) as between subjects' factors. Results indicated that there were no significant differences in CW2 (p = .480) mark and final module (p = .148) mark as a consequence of type of engagement in StarQuest. There was however a significant difference in CW1

module marks as a consequence of type of engagement in StarQuest (p = .003). Bonferroni post-hoc analysis indicated that there were significantly lower CW1 marks in the Collaborative group compared to the Competitive group (p = .003, mean diff = 8.9%) and the Control group (p = .027, mean diff = 7.3%). There was no significant difference in CW1 mark between the Competitive and Control groups (p = 1.00) (Figure 4).

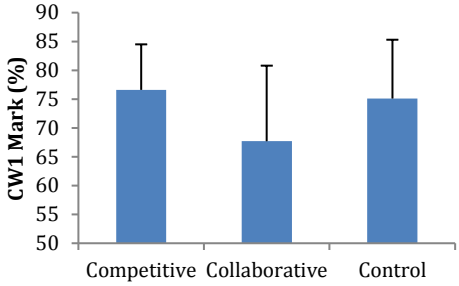

Figure 4: Mean ± SD of CW1 mark (%) between competitive, collaborative and control groups

The study demonstrated that the motivational conditions of learners (individually and collectively) influence the learning dynamics, and that competition within teamwork worked better with this group of students. One assumption as to why the Collaborative group performed worse that the Competitive group is due to the type of cohort. The majority of Sport Science students are also competing athletes and by their very nature are competitive individuals, who like to outperform their 'team mates'. Five respondents to Q1 emphasised that the competitive element provided them with motivation to contribute more in order to increase their level, e.g. "it was a good indicator to see how well you were engaging with the team, tackling a task more like a competition to stay each week with the most health", "I'd try not to have the worst score, that would mean I was engaging more and I'd share more information", "I would want to rank well/better than others" and "Made it into a bit of a competition, which did make me take my turn".

The Collaborative group may also have been guilty of social loafing (Høigaard et al, 2006) and leaving engagement with StarQuest to the rest of the group. Furthermore, even though the collective engagement in the Collaborative group was higher than the Competitive group, the spread of use was particularly heavy on some students and not at all on others. In their answers to Q1, several respondents mentioned that it is important for everyone involved to engage with the software, e.g. "Useful when everybody engages", "Requires […] all participants' involvement" and "works well if everyone contributes". There was also mention of the usefulness of being able to see who has contributed to a piece of work. It is suggested that this could be a result of students being made to work in a fashion that is not necessarily familiar or welcome. Forcing them to work collaboratively may have been looked upon unfavourably by the students and thus negatively influenced their attainment in CW1. Outcomes from CW2 show insignificant outcomes that may be due to a lack of support provided, compared to CW1. A small-scale study carried out on gamification and its effects on brainstorming (Yuizono et al., 2014) also showed insignificant difference between results generated from cooperation and those from competitive gamification.

Autonomy might have been better fostered in the Control mode, where they were using the platform like any other social platform where resources can be shared. The majority of respondents (30 of 51) gave an overall positive response to Q3, where the ease of sharing information and ideas between group members was one of the most popular answers to this question, together with the need for participation by all members of the group, e.g. "it [relies] too heavily on everyone putting effort in", "If all numbers of the group used it then I believe it could work". Beersma et al. (2003) concluded in their study that teams with extroverted and willing members performed better under the collaborative structure, whereas teams low on these orientations performed better under the competitive structure.

The study also discovered that a number of groups (level 2 students) were already engaging with other platforms, which may have introduced friction and confusion to using a new platform. Despite the generally positive comments about team-working using StarQuest, there were some negative remarks. Ten respondents said that it had not been useful to them and that they had not used it, or not much; some people said that it was better to meet in person – "We met up as a group and did work together which I think is a better way to do it" – or that they used alternative platforms instead – "most are happy using Facebook/WhatsApp etc." These feedback are also echoed by responses to Q1, where a few respondents said that they preferred

alternative tools or methods, e.g. “I preferred other ways of storing information I did not find it useful as I did not enjoy how it was organised, there are other ways to share info more effectively”, “there is other social ways to communicate with my group about articles & work via email and WhatsApp” and “Overall it is mainly like Facebook. However, Facebook is better for us as we get notified + it’s on tablets etc.” Five respondents considered it not to be relevant to them or to their needs, though most of them acknowledged that it could have value: “Good idea, wrongly used. 2nd years already had a successful format for completing [the course]”, “It’s good, it just was not in line with our groups learning style” and “Good idea. In practice, I found it [unnecessary]”. Furthermore, the fact that the platform was not used in a formal setting may have also caused a lack of commitment. Feedback to Q3 included “If it was part of the coursework then I think people would use it more” and “If it was compulsory [it would] force people who don’t contribute to make an effort”.

5. Conclusion

This paper discusses the potential of using gamification to support digital based co-curation and collaboration. The pilot demonstrates that teamwork skills can be scaffolded via StarQuest, and the mode the teams were in impacted on their level of engagement and attainment in the learning process. The academic achievement data suggests that the gamification of learning does not necessarily result in improved attainment for all students. It is clear that the marks for coursework 1 for those in the Collaborative condition were significantly lower when compared to those in the Control and Competitive conditions and consequently further investigation into the reasons for this anomaly are required. Analysis of interaction data indicates that autonomy afforded within the control and collaborative modes encouraged learners to interact more with the system, whereby the competitive group interacted less (less liking and commenting on others’ posts) but competed more within the platform and possibly outside the platform judging from their coursework marks.

The study suggests that the motivational orientation of the learners (individually and collectively) influences the learning dynamics, and that the Competitive group outperformed those in the Collaborative group, which we propose is due to the Sport Psychology students being naturally competitive, in order to increase their level and position in relation to their peers. This suggests that the subject area being studied may attract a different type of student (e.g. Sport Psychology versus Art and Design), which consequently may have significant influence over whether a competitive or cooperative climate would be most advantageous in their learning and consequently summative assessment. Therefore, further investigations into the reasons for this anomaly are required.

The pilot also emphasises that the provision may prove to be more effective with level 1 students compared to other advanced levels, linking to the motivational conditions of learners (individually and collectively) that influence the learning dynamics and culture as they level up which has also been recommended when implementing PBL in to the curriculum (Savin-Baden, 2003). Many of the level 2 students this study had already been introduced to a systematic way of looking at the PBL pathway in the level 1 module (Smith and Cook, 2012) and consequently had already established their own collaborative methods and channels of communication in the first year, e.g. using Facebook and WhatsApp groups.

Further work will include an in-depth analysis of group and individual activities under both Collaborative and Competitive modes, and to further understand students’ current engagement with their module. Additionally, future studies should seek to examine how online platforms such as StarQuest improve collaborative and co-creation activities amongst students using other channels of communication that were highlighted in the data. It is important to bear in mind that the beneficial effects of the scaffolding role that StarQuest (and other such platforms) aims to fulfil may not always be evident from online activity or in short term improvements in achievement but rather in the way students tackle problems and increase overall discourse amongst themselves, be it face-to-face or online. Gains of this kind are as such perhaps more important for the students than an increase in assessment marks, when considering the ability to function effectively in the workplace.

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