Comparing teaching approaches in two student-designed games units

Student-designed games have been referred to in many different ways in the literature, including games making (Almond, 1983; Cox and Ledingham, 1988), child-designed games (Rovegno and Bandhauer, 1994), games invention (Curtner-Smith, 1996), and inventing games (Butler and Hopper, 2011). Although there may be slight discriminations between each of these terms, they are all part of the same subject matter. According to Hastie (2010), a student-designed games (SDG) teaching unit could be described as the process in which students create and practice their own games, and in which the teacher as facilitator is able to guide and establish certain limits.

The concept of SDG emerged in the late 1960s for the first time in the physical education (PE) literature when Mauldon and Redfern (1969) introduced the idea that children were experts in game playing and therefore, they should have more liberty to create their own games.

The literature on SDG can be separated into three periods. The **Characterisation period** (1980s and 1990s) was represented by papers that identified potential educational outcomes and methodologies appropriate for teaching SDG. Although this should be considered an important period for

delimiting the understanding of SDG, none of these discussion papers presented any data that would serve to support their claims. Important educational values were considered, such as the ability to teach students to 'find out for themselves' why rules were so important in a game (Almond, 1983) and critical thinking in PE (Rovengno, Skonie, Charpenel, and Sieving, 1995). With respect to teaching methodologies, Smith (1991) was one of the first authors to clearly relate the Teaching Games for Understanding (TGfU) model while incorporating Thorpe, Bunker and Almond (1984) games categories and therefore delimitating the games that would be designed by the students. It was also during this period that a few papers directed their attention towards defining what is, and what is not, SDG. Rovegno and Bandhauer (1994) for example outlined a number of misconceptions about SDG. These authors suggested that in some ways, SDG had to overcome the idea that empowering students to create their own game does not result in 'education anarchy' in which there is no educational objective or strategy of teaching.

The **Diversification period** (2000s) focused on discussing the various curricular uses of SDG. These include using SDG as an assessment tool (Hastie and Curtner-Smith, 2006), in motivating students (Oliver, Hamzeh, and

McCaughtry, 2009), and in comparing students' behaviours in PE classes when playing teacher-designed games and SDG (André and Rubio, 2009). Unlike the previous period, these studies began to show a greater concern for academic research rigour, and thereby presented supportive data for their claims.

The **Teaching and Learning period** (2010-present) focused on diversifying different teaching methodologies and students learning outcomes, thereby blending the previous periods. That is, this period was concerned with considering the efficacy of SDG in promoting different learning outcomes and considering different teaching methodologies to enhance students' experience (see Casey and Hastie, 2011; Casey, Hastie and Rovegno, 2011). While introducing new methodologies, specific issues of SDG teaching were addressed. For instance, one major concern with respect to teaching SDG is ensuring that all students are involved in the creative process of game design. Hastie and Casey (2010) presented the jigsaw classroom method in which each student is responsible for designing a specific part of the game. Having the same concern, Giménez (2011) posed the concept of giving different roles to each student involved in the SDG process, similar to what is presented in the Sport Education model (Siedentop, Hastie and der Mars, 2011). Most recently, Butler (2013, 2016)

also presented a teaching methodology involving ten stages designed to promote the learning of democracy within game design. Butler's "Playing fair" was the second book presented in the literature that focuses exclusively on games creation.

Another concern within teaching SDG lies in providing sufficient time for the creative process of game design without diminishing the appreciated playtime of PE classes. This issue was addressed when Hastie, Casey and Tarter (2010) reported the outcomes of project where students created games outside of school using wikis as the recording and communication tool. In that study, the students, PE teacher, librarian and SDG expert (an external researcher) became interconnected beyond school hours as the students designed their games and reported its steps through the wiki. This was the first time in which information and communication technology (ICT) was used to teach SDG. Casey, Hastie and Jump (2015) also successfully used a wiki for a SDG unit with previously disengaged students in PE.

In summary, the literature on SDG has developed a level of maturity where it is now possible to delimitate what SDG actually is (characterization), understanding the different potential uses of SDG (diversification), and deepening

the understanding on how it can be taught to enhance students' experience and learning (teaching and learning) about games.

In order to expand our understanding about the teaching and learning environment, it is important that we establish comparisons between different forms of teaching SDG. In other words, the successful implementation of a given teaching approach depends on many factors (e.g. school environment, teachers and students' beliefs, interests and preferences). By consequence, rather than just presenting a new teaching methodology, the present research sought to compare two teaching approaches presented in the literature in order to gain a better understanding of potential strength and weakness of each delivery.

Given the concern of providing a deeper understanding of what could be a "better fit" to all parties involved in the teaching and learning process of a SDG unit, the purpose of the present study was to compare how two different teaching approaches had an impact on students and the teacher. The first approach involved using ICT tools during game design in order to allow student involvement beyond class time, while the second (and more traditional approach) saw students designing games with face-to-face interactions during their regularly scheduled PE lessons. More specifically, the study sought to identify how each

approach affected both the teacher and students. For the teacher, issues of planning and instructional support was the focus. For students, issues of overall engagement as well as the ability to work together as a group were the key topics of study. Together, these data serve to add to previous discussions as they identify some of the benefits and drawbacks of teaching SDG when using different teaching approaches. Although the literature has presented different possibilities for the implementation of SDG, a comparison between two different approaches may help teachers decide which provides a better fit for their own experience and their expectations for their students.

Methods and procedures

Study design

The present study was conducted using a case study design. According to Stake (2003), a case study is a system that may be able to identify the diverse elements that compose its organization, explaining how each component interferes with one another and what can be learned from this relationship. In the present study, there were three elements that needed to be considered, these being the teacher, the students, and the different forms of interactions promoted by each of the two teaching approaches.

It is important to acknowledge that the researcher taught both SDG teaching units. Having an ongoing interaction with students and blending the activities of teaching and data collection, having an ongoing role as a teacher allowed the researcher to provide a practical point of view as he dealt with the same challenges as other teachers. Hence, the study design was able to provide a contextualized description of the environment. Moreover, having control of both teaching units also guaranteed that both group of students were receiving the same quality of instructions, and thereby increasing the internal validity of the study.

Both SDG teaching units were conducted concomitantly, and both used the same pedagogical principles presented by Hastie (2010). The key difference between the two units was that one iteration involved the use of ICT tools in which student designed their games online and outside of formal class time, while the other followed a more traditional, in-class format where students engaged in face-to face interaction to design their games during class time. These differences allowed for the in-depth examination of the differences between (and hence the strengths and weaknesses) of each format in terms of teacher planning, in-class instruction, and reflection, as well as the students' responses to the SDG process.

In order to render the SDG experience as complete, both groups progressed through the five stages of game design recommended by Hastie (2010). The introduction of SDG (stage 1) was the process of checking students' previous knowledge, introducing the concept of games categories (Bunker and Thorpe 1986) and assessing their understanding of the subject matter. Game design (stage 2) involved learning about students' roles (e.g. documenting the game while designing it), and leading questions to design their games. Playing each other's games (stage 3) involved the student design teams playing other groups' games and giving feedback. Game refinement (stage 4) was the process of modifying rules and reconfiguring games to improve the original version of the game. Establishing the final game (stage 5) was the process of preparing the game's playbook in its final version.

Following Hastie's (2010) 5 stage game design, the two teaching approaches differed on where/how the games were designed. The students from the non-technology (NT) group performed all game design activities within their scheduled PE class time. That is, each lesson provided time for students to discuss and write how their games would operate. This NT class was not required to do any activity outside the school. The NT teaching approach has been previously

used in the literature (see Hastie and André, 2012, André, Hastie and Araújo, 2015). On the contrary, ICT students performed all game design activities outside of the PE classes. During their scheduled class times, the focus was directed towards game play, with the goal of increasing the time that students had to explore and experiment with their games. To achieve this, the virtual hub known as "Edmodo" was introduced whereby the students from the ICT group were able to communicate with group members, peers from other groups and the teacher at any point of the day.

Edmodo is a website designed to create a virtual classroom environment in which teachers and students are able to communicate online. In essence, Edmodo can be described as the 'educational Facebook'. It has a similar design to Facebook, making its navigation intuitive and user friendly. The students from the ICT class used Edmodo to design their own games, post their rules ideas, upload diagrams of the game court, and to engaged in discussions that could be limited to group members or open to every student in class. The decision to use Edmodo and other supporting ICT tools (e.g. Microsoft PowerPoint and web-based tools) was based on the first author's positive experience teaching with these tools as well as students' familiarity with the conventions of Facebook (of which over 95% of

students had an account). The ICT teaching approach has been previously used in the literature (see Hastie, Casey and Tarter, 2010; Casey, Hastie and Jump, 2015).

Participants and setting

The participants in this study were 82 eighth and ninth-grade students (34 male, 48 female) from a junior high school located in the southern region of the United States. The school enrolled 1,100 students of which 25% received free or reduced school meals and 87% had English as their first language. The students became members of 17 construction teams that remained together for the duration of the project. The NT group consisted of 31 students divided into 7 groups, while the ICT group had 51 students in 10 groups. The school selected for this study provided a laptop for each student and therefore all students were eligible to participate in either intervention.

The school offered PE classes every other day so that students participated in two classes one week, and then in three during the following week. As a result, the intervention was designed in a way that the researcher would teach one class each day, alternating the ICT and NT groups. Although there was no allocated time to complete the project, ultimately, the SDG intervention consisted of ten 75 minutes lessons for the ICT group and eleven 75 minutes lessons for the NT

group spanning for 5 weeks. All participants provided assent to participate and their legal guardians gave informed consent. The study protocol was approved by the university's Institutional Review Board for human subjects.

Data collection

This study incorporated four different methods of data collection. For all students, these included field note observations, interviews, and lesson plans. For the ICT group, data were also collected from the entries from each of the 10 Edmodo pages (one for each group of game design).

Field note observations. The researcher used a portable digital voice recorder to make personal observations about students' actions during all lessons. The observations included descriptions, analysis, students' quotes and informal interviews with students during lessons.

Interviews. At the end of the intervention, all students participated in group interviews which had two goals. First, they were used to double check what was reported in other methods, and second, they served to provide further explanations on those features of the units that enhanced or diminished the students' experience.

Lesson plans. The lesson plans of the teacher-as-researcher were used to analyse the strategies, content and evaluations included in each lesson to enhance the students' experience and optimize their learning.

Edmodo. As a data collection method, Edmodo may be seen as an extension of the field note observations, given that the researcher was able to visualize posts from all students while they designed their games.

Data Analysis

The systematic process of inductive analysis and comparison proposed by Lincoln and Guba (1985) was used to filter the data from the four sources. First, the field notes observations and Edmodo posts recorded were examined to establish the first interpretations on how students and teacher reacted to each of the teaching methodologies. Second, these interpretations were compared with the interview transcripts and lesson plans in order to confirm or contradict the preliminary interpretations. When accumulative data confirmed the same concept, themes were generated. Throughout this process, the researcher also was careful to look for deviant or negative cases, that is, events or comments that ran counter to the events that run counter to the emerging propositions or hypotheses.

Trustworthiness

The present research used two methods to ensure trustworthiness: triangulation and ethnographer observer. Triangulation is the process in which multiple methods are used to analyse the same research question, providing a more holistic perspective and reducing the likelihood of misinterpretation (Stake 2002). This study used four methods to answer the four research questions. The data collected with one method were either re-evaluated with another data collected from another method (in order to guarantee research rigor) or further explanation was drawn as each method provided complementary information regarding the subject matter that was being analysed.

Use of an ethnographic observer is a process in which another researcher who is considered an expert on the studied subject matter, takes a supporting role to ensure that the proposed theoretical framework is being properly delivered (see for example, Hastie and Buchanan 2000). In the role of this ethnographic observer, the second author attended many lessons of both groups (NT and ICT) and had several meetings to discuss the intervention pedagogy in order to provide his perspective on: (1) how SDG was being taught; (2) reassuring that the ICT group and the NT group were both receiving a quality SDG lessons; (3) making

his own observations (in class) regarding each research question in order to work as a member check when the researcher was drawing analysis of students' actions.

Results

The results of this study are presented in accordance with the four research questions. Thus, the findings of each role involved in the teaching and learning process (students and teacher) are reported while considering each teaching approach (ICT and NT) and each research question. Therefore, the results are presented in four sections: (a) teacher's planning, (b) teacher's demands for supporting students, (c) students' overall engagement, and (d) students' ability to work together.

Teacher's planning

There were two main topics that affected the teacher's planning. These have been given the labels of "introducing students to new culture(s)" and "providing resources to support game design".

Introducing students to new culture(s). Given that only three out of the 82 students (from both classes) reported having some previous experience in designing their own activities in PE, SDG presented a new scenario for most of the participants in this study. Most students seemed to enjoy this freedom of

choice. The following quote from one interview is representative of the opinion of many students: “You don’t get to do what you like to do in PE a lot of times, like a lot of games in PE are kind of stupid, but when you make your own game, you actually get to do what you like to do”.

Unlike most PE classes, the students were empowered not only to decisions that included who they would work with and who they would play with, but more importantly, with decisions about the content included in classes. Moreover, students had to deal with the idea that rather than playing familiar games with established rules, they had to think about how games should fit their needs and interests. Although these were elements that were welcomed by most students, it still required some time for them to full appreciate the idea, particularly as they were being held accountable to deliver certain assignments in order to have a PE class. Despite of all this novelty, the teacher had little difficulty in establishing the new culture with the NT group (field notes).

Nevertheless, when including the responsibility of creating a new game also required work outside of school (ICT group only), a further new culture was also established, that being the idea of “PE homework”. The teacher found this as a much more challenging culture to institute. As one student noted in the

interview, “I’d rather do the work in class because if everything [game design] is at home I think I forget about it or I procrastinated and would not do it.” Although establishing the idea PE homework was a challenge that had to be overcome, it also seems to increase student responsibility. This empowerment was well received by some students as with time, they became more independent, thereby reducing the need for the teacher to pressure students with respect to performing their duties (field notes).

Providing resources to support game design was a required modification that the teacher needed to address in the ICT group. The process of working outside of school also required working in groups and also working online. In order to reduce the possibility that students were not being able to login, the teacher included a section on how to login during a class at the beginning of the unit (lesson plan). However, the biggest challenge was getting students used to logging in to Edmodo outside of school.

In order to encourage students, the teacher invoked three strategies. These were: (i) making Edmodo look ‘fresh’ by introducing new content every day; (ii) making the interface user-friendly by including instructional videos; and (iii)

including entertaining content such as videos of different games that are less common in the American culture (lesson plans).

As a result, implementing the SDG unit using ICT required an overwhelming number of new practices that were not part of these students' prior PE routine. Consequently, the teacher had to provide resources that supported students in many different ways. These included: (i) helping students log in to Edmodo, (ii) creating video tutorials explaining Edmodo's interface and tools, (iii) following students game design progression in Edmodo, and (iv) dealing with technical issues while dealing with the technology (lesson plans). Despite having many new duties to teach students with ICT by the end of the SDG teaching unit, the ICT lessons required less planning as most students were able to take responsibility for their assignments. It is also important to acknowledge that setting up these resources was particularly time consuming because of the novelty of the approach. It could be reasonably expected that future units would be much more streamlined as most of these tasks would already be in place (lesson plan reflection).

Teacher's demands for supporting students

There were two main topics that affected the teacher's demands for supporting students. These were (i) teacher direction of student work; and (ii) the degree of linearity in students' work.

Teacher direction of student work. When comparing the two teaching approaches, the teacher's direction of student progress was almost a mirror image across the two formats. That is, during the game design stage (stage 2) the teacher had significant input into students work in the NT group, while having much less during the refinement of the game (stage 4). This scenario was reversed with the ICT group. In this case, the teacher had little involvement during the game design phase, but significantly more during the refinements of the game (field notes and lesson plans).

The format on how these units were designed by the teacher played an important role in this regulation of the students' work. In the NT group, the teacher had all students working on the same activities at the same time. As a result, the teacher was able to visit each group while they were discussing their ideas (stage 2) and talk to them about how their game design was developing. With the ICT group, there were significant variations on how much support/ feedback the teacher was able to deliver for each group (Edmodo). For example,

during the game creation phase, the teacher had less awareness of how students were conducting their game design. This was because Edmodo was not used on regular basis by some groups, and additionally, the students rarely asked for help.

As previously mentioned, despite the strategies put in place to encourage students to adopt Edmodo, there were some groups that did not use this platform. As a result, the teacher was not able to give much feedback to these students during their design process (field notes & Edmodo). However, it is important to acknowledge that this finding was more related to students' behaviour (lack of use of the chosen platform – Edmodo) than the ability to follow students work through the online platform.

In summary, while considering the beginning stages of game design, the NT group was taught using a 'fill in the blanks' approach in which the teacher presented a more restricted pathway with students completing the tasks as they were given. On the other hand, the ICT group was taught in an 'open-ended' approach. That is, the teacher posted questions and tried to instigate their creativity, seeking to provoke their critical thinking, but was unable to assess this process most of the time.

The teacher also experienced different scenarios during those times where the students were refining their games (stage 4). In the NT group, after playing the games, several groups would engage in discussions at the same time, hence, the teacher struggled to follow all conversations, having less chance for the teacher to moderate all students work (field notes and lesson plans). At times, this was considered problematic as the discussions would often lose track and start focusing on who won/lost the game and who was responsible for a failure or triumph (field notes).

On the other hand, the teacher had more input into the discussions and students' work of the ICT group. He would pose specific questions in Edmodo to lead the discussions in a way that students were able to identify the major positive and negative elements of the played game. Sample discussion questions included: "Did you like the game? Explain why or why not? What rule would you change? Although not all students participated in the discussions, there were a greater number of students who engaged online in this stage of the game creation compared to the number of students engaged in stage 2 (Edmodo & lesson plans).

While comparing the two groups of students it is important to call attention that what was reported in the study is a result of the teaching approach

(ICT or NT) and students' behaviour. In other words, the teaching approach may provide the possibility of more or less support to students' work, but students' accountability would also be crucial to determine if other environments would provide similar or different findings.

Degree of linearity of students' work. The different teaching approaches affected how students would work and by consequence, the demands for supporting students also varied. Although the five stages of game-design were introduced in the ICT group, different groups were working on different stages at a same time. That is, while there were students who had already presented and played their game and therefore they were starting stage 4, other groups were still working on stage 2.

The NT classes followed a predictable linearity in the presentation of each of the five SDG stages. That is, there was a clear delimitation when progressing from one stage to another in all five stages. Given that all activities were developed in class, the teacher could determine when one stage was complete and when new challenges had to be provided to students (lesson plans).

As a result of these differences, the teacher workload varied. In the ICT group, the lack of linearity among different groups meant a greater workload, as

different students were dealing with different issues during the same period of time (lesson plans). On the other hand, in the NT group, the teacher was able to address many issues that were common to many groups while addressing the entire class (lesson plans).

Students overall engagement

It is important to acknowledge that students' overall engagement was perceived as very high in both groups as all groups were able to fulfil all their game design tasks and they all showed an interest in the process of game design. While few students were ever off-task (field notes), there were significant differences across groups. While it is not being claimed that the students from the ICT group were more engaged than there NT peers, it is important to note that this teaching approach did have the potential for greater engagement due to extended times when students could engage in group work.

As previously mentioned, the ICT group followed an 'open-ended' teaching methodology and as a result, students from this unit suggested they had greater autonomy. Given that the process of game design occurred outside regular school hours, the students needed to learn to: (i) work by themselves, (ii) determine when they would work and (iii) how much time and effort they would

contribute during this process. These requirements carried two interrelated outcomes: students were able to work on their own pace; and students had greater opportunities to contribute according to their interests (field notes).

As a result, students' engagement varied greatly. For instance, when asked how one of the groups worked outside the school, one student respond: "Well, I got in Edmodo every day because I got the App and then towards the PowerPoint part [playbook] I saw that 'Paul' (pseudonym) was not posting so I posted on Edmondo reminding everyone" (interview). This reaction shows how one student went above and beyond engaging in Edmodo's teaching opportunities and called attention to other group members that were not as engaged. On the other hand, it was clear that the activity on the Edmodo site became more substantive by groups on the days just before they were due to present their games in class.

Despite this increase in autonomy and opportunity to participate, a number of ICT students considered this to be an overload of the requirements expected for traditional PE classes. This was particularly the case in the weeks where there were three lessons scheduled. Given that the ICT students had to design and make refinements of the game outside of class, these students seemed overwhelmed

when they only had one day to prepare between classes (Edmodo, field notes and interviews).

As mentioned previously, the NT group followed a 'filling-the-blanks' teaching approach. As a result, students that were taught in this group had less autonomy. Given that all activities were done in class, NT students were more reliable in terms of fulfilling their responsibilities throughout the semester. The teaching methodology along with the students' reactions led to two important consequences when considering students' behaviour. First, all students followed the same pace throughout the unit, and second, it was easier for students to follow all class activities.

As mentioned previously, the NT group followed a linearity in the presentation of the five game development stages. As a result, NT students had the same amount of time to work through each stage. Of the seven design groups, only one had difficulty in keeping the same pace as the other six groups during game design (field notes). It is suggested that this due to the NT students having a better understanding of what they had to do in each given stage, together with the higher level of direct support from the teacher during class (field notes).

Students' ability to work together

There were two main topics related to students' ability to work together. These related to (i) intra/ inter group communication, and (ii) the quality of playbooks.

Intra/ inter group communication. When considering group members' interactions (intra group) while designing their games (stage 2), the ICT students reported difficulties in designing their game outside of class. Indeed, many groups chose not to use Edmodo while designing their game. Moreover, although Edmodo is designed for students to place comments in different time periods, none of the groups approached game design in this way. As a result, many students chose to communicate in more direct ways such as talking to each other between classes and/ or talking on the phone (Edmodo). Two interview comments help to illustrate this logic: "You would call somebody and say: 'Get on Edmodo', but by that time, you already called so what was the point?" and "To me, it was just better to say some ideas [to my group] in person, I would just rather explain it, than type it. In Edmodo, you would never know who would be in and when."

The NT students reported positive relationships and productivity in intra-group interactions while designing their game in class. While NT students did not report any issues of miscommunication while designing their games, it is

important to acknowledge that the groups used different approaches to game design. Out of the seven groups, three groups designed their game in a very active manner. That is, they did not sit down for long and talk about their game plans. Rather, they discussed one or two ideas and started testing them within a few minutes after they were given the assignment. The remaining four groups discussed their ideas for a longer period, doodled court diagrams and even talked about a few specific situations before trying their game (field notes).

However, the opposite outcome was found when considering the inter-group interactions when discussing game refinements (stage 4). The ICT students reported positive and productive interactions while discussing games refinements online. In the ICT group, students discussed the game after class while logging on to Edmodo. The teacher would write a post asking for students' opinions of the game that they played in class and each student had to reply with their opinion about the game and explaining their reasons. The following quotes illustrate how this procedure took place in Edmodo:

- (Teacher) "If you are receiving this post please reply to the game you played last PE class presented by the 'Bear' and 'Tigers' (pseudonyms) groups. 1) Did you like the game? Explain why or why not? 2) What rule would you change? 3) Was the game challenging?
- (Student response) "We played the 'Tigers' game. It was fun, but I think that the idea of passing the ball to another person is bad. The game ends

> too quickly. It would be better to have 2 dodgeballs on each team and the first group that gets all the 4 balls wins. Other than that, love it (:"

The ICT students were very focused on discussing the refinements to their games. In Edmodo, students communicated in a very positive way, not only on the refinements of the game, but also in the aspects that they enjoyed, having positive feedback in most of the posts (Edmodo). Two student quotes support this notion: "Everyone said at least one thing, something nice and then they might have added a suggestion"; "If they said that something needed to be improved, they said it in a nice way" (interview).

In the NT group there were reports of negative interactions among inter-group interaction while discussing games refinements. The NT group were sometimes very critical of other groups' games or when game owners were sometimes unwilling to listen to suggestions. The following quote from an interview explains why one student refuted another's suggestion: "There would be groups that would want to mould the game to make it easier for them to play…saying like 'make the goal bigger'. In fact, the goal was already big, it's them that can't score". Apparently, the NT students had a difficult time of

detaching the competition that occurred between game play and the game refinements.

Good quality of playbooks. The quality of playbooks is reported not as an element that affected students' ability to work together, but rather as an outcome of their group work. The ICT students had the opportunity to start designing their game while answering the leading questions of a PowerPoint presentation posted in Edmodo. As a result, students had the ability to change their playbook as they made changes to their games. The playbook presented by the ICT students were able to follow all the leading questions with significant detail, and they showed a greater concern for presenting all rules with the advantage of presenting visual aids that enhanced the overall understanding. This group was also able to include clear diagrams (while using PowerPoint's drawing features) as well as extra features that went beyond the initial requirements, such as the inclusion of illustrations that showed the equipment that were used in the game.

The NT students' playbooks were not as sophisticated compared. First, the process of writing the playbooks in the NT group started only at the very end of the unit. Second, the NT group playbooks provided less information about their games. The most common issues found with the NT playbooks were: (i) unclear

diagrams, and (ii) rules were simplified, (most playbooks missed important rules). It can be concluded that not having the tools that the ICT group had in the Microsoft PowerPoint, the NT students were unable to present clear diagrams due to a lack of drawing skills. Although the NT students were given a designated space to include each rule that was asked in the portfolio, none of the playbooks used all of the space given (field notes).

Discussion

The purpose of this study was to reflect upon the different teaching approaches available to deliver SDG. It is important to acknowledge that comparing different teaching approaches while conducting a qualitative study is a difficult task as the results should not be seen as generalizable, rather as a reflection upon experiences that may aid teachers to select a teaching approach that enhances students experience and learning as well as considering the teacher's own preferences and at last, the school environment. Hence, making the decision of which teaching approach to select is not an easy task as many elements must be considered. The present study has established a comparison between two groups from the same population of students, with the same school environment and having a single teacher-researcher as a reference. Therefore, as

much as possible, the study sought to eliminate variables that would unable a fair comparison, however given that the study was taken place in a school (an environment open to diversity among different classes) variances from group to group are always expected.

Considering the four research questions (i) teacher's planning; and ii) teachers demands for supporting students; iii) students' overall engagement; and iv) students' ability to work together as a group), the discussion section presents further deliberation on four topics: i) teacher experience, ii) teaching style preference, iii) students' engagement, iv) students' relationships with peers.

Teacher Experience: planning & supporting students

Student-designed games is proposed as a content and methodology to be implemented within a student-centred perspective for physical education. However, when considering the teaching styles, it is important to acknowledge that there is a spectrum between directive teaching (teacher as an instructor) and student-centred teaching (teacher as a facilitator). In the present study, both teaching approaches were focused more towards the latter end of the spectrum. However, the ICT teaching approach provided students with even more freedom of choice and therefore it was more student-centred. It is important to

acknowledge that the ICT tools alone could not be considered as a reason to make this statement. The ICT approach included the process of designing the game as a take home activity, and this chosen pathway led to a number of consequences that required the teacher to integrate different sources of knowledge. The teacher had to be able to integrate his previous experience with SDG, constructivism and ICT tools. At this time, we would call attention to the Technological Pedagogical Content Knowledge (TPACK) theoretical framework presented by Schmidt (2009). According to this author, in order to deliver a teaching approach in which includes technology integration, one must be able to link all three forms of knowledge (technological, pedagogical and content knowledge). In the present study, the teacher sought to link all three forms of knowledge: Edmodo and supporting software (technological), constructivism (pedagogical) and SDG (content). Considering that each source of knowledge alone can be considered a challenge, the teacher in this study felt more tested implementing the ICT approach as he sought to make these links.

In the NT approach, the teacher was able to perceive students' difficulties as they were designing the game while interacting with students face-to-face. Hence, he felt it was easier to provide suggestions on how to approach specific

problems. In the ICT condition, the teacher would interact with students online and would often be unaware of all issues that students had encountered during the game design process. As a result, the teacher in the ICT condition felt that he had to think more about his previous experiences as he anticipated what issues students might encounter. Thus, his experience seemed more important to guide students in within the problems that could arise.

The ICT condition also required experience with multiple ICT tools. The technological interface chosen to conduct this study, Edmodo, is a good example why ICT experience was needed. Although the teacher had experience with Edmodo and chose this interface due to its user-friendly design, the students still needed to be taught its tools and features. The teacher chose to create instructional videos with screen recordings in which showed how to navigate in Edmodo. The production of these videos required the ability to use another software that enabled the teacher to record his own computer screen. Consequently, technological skills beyond the specific ICT tool chosen may be needed. Inan and Lowther (2010) have shown that teachers had this same perception while analysing the main factors that influenced teachers to use ICT tools in their teaching. The feeling of readiness (capabilities and skills needed to integrate

technology in instruction) was the most significant of all variables analysed, overcoming even teachers' beliefs.

It is important to acknowledge that the introduction to SDG alone may be considered a 'culture shock' for many students. This culture shock may lead to the belief that SDG is just a new form of 'ball rolling' as Rovegno and Bandhauer (1994) were able to identify as one of the most common misconceptions of SDG. Moreover, the teacher needed to consider the school culture when implementing SDG with the proposed ICT condition as it required another number of "culture(s) shocks". Given that all student had laptops for all other classes, the teacher believed a priori it would be easier to use technology integration in this school. Nonetheless, the biggest change for students in the ICT approach was the introduction of homework assignments, a case considered problematic by many. Mitchell, Stanne and Barton (2000) have reported that despite teachers' positive response of using homework in PE, few teachers use this procedure. In addition, the resistance of PE homework may even come from their parents. Tannehill, Romar, and O'Sullivan (1994) reported in a study that over 70% of parents were against PE homework. Therefore, the teacher needed to justify his teaching

methods as well as strategies to engage in an activity that is not considerate PE culture.

Finally, the ICT teaching condition also produced a greater workload as the teacher had to deal with assignments beyond lesson plan preparation and teaching classes. This was consistent with the findings reported by Hastie, Casey and Tarter (2010) when teaching SDG with wikis (ICT tool) with a similar teaching methodology.

Teaching Style Preference

The way in which the teaching approach was designed also affected the teaching style. When students were given a take home assignment to be completed as a group, they had to deal with several decisions involving inter-group interactions (cooperation, leadership, listening skills, work division), as well as the amount of time and effort given to complete each task. Hence, students in the ICT teaching approach were required to be much more autonomous given that the teacher did not have control on any of these elements. By consequence, the SDG with the ICT teaching approach required the teacher to have less control of students and a reduced capacity to hold them accountable. At times, this was challenging, particularly when students were responsible for presenting their

game in the upcoming class, but where the teacher could not see any evidence on Edmodo of them being ready. As noted by James, Griffin and Dodds (2008) despite teachers' efforts to promote an instructional alignment and classroom ecology (in which this case would extend to the online environment), teachers may seek to promote environments that are not favourable to what they seek for students to learn.

As reported in previous research, the present study also reported that students approach game design in many different ways and as a result, it would be best if different teaching approaches would be able to address this matter. Hastie and André (2012) reported that boys and girls show different approaches to designing the games. Boys are usually 'doers' (where they design their game by testing their theories) and girls are usually 'planners' (where they create the entire game before testing it). This is another indication that it is important to provide different game design options to optimize student productivity. Given that students in the ICT group were unable to pick their own designing preference, it would be understandable that some students just chose not to use the online platform given to design their games as they would not fit to the 'planner' profile that would be needed in this approach.

Students' Engagement

Students' overall engagement were high in both teaching approaches. As previously mentioned, all design groups completed all their game design tasks without the need of any form of extrinsic motivation (e.g. punishment or rewards). Student interest and engagement in this study was consistent with previous studies that used both forms of teaching approaches – NT and ICT (André, Hastie and Araújo, 2015; Hastie & André, 2012; Casey & Hastie, 2011; Hastie, Casey & Tarter, 2010; André & Rubio, 2009). Nevertheless, when analysing each one of the groups separately, it is important to acknowledge that while the ICT groups had higher variations of students' engagement, the NT group did not vary greatly. That is, most NT students spent the same amount of time and effort completing any given task. This outcome would seem consistent with the "filling in the blanks" teaching style. On the other hand, although ICT students complained about having homework in PE, it was still considered a powerful tool to enhance students' engagement. That is, the ICT students had the opportunity to choose to dedicate more time and effort when they showed and interest and need. However, it is important to acknowledge that a variation on student engagement did not only meant a higher engagement, some design groups

from the ICT group also showed a lower involvement when comparing to the NT groups.

The key factor producing this variance in engagement was not the use (or lack of use) of ICT tools, but the teaching approach that involved take home assignments to be done in group work. Most ICT students did report to be dissatisfied in having homework assignments for PE. In spite of that, many ICT students reported a higher dedication than NT students. According to Hastie and Pickwell (1996) students are engaged in class either driven by their own interests or by being motivated. Thus, the feeling of being obligated and/or interest to complete an assignment (interest of being successful in class) in the ICT group overcame NT students' interest in SDG, leading to an overall higher dedication in their game design preparation.

Another element that needs further deliberation when considering students' engagement is the learning environment promoted during the game design process. The major issue with Edmodo was related to the fact that students did not choose to use Edmodo as it was presented to them. It was suggested that students would post comments in different times and lead towards a discussion that was ongoing and would eventually create a game. Students that did use

Edmodo scheduled a time to meet their group members online, and students that did not use Edmodo claimed that it was hard to schedule a time that would accommodate everyone's agenda. Waters and Napier (2002) identify five elements to create online teams that are able to complete their tasks successfully: getting support from the facilitator, getting acquainted with group members, establishing the form of communication, trust among teammates, and getting organized (determining each member's role and their objectives with specific due dates). On the one hand, given that all students in the ICT group were able to pick their group members, it can be stated that knowing their group members and trusting them should not be considered major issues. On the other hand, the other three elements may explain why students had so many issues in designing their games online. First, the instructor had difficulty in supporting all groups. Given that they chose to use Edmodo as a chat room, the instructor would only see the entire discussion after it was completed. Second, although most students wanted to meet online all at once, some students would place comments and wait for answers, showing that they chose different forms of communication. Third, students did not show a clear pathway on how they organized themselves, and the instructor did not give clear instructions on how they were supposed to

accomplish this. As a result, in order to expect a better online engagement, it is necessary to teach students how to collaborate online.

As a result of these findings, the learning environment during the game design process appeared to be a process that needs further study when implementing an ICT teaching approach to game design process. Of interest, however, is that recent studies have also shown this to be a concern with the NT approach. Butler (2013, 2016), for example, has emphasized the need to create an environment that leads to a positive collaboration while creating games. Butler calls attention to the creation of rules for consensus building, group decision-making process, majority rules voting and inclusion. Hence, although SDG have been claimed as a powerful tool to promote teamwork and cooperation (Almond, 1983; Hastie, 2010), Vidoni and André (2016) have reported that although most students are able to create a positive learning environment, a lack of teacher orientation in the group organization can lead to students' exclusion and off-task behaviours.

Students' Relationships with Peers

Students from both teaching approaches dealt with two kinds of relationships during their SDG units: intra-group (game design group members) and inter-group (students from different groups).

In both teaching approaches, students were able to have positive interactions with their group members. However, the effectiveness of their communication varied according to their teaching approach. The majority of the students from both groups stated how they wanted to work together when designing their games. Considering that Edmodo did not promote this directive (live) form of interaction, the ICT students had difficulty in using Edmodo while designing their game.

In class, the NT students were able to approach the game design in different ways. The girls would remain sitting and discuss the entire game before they would test it (‘planners’), whereas most of the boys would not discuss their ideas for long without testing their theories (‘doers’). In the ICT group, boys had significantly less participation in Edmodo than girls, showing that the game development of ‘planners’ and ‘doers’ may have played an important role. Edmodo was not as much an imposition for girls because they were still able to discuss each rule one by one before trying their ideas. However, if boys are

'doers', the online game design that was imposed by Edmodo did not fit their game design preferences.

When considering students' relationships among students from different groups (inter-group), a big disparity was found between the two teaching conditions. The ICT group showed to have a more productive interaction among inter-group discussions when comparing to the NT group. Although Edmodo was considered a restraint for developing the game design, it was considered more 'democratic'. This seems to be consistent with the literature that reports a positive interaction among students when collaborating online (Yücel and Usluel, 2016) and when feeling valued in an online interface (Kuo and Belland, 2016). Although this literature relates to online higher education, the principles in which were reported in these studies seem to be consistent to what led the positive interaction among pupils. Students who are constantly overlooked in PE such as girls and lower skill students (similar to the minority students reported by Yu-Chun & Brian, 2016) were the most active in Edmodo. This form of discussion was also considerate more appropriate since the teacher was able to initiate all groups' discussions by placing the focus of attention. Moreover, students were able to express themselves without being restrain by others. Holland and Muilenburg

(2011) reported similar findings showing that Edmodo was able to promote discussions with big group of students. The authors also recognized that students needed guidance to discuss the desired subject matter otherwise students would discuss personal matters.

Conclusions and Future Research

The present study established the comparison of two different teaching approaches while teaching SDG in order to identify what may enhance or diminish students experience and teacher practice in each teaching condition (ICT and NT).

In the present study, the teacher as a researcher felt that he dealt with more challenges while conducting the ICT teaching approach. The teacher had to anticipate some of the issues that students would encounter in their games while promoting questions in an online interface. The technological challenges were also greater than what was initially anticipated, showing that a technological knowledge beyond the interface that was being used (in this case Edmodo) showed to be crucial to resolve some of the issues that arose. Moreover, the choice of the teaching approach should also consider the preferred teaching style. While both approaches were conducted using a student-centred perspective, the ICT approach gave students more freedom as they designed their game with less directive supervision. Hence, while providing different forms of students' work supervision, teachers may also what to answer the question: How much freedom should I be giving to my students?

The study found that students had gains and loss in both teaching approaches. In the ICT approach, students felt restrained in designing their games, but had more productive interactions among classmates. In the NT teaching approach, students had a better interaction with their group members, but many challenges arose when interacting with other classmates about game refinements. Different student populations and schools lay lead to different outcomes than the ones reported in this study, however being able to identify the learning environment and its many variables seems as crucial components to be considered when deciding upon the teaching approach.

There are many forms of teaching SDG and further research is needed to understand what can enhance or hinder teacher's practice and students' experience in each given condition. The present study is able to provide contextualized descriptions that may enhance our understanding, however some of these findings may be further explored with quantitative methodologies while seeking for further generalizations. Moreover, in future research, a hybrid teaching approach may be considered in order to include the main features of each teaching condition. In this scenario, it could be suggested a face-to-face interaction while designing the games (NT), and online games discussions (ICT).

The face-to-face interaction may give students the ability to approach the game design in different forms and the online interactions may ensure opportunities for all students to discuss the game. Moreover, knowing that ICT may use different tools that are likely to change over time, other ICT tools may be considered when proposing other ICT teaching approaches in SDG.

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