

Original citation: Emblen-Perry, Kay (2017) *Promoting Education for Sustainability Through Game-based Learning : Using the Sustainable Strategies Game to Improve Students' Knowledge and Skills of Sustainable Business Practices*. In: Handbook of Sustainability Science and Research. World Sustainability Series . Springer International Publishing, Cham, Switzerland, pp. 849-866. ISBN Hardback: 978-3-319-63006-9 eBook: 978-3-319-63007-6

Permanent WRaP URL: <https://eprints.worc.ac.uk/id/eprint/6022>

Copyright and reuse:

The Worcester Research and Publications (WRaP) makes this work available open access under the following conditions. Copyright © and all moral rights to the version of the paper presented here belong to the individual author(s) and/or other copyright owners. To the extent reasonable and practicable the material made available in WRaP has been checked for eligibility before being made available.

Copies of full items can be used for personal research or study, educational, or not-for-profit purposes without prior permission or charge, provided that the authors, title and full bibliographic details are credited, a hyperlink and/or URL is given for the original metadata page and the content is not changed in any way.

Publisher's statement:

This is an Accepted Manuscript of a book section published by Springer International Publishing, on 4 October 2017, available online: https://link.springer.com/chapter/10.1007%2F978-3-319-63007-6_51

A note on versions:

The version presented here may differ from the published version or, version of record, if you wish to cite this item you are advised to consult the publisher's version. Please see the 'permanent WRaP URL' above for details on accessing the published version and note that access may require a subscription.

For more information, please contact wrapteam@worc.ac.uk

Promoting Education for Sustainability through game-based learning: Using the Sustainable Strategies Game to improve students' knowledge and skills of sustainable business practices

Kay Emblen-Perry, Worcester Business School, University of Worcester, Worcester, UK.

Abstract

The need to ensure that learners acquire the knowledge and skills required to promote sustainable development and evolving preferences for experiential and collaborative learning within Higher Education are reshaping approaches to Education for Sustainability. In response the Sustainable Strategies Game seeks to provide experiential game-based learning and teaching for business sustainability within Worcester Business School.

The Sustainable Strategies Game aims to stimulate collaborative engagement in business strategy making that promotes sustainability literacy skills, the adoption of sustainable practices, the sustainable use of common resources (freshwater) and encourages students to explore the equitable sharing of benefits gained from the use of this generic resource.

This paper presents qualitative evidence from research conducted into student perceptions' of the effectiveness of SSG as a new way to learn and think about business sustainability. It utilises the HEA Framework for Engagement through Partnership and the Framework for Engagement in Game-based Learning and Teaching to explore the value the Sustainable Strategies Game has for experiential and collaborative learning for Education for Sustainability and its ability to engage students in the complexities of integrating social, environmental and economic impacts of consuming natural resources within business operations. The findings suggest that the Sustainable Strategies Game provides an entertaining learning environment that challenges sustainability thinking and behaviours and encourages students to engage with the key principles of business sustainability and investigate business strategies that carry less impact on society and the environment.

Key words: Student engagement, Education for Sustainability, game-based learning, experiential learning, business sustainability

1. Introduction

Learners' preferences for interactive, experiential learning are now rapidly evolving in Higher Education (HE) environments. This, coupled with the need to promote literacy skills in sustainability to prepare students for the workplace, are reshaping the practice of Education for Sustainability (Efs) in HE (HEFCE 2013; Higher Education Academy 2015). These trends are moving traditional instructivist approaches to learning and teaching towards participatory user interactions (Conole and Alevizou 2010).

To address these preferences, the author utilises group-based games to offer a

participatory approach to EfS learning and teaching for Level 5 and Level 6 students. This research explores the effectiveness of one of these games in engaging students in learning for sustainability; the Sustainable Strategies Game (SSG). This game underpins the ethos of sustainability taught within the generally instructivist business curriculum: efficient and equitable use of natural resources, environmental and social impact mitigation, collaboration, resilience etc. Frequently these require the inclusion of moral and ethical sensitivities. Embedded within the game is the expectation that players will challenge their own, as well as organisational, sustainability values.

SSG is designed to enhance experiential learning and develop student engagement in business decision-making within the complexity of sustainability. The game strives to increase students' understanding of the potential impacts that organisations can have on the environment and society and encourage their exploration of alternative strategic responses. This requires them to consider economic growth, prudent use of natural resources, protection of the environment and influence on the neighbouring communities. It also engages students in the softer skills of business management such as influencing, collaboration and negotiation within a safe learning environment.

Student engagement is one of the most important issues currently facing the HE community (Leach 2016). It presents an important learner-centred approach to EfS that is likely to enhance learning outcomes including retention and improved employment prospects (Christenson, Reschly & Wylie 2012; Drayson 2015). Research evidence suggests playing games can improve this engagement as well as enhancing students' learning (Cooper et al. 2010; Fabricote and Lopez 2012; McGrath & Bayerlein 2013; Nagle et al. 2014; Cheong et al. 2014) hence SSG has been introduced to the business sustainability curriculum. Tilbury and Wortman (2008) consider that games promote new ways of learning and thinking, which is a fundamental within EfS (HEFCE 2013). SSG seeks to meet Net'geners preferences for collaborative, experiential real-world activities (Oblinger and Oblinger 2005) and deliver student-centred learning for insight rather than learning for technique (Beech and MacIntosh 2012) through problem solving, collaboration, negotiation and peer-to-peer learning. Problem solving within a game requires cognitive investment, emotional commitment and active participation for engagement and deeper learning (Chapman and Dunkerley 2012).

SSG aims to provoke an individual and collective sense of responsibility that Burgess (2006) and Ellison and Wu (2008) consider able to motivate learning for good practice; a fundamental requirement of EfS. Its ability to develop students' self-perceived competence may be a key motivator for engagement (Fazey and Fazey 2001).

The game provides an alternative learning environment from the more familiar instructivist approaches such as classroom PowerPoint slide based lectures frequently used within business management. It provides a distinctive, experiential perspective in which students may engage in deeper learning as they are actively involved in the learning task rather than being passive recipients of information (Armier, Shepherd and Skrabut 2016). Active participation in the game seeks to engage students through education and entertainment, challenge their thinking, and generate an emotional response. These are employed as indicators of engagement within this research.

The research presented here explores students' experiences of playing SSG and assesses the game's ability to engage students in EfS. This level of engagement is evaluated in two dimensions: firstly, students' perceptions of the game as an engaging, educational and entertaining learning experience and secondly, students' suggestions for future developments

of the game that are an indicator of their cognitive investment and engagement. The Framework for Engagement in Game-based Learning and the HEA Framework for Engagement through Partnership (Higher Education Academy 2016) are used to discuss the research findings in more detail to assess the scope and strength of SSG in engaging students in experiential and collaborative sustainability learning.

This paper contributes to the debate over pedagogical approaches to EfS and provides an insight into experiences of students engaged in game-based sustainability learning, which may be of use to others considering similar gamification of learning and teaching.

2. The game and its game-based learning and teaching context

2.1 The Sustainable Strategies Game

SSG is a paper-based game in which groups of students (self-selected) represent the management team of one of a series of manufacturing organisations based around a fresh water lake. Several hundred thousand people also live in close proximity to the manufacturing plants and rely on this common water source.

The game, based on fictional locations and outcomes, provides a structure for exploring how organisations may deal with this complex environment for strategic decision making. During the game the teams explore a number of problems including how to operate their plant profitably whilst considering the prudent use of the shared natural resource and impact on the local communities and the environment. As each plant operates it abstracts water from the common water source and discharges pollutants back into it. No regulations exist to control plant emissions, water use or discharge. However, the successful operation of each manufacturing plant, and therefore profitability, depends on the quality of the water.

SSG is played over a series of rounds during which the students make strategic operational decisions: to limit their emissions and therefore limit pollution or continue to pollute as business as usual. The payoff from their decision is their income which is related to the quality of the water. This is determined by the strategic choices made by all management teams. If the water quality declines production processes are negatively impacted and costs increase so that income falls. The income available in each round is determined by the number of companies choosing to pollute the water or to limit pollution. Decision making involves each group considering their potential income, the risks and rewards of their chosen strategy and the choices of the other teams. These decisions are taken within the game environment of others' behaviours and players' personal perspectives on sustainability.

After the eighth round teams are able to collaborate and/or negotiate with other management representatives. In addition, they can choose to fund a prosecution of the most polluting company (a one off payment). In line with the general success rate of environmental lawsuits in the UK, teams have a 1 in 3 chance of being fined. If successfully prosecuted the guilty party is financially penalised.

At the start of the game the students are given game playing instructions which provide cues to learning along with details of their company including its' social, natural and economic environment. Players are also advised of a prize for the winners, that is the company with the

highest bank balance at the end of the game, but are not told what the prize is.

2.2 The wider context of game-based learning and teaching

The value of games as tools to generate positive effects on learning outcomes has been widely recognised (Gee 2007; Davis and Sumara 2006; Annetta et al. 2009; Katsaliaki and Mustafee 2015). Cheong et al. (2014) and Nagle et al. (2014) highlight the capability of games to engage and motivate students who no longer find traditional learning and teaching styles engaging. Cooper et al. (2010) suggests this is due to their ability to harness collective problem-solving skills. Consequently, games provide a valuable learning environment for EfS as they engage students in cognitively demanding activities that involve problem-solving and decision-making skills (Fabricatore and Lopez 2012).

Games within EfS are able to shift players' ideas through increasing their awareness of their personal values and environmental behaviours (Dieleman and Huisinigh 2006). Kafai (2006) reinforces this, and deems the quality of engagement in a game a significant indicator of its ability to stimulate behaviour change. This research therefore explores the ability of SSG to challenge students' thinking.

Game features are able to generate adaptive responses by challenging individual and group behaviours if they are specific problem solving activities (Schell 2008). Gee (2007) considers in-game contextualisation of these features will generate experiential learning that is able to provoke players to rethink game-playing strategies. In addition, unexpected events introduced into a game during play may inspire students to understand and alter their behaviours (Miller and Page 2007). Such 'mutual adaptations' may affect players' objectives and challenge thinking by encouraging behaviours to be re-evaluated in response to unexpected events. These unexpected events may require adaptive responses to cope with the added complexity introduced (Bloom 2010). Therefore, this research uses the potential interventions identified by students as indicators of active participation, emotional response and cognitive investment, to explore student engagement in SSG.

In-game features offer opportunities to change behaviours and develop learning (Fabricatore and Lopez 2012). These include uncertainty, i.e. the inability to fully predict or control the outcomes of actions within the game, and non-linearity, i.e. the interaction amongst game elements that can generate different outcomes. Lizzio and Wilson (2008) consider such game-problems are valuable as they deliver opportunities to develop ideas, promote collaboration and change behaviours in the safe environment of the game.

Ellison and Wu (2008) also highlight the value of game-problems and suggest they can drive learning for good practice as they are able to generate both an individual and collective sense of responsibility within players. Annetta et al. (2009) suggests this sense of responsibility comes from employing game-features that challenge or reward behaviours to achieve compromise between stimulating engagement and maintaining focus on learning.

Whilst supporting this view the author considers that learning for good practice also needs to address the learning expectations of students and their future employers as well as to engage students in sustainable futures and advocacy for sustainability within the workplace. Rather than provide the frequently accepted instructivist environment in which students employ just in time learning to obtain a passport to employment (Zepke and Leach 2010), SSG attempts

to engage students with EfS and challenge their thinking to develop learning for insight (Beech and MacIntosh 2012), sustainability literacy and awareness and the adoption of sustainable practices.

2.3 Influences on students' gaming experience

Frymier & Schulman (1995) propose that students must recognise the relevance and value in the learning to engage with it. Pelozo and Shang (2011) define this value for consumers as their perception of the return from interactive and relativistic experiences. As students are consumers of educational output (Vanderstraeten 2004) they can be considered to act as customers showing an evolving preference for interactive and relativistic learning and teaching experiences, i.e. interactive, collaborative, experiential learning activities. Students respond to the learning and teaching experience, mirroring a customer's reaction to a product or service i.e. they appraise whether to engage or not depending on their perception of the value the experience will offer. Students' experience from, and engagement with game-based learning and teaching may therefore depend on their level of education, familiarity with edutainment, and their experiential exposure to the issues existing within the game.

Interacting in-game processes inherent in a game may influence the students' gaming experience (Iten and Petko 2016). For SSG these may include the introduction to the game, the game process itself players' confidence in their understanding of the game and the debriefing. When introduced to the game students are provided with both written and verbal game-play instructions to ensure different learning styles are addressed as recommended by Kolb et al. (2014). At the end of the game students are debriefed, which Krause and Coates (2008) suggest provides an opportunity to use a constructivist approach to learning that allows them to construct knowledge through reflection on game-play experience. This debriefing may help students to engage in a community of learning that enables them to share and explore group generated strategies and provide and receive peer reflection and feedback which promotes student engagement (Kuh, Kinzie and Buckley 2006). In addition the individual and group expectations and behaviours generated within the game may contribute to players' experiences, for example the potential status rewards from winning, team members' willingness to cooperate and collaborate and team members' personal beliefs in business responsibilities. The opportunity to collaborate after round eight of SSG may present challenges to groups' and individual players' behaviours and encourage the development of alternative and/or combined operating strategies.

During each round of SSG the groups evaluate the encountered and perceived risks and rewards within the game, which Wang and Sun (2011) suggest affect players' gaming experience and encourage behaviour changes. Rewards include maximised financial returns generated through the students' strategic choices and individual groups' decisions to spend capital to increase future returns through investment for technological improvement or to potentially penalise others. Game risks encountered by each group are affected by external factors such as the other groups' strategies that may influence the income received and the players' perception of the likelihood of being fined for operating as the most polluting company.

3. Research methodologies

This paper presents the findings from the initial cycle of action research to investigate the value SSG has for generating student engagement through experiential game-based learning and teaching within business EfS. Action research provides a route for progressive problem solving (Riel and Lepori 2011) and offers a systematic approach to identifying innovations (Braun and Clark 2006) which provided opportunities to improve learning and teaching practice (Riding, Fowell and Levy 1995). The paper combines participants' responses from a survey conducted with Level 5 and Level 6 students with reflections from the author to critically examine intellectual and emotional engagement engendered by the game.

The author implemented a qualitative survey to explore the nature and depth of engagement with SSG and EfS which allowed students to reflect on the quality of their learning experience. Obtaining qualitative feedback within deductive research encourages participants to process external information and develop understanding and productive thinking, rather than just the reproduction of information (Mayer 1996). Students participating in this research had a range of knowledge of business sustainability. Some Level 6 students (third year undergraduates) had taken a business sustainability module at Level 5 (but had not played SSG previously); no Level 5 Students (second year undergraduates) had previously studied business sustainability within WBS or played the game.

The survey collected evidence to explore two indicators of engagement: firstly, students' testimonies as to SSG's ability to provide both learning and entertainment and secondly students' recommendations for enhancements to SSG. This research does not discuss the content of the suggested interventions; rather it uses the fact that students have responded as an indicator of their intellectual and emotional engagement. These two evidence bases will establish the potential for SSG to educate, entertain, challenge thinking and elicit an emotional response, which demonstrate students' cognitive investment, emotional commitment and active participation.

The questionnaire was distributed at the end of the game following the debriefing session. This emphasised reflection-on-action (Schön 1987) and asked students to mentally revisit their personal feelings and events to gain insights into their intellectual and emotional engagement with the game and EfS. All student responses were given participant numbers and are used within the analysis of findings below. Codes P1 to P19 identify Level 6 students and P20 to P31 Level 5 students. The author's reflections on game play interactions, outcomes and student behaviours are also included. Proposals for game developments may be incorporated in future iterations of the game if appropriate, which is outside the scope of this article.

This qualitative, reflective data gathering approach also encouraged students to more deeply engage with nebulous concepts of sustainability, which are frequently ethical and moral in nature, and to think about their learning. Barnett (2007) suggests that such complex open-ended ideas, perspectives, values, beliefs and interpretations require students to engage emotionally as well as intellectually, which will generate both engagement and deep learning.

Thematic Analysis was employed to explore the participants' responses as it enabled qualitative analyses of responses to questions related to students' experiences, views and perceptions (Burns 2005; Braun and Clark 2006) which were the key target of this research. It provided a realist-deductive approach to the analysis; realist as it focused on the assumed reality evident in the responses and deductive as the labeling and themes used were directed by established ideas. Initially students' experience of the game's values for teaching and learning

were used to explore levels of engagement with SSG. This was established using core words related to learning (e.g. ‘educational’ ‘insightful’ ‘informative’) and entertainment (e.g. ‘fun’, ‘enjoy’) to define a patterned meaning to the responses. Findings were collated both qualitatively and quantitatively and where appropriate, findings were related to the students’ level of study.

Evidence for an emotional response to playing SSG was provided by classification of the content of the players’ feedback based on indicators of their cognitive investment, emotional commitment and active participation. This deductive reasoning identified comments that indicated a student’s reaction to, or feeling towards the game, that was based on more than entertainment. Recognising whether SSG is able to engage students through their emotions as well as through learning and entertainment is valuable within EfS as emotional triggers are able to induce sustainable behaviour (Scott et al. 2016) and potentially develop much needed advocates for sustainability.

In addition, the Framework for Engagement in Game-based Learning and Teaching was created to assess the strength of students’ engagement. This bespoke framework utilised the three dimensions of student engagement proposed by Chapman and Dunkerley (2012); cognitive investment, emotional commitment and active participation. By assessing players’ feedback against these dimensions the depth of student engagement in game-based learning for EfS was established. Students’ responses were located on the framework according to the degree of engagement indicated by expressions of commitment and participation.

Finally, SSG’s performance against the HEA Framework for Engagement through Partnership (Higher Education Academy 2016) was established. This framework was used to assess the game’s ability to enable and empower students through learning, staff engagement and sustainability to create deep engagement; the aim of both the HEA Framework for Engagement through Partnership and EfS. Research findings were mapped against its four overlapping dimensions of engagement: learning, teaching and assessment; subject based research and enquiry; curriculum design and pedagogic consultancy and scholarship of teaching and learning. By comparing the students’ learning experience to these four factors the value of SSG for engagement can be established.

4. Results, Analysis and Discussion of Student Feedback

4.1 Students’ experience of playing

Participants’ responses to the survey indicate that the majority of students consider SSG both educational and entertaining; 96% of students confirm that playing SSG engaged them in learning for sustainability and 77% confirmed that they found the game entertaining. For example:

It was a good way of understanding the point of sustainable thinking (P26, Level 5)

I learned companies that have concern over resources, environment and pollution usually lose out in terms of profit (P6, Level 6)

I had a fun experience playing the game, trying to suss out what other groups responses would be in order to choose our answers (P11, Level 6)

The game was enjoyable (P4, Level 6)

Over two thirds of Level 6 students and 62% of Level 5 students use core words for both education and entertainment in their survey responses. For example:

Eye-opener, enjoyable, educational (P1, Level 6)

I really enjoyed it and found it informative (P15, Level 6)

I learned new things by enjoying a team game (P30, Level 6)

Fun interactive experience which enabled me to think about how sustainability would impact businesses in real life situations (P22, Level 5)

Charsky (2010) considers that if education and entertainment can be seamlessly combined within learning and teaching the resulting experience is 'edutainment'. The findings of this research suggest that students consider SSG offers 'edutainment' that engages them. For example, one student considers SSG to be,

An excellent game that kept me fully engaged (P31, Level 5)

The survey responses indicate students develop high levels of self-perceived game competence when playing SSG, which Fazey and Fazey (2001) consider a key motivator for engagement. For example:

It was fun and a different experience to the lecture. I enjoyed working with my team to make conscious sustainable decisions (P24, Level 5)

It was good working together and coming up with a strategy (P11, Level 6)

These examples of self-perceived competence also suggest SSG is able to enhance learning for sustainability through collaborative engagement in the in-game sustainability practices which explore the equitable sharing of the use and benefits of generic resources. The author notes that SSG unleashes some students' competitive nature and it appears that success in the competitive elements of the game (particularly if their competitors were penalised by their actions) enhanced their self-perceived competence and enjoyment of playing.

When explored in more detail the research findings indicate both Level 6 and Level 5 students recognise SSG as a valuable opportunity to develop knowledge of the tensions inherent within business sustainability whilst being entertained. 100% of Level 6 students and 92% of Level 5 students indicate that they engaged in sustainability learning whilst playing; 74% and 83% reported being entertained. More Level 6 students recognise the learning delivered through SSG than Level 5 students which the author considers may be due to the students' level of education and familiarity with game-based learning.

However, more Level 5 students identified their enjoyment, suggesting that this cohort were more engaged in the entertainment of game playing. This may be due to differences in students' academic experience, exposure to EfS and business strategy making and/or experience of game-based learning. The author notes that five weeks after playing SSG (which included the Easter break) Level 5 students were still talking about their enjoyment of it and how they would respond differently if they were to play again e.g. collaborating earlier in the game to influence behaviour change, adopting different business strategies etc.; Level 6

students asked to play more games and some even brought their own games into the taught sessions.

The research findings demonstrate that more than two thirds of students at both Level 6 and Level 5 felt that playing SSG had challenged their sustainability thinking, both as individuals and with regard to business behaviours. Students' responses suggest that 68% of Level 6 and 66% of Level 5 students engaged cognitively with game-based learning and teaching. For example:

Positive and insightful [experience] about other people's behaviour and business (P13, Level 6)

[It] made me think about the needs and wants of the game in comparison to individual vs. collective rationale (P12, Level 6)

[It] made me understand that it is so complex to act sustainable for a company thinking about profit and environment at the same time (P26, Level 5)

[It] taught me the complexity of making such decisions within a real life study (P28, Level 5)

Whilst the majority of students confirm that playing SSG had challenged their thinking, fewer appear to have developed an emotional response to the sustainability topics within the game or to the game itself. However, although this impact is lower, SSG has still managed to emotionally engage almost 50% of the players which Barnett (2007) suggests may promote deep learning.. Examples of evidence for this emotional engagement include:

It made you think about the importance of sustainability, and whether the prize was more important than being sustainable (P4, Level 6)

We made the most profit out of all the businesses – so as a business perspective we were successful. However, from someone who is concerned about the environment then the 'limit pollution' action should have been considered more often (P6, Level 6)

It was difficult to make the 'right decision' based on what we thought other groups would do (P10, Level 6)

Helps boost understanding on what the actual effect on businesses, locals etc. of pollution and regularly how business can get away with doing their own thing (P18, Level 6)

The author notes that tensions over willingness to 'do the right thing' at the expense of foregoing potential maximum short-term returns emerged within and between groups. The research findings indicate that some students also recognise this and have highlighted the conflict between their desire to win the game and the knowledge that their group is not behaving sustainably. This aspect of the game playing experience will be explored further in future research to maximise the opportunities it presents to enhance engagement in sustainability learning.

To further understand the level of students' engagement with EfS created by SSG players were asked to suggest game changes and/or additional game-features and in-game challenges that could be incorporated to enhance their experience of playing the game. This

reflection on playing helps to cognitively and emotionally embed the processes taking place within the game and makes them more relevant to the participants, which Wolfe and Byrne (1975) suggest further develops engagement.

The analysis of survey responses highlights the fact that 94% of students made at least one suggestion for a potential development of SSG, with 45% suggesting two or more opportunities for enhancement. This emphasises students' engagement with the learning outcomes, purpose and rules of SSG as well as the interactions facilitated and problems to be overcome during the game sufficiently to be able to recognise potential improvements.

4.2 Discussion of findings

The research findings suggest that SSG is a cognitively demanding environment that provides an opportunity to engage students within learning and teaching for EfS. It also promotes the development of sustainability literacy skills through game-based edutainment and participatory interaction which the author considers an encouraging sign for future advocacy for sustainability. Two models are used to assess the extent of this engagement; firstly, the Framework for Engagement in Game-based Learning and Teaching and secondly, the HEA Framework for Engagement through Partnership (Higher Education Academy 2016). Mapping research findings against these models allows the strength of student engagement, sources of engagement and outcomes of the game-play experience to be explored further.

The Framework for Engagement in Game-based Learning and Teaching (Figure 1), based on the dimensions of engagement identified by Chapman and Dunkerley (2012), suggests students have actively participated in SSG and engaged strongly with both the game-play experience and the concepts of sustainability embedded within it to cognitively invest in their learning. The interactions facilitated by the game between individuals, within and between groups and between students and the key principles of business sustainability (efficient and equitable use of natural resources, environment and social impact mitigation, collaboration and resilience) also emerge as strongly engaging the research participants.

Although fewer comments indicate an emotional response to the sustainability concepts in the game, those students commenting on this demonstrate high levels of engagement.

Mapping the research findings against the HEA Framework for Engagement through Partnership (Higher Education Academy 2016) (Figure 2) suggests that being involved in game-playing, participating in in-game interactions, demonstrating sustainable approaches and reflecting on game playing experiences has provided learning and teaching outcomes that allow both students and staff to reflect on, inspire and enhance practice for learning, which is the objective of the Framework.

The intrinsic and extrinsic value identified by the framework highlights SSG's ability to generate active participation in EfS through the edutainment of game-based learning, collaborative learning and reflection on action, all of which challenge sustainability thinking within an alternative learning environment. This may inspire sustainable behaviours as advocated by Scott et al. (2016) and awareness of personal sustainability values (Dieleman and Huisingh 2006) both of which promote new ways of thinking and learning which are fundamental within EfS (HEFCE 2013). Game playing and game development appear to engage students as producers of sustainability knowledge and co-researchers who contribute to

scholarship, rather than as receivers of information.

	Weak engagement	Medium engagement	Strong engagement
Cognitive investment		<p>It was an interesting game</p> <p>It was valuable to see the results</p> <p>Don't think it is exactly how real life would go</p>	<p>Eye-opener...</p> <p>Insightful...</p> <p>It was valuable...</p> <p>Fun and challenging...</p> <p>Helpful and challenging...</p> <p>Helps to boost understanding</p> <p>Made you think...</p> <p>It opened my mind...</p> <p>Very challenging game...</p> <p>Taught me...</p> <p>The game was highly educating...</p> <p>I learned new things...</p> <p>I learned a lot....</p> <p>You understand how...</p> <p>Educational...</p>
Emotional commitment			<p>Great experience...</p> <p>Good game even though we lost</p> <p>I enjoyed working with my team to make conscious sustainable decisions</p> <p>Excellent game that kept me entertained and fully engaged</p> <p>It is a shame destroying the environment is a profitable activity</p>
Active participation		<p>A different experience to the lecture</p>	<p>Using our tit-for-tat strategy....</p> <p>It was good working together...</p> <p>Fun, interactive experience...</p> <p>Engaging experience in comparison to normal lectures as it required me to be more involved</p> <p>Played in class as a group</p> <p>I really enjoyed playing the game and I would be interested in playing more games like this</p> <p>The game was easy to understand</p> <p>Enjoyable...</p> <p>An engaging experience...</p> <p>Challenging...</p> <p>Different to normal lecture and more understanding...</p>

Figure 1: Framework for Engagement in Game-based Learning and Teaching

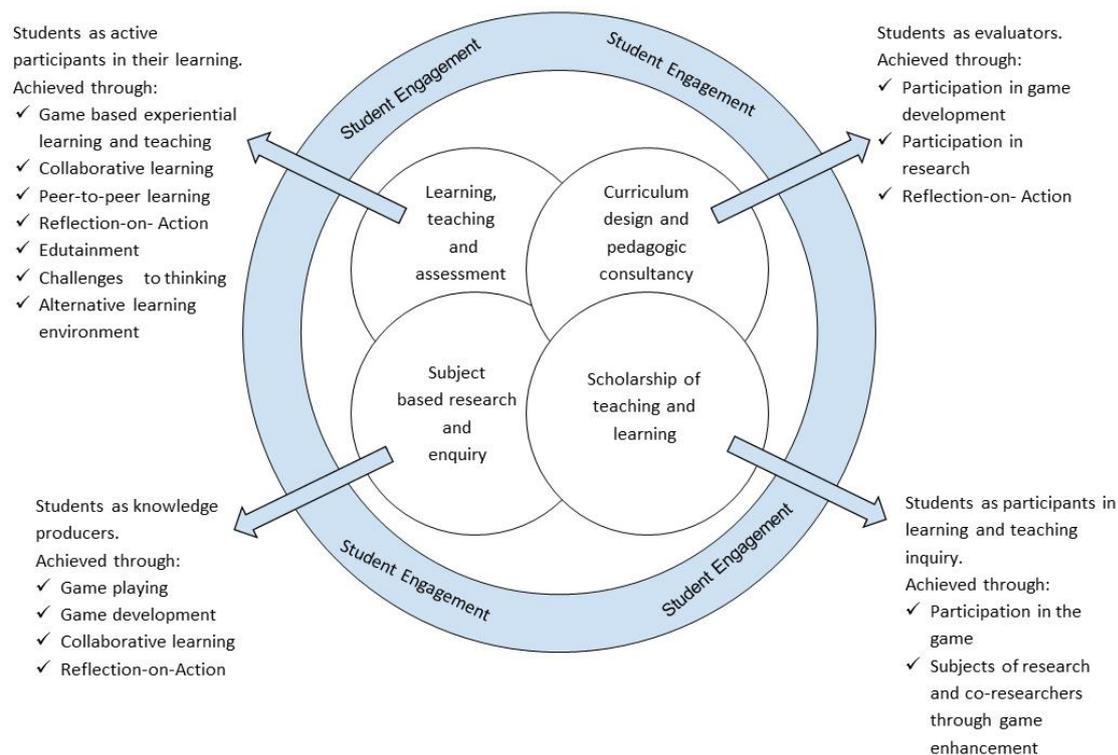


Figure 2: SSG’s effectiveness in meeting the HEA Framework for Engagement through Partnership (Higher Education Academy: 2016)

This research has also offered students roles as co-researchers, game participants and game developers which have allowed them to evaluate the lecture content and participate in future curriculum design thus achieving the constructivist approach to learning. These activities, along with the post-game debriefing, encourage experiential learning and reflection-on-action that allow students to construct knowledge through critical reflection on game-play experience recommended by Krause and Coates (2008) and Bonwell and Eison (1991). These learner-centred activities also offer the constructivist methodological approaches to EfS recommended by Sterling (2012) and demonstrate the drivers of engagement incorporated within the HEA framework. All of these inputs and learning outcomes captured within the framework provide students with the opportunity to shape their own learning experience.

5. Implications for Practice

The results of this research confirm that using SSG as an alternative approach to learning and teaching to business sustainability is able to positively influence students’ engagement, which HEFCE (2013) considers fundamental within EfS. Thus games, if appropriately designed and implemented, can cognitively engage students and make a difference to sustainability learning outcomes and the value of students’ learning experience. The fun, interactive and experiential nature of the game appears to generate this value whilst the game play experience and interaction with the key factors of business sustainability

encourages the creation of a learning community, and as the research shows, some emotional involvement. Interaction within the student cohort encourages the players to become a community of competition which further engenders engagement and collaborative learning for sustainability.

This research suggests that investing in games can make a difference to levels of student engagement which repays the investment in EfS curriculum design. This may be because games are able to address learning expectations of students, develop a focus on learning for insight within EfS which is valued by Beech and McIntosh (2012) and highlight the real-life tensions between profitability and good practice faced by businesses. The research also suggests SSG provides a valuable learning environment for EfS by engaging students in problem solving skills and sustainable decision making which is valued by Fabricatore and Lopez (2012). These game-based learning outcomes may in turn stimulate a sense of personal and business responsibility within players; a vital requirement for sustainable business futures. Games appear to provide an opportunity to provide learning support without simply providing information, which Armier, Shepherd and Skrabut (2016) consider a potential driver of deeper learning.

Many businesses claim possession of a range of skills for sustainability to be important when recruiting graduates (Drayson 2015). This research has identified that SSG can contribute to the development of such skills, including an understanding of how business decision making is frequently in conflict with the most environmentally and socially sustainable actions. SSG appears to present a learner-centred approach to EfS that engages students in both hard (e.g. financial management and strategy making) and soft business skills (e.g. negotiation, influencing and collaboration) whilst challenging their thinking in a safe learning environment. Christenson, Reschly & Wylie (2012) suggest this provides an opportunity to enhance learning outcomes including retention and improved employment prospects. Participation in the game may therefore enhance students' employability skills.

In order to progress this research, additional cycles of action research will be implemented to obtain specific suggestions for interventions and further explore the benefits of game-based learning and teaching to student engagement within EfS. Additional interventions may be incorporated into SSG to provide an enhanced collaborative and experiential learning experience.

5. Conclusions

The research presented here suggests that strong student engagement has been obtained from the cognitive investment, emotional commitment and active participation in the game-based learning and teaching offered by SSG, one of the group-based games utilised as a participatory approach to EfS within Worcester Business School. This strong level of engagement appears to have been generated by the entertainment and interactive experiential learning encapsulated within the game-play experience. The Framework for Engagement in Game-based Learning and Teaching confirms the value students have placed on the learning experience offered by this approach to sustainability learning, a feature supported by the Thematic Analysis of survey responses. Post-game reflection has helped students recognise that playing SSG has provided an opportunity to participate in an experiential, active, collaborative learning experience that

enhances self confidence in sustainability including the consideration of business strategies that promote appropriate, fair, shared access to generic resources.

The game appears to challenge students' thinking and provide experience of softer skills required for a business career, including negotiation, collaboration and influencing. These have been practiced in the safe environment of the lecture room. Group interaction (including the community of competition created by students) and learning support experienced during game-play may have contributed to the high levels of strong student engagement highlighted by the research findings. The Framework for Engagement through Partnership (Higher Education Academy 2016) has proved valuable in scoping the source of SSG's in-game, learner-centred approaches to EfS and reinforces the value of the entertainment and experiential and collaborative learning provided by the game.

This research into game-based learning has offered an evidence-based, practical and theoretical understanding of students' preferences for experiential activities. This is now influencing the author's design and planning of learning activities to support student learning, both in existing modules and potential new programmes for EfS. Additional action research into the effectiveness of this innovative approach to sustainability learning and teaching will allow further consolidation of research and scholarship into the professional practice of EfS.

References

- Armier D, Shepherd C, Skrabut S (2016) Using Game Elements to Increase Student Engagement in Course Assignments. *College Teaching* 64(2). Available from: <https://eric.ed.gov/>
- Annetta L, Minogue J, Holmes S, Cheng M (2009) Investigating the impact of video games on high school students' engagement and learning about genetics. *Computers & Education* 53(1) 74-85. Available from: <http://www.sciencedirect.com>
- Barnett R (2007) *A will to learn: Being a student in an age of uncertainty*. McGraw Hill. New York
- Beech N, MacIntosh R (2012) *Managing Change: Enquiry and Action*. Cambridge. Cambridge University Press
- Bloom J (2010) Systems Thinking, Pattern Thinking, and Abductive Thinking as the Key Elements of Complex Learning Annual Meeting of the American Educational Research Association, AERA, Denver. Available from: <http://www.academia.edu/>
- Bonwell C, Eison J (1991) *Active learning: Creating excitement in the classroom*. Washington, D.C. Jossey-Bass.
- Braun V, Clarke V 2006 Using thematic analysis in psychology. *Qualitative Research in Psychology* 3: 77-101. Available from: <http://www.tandfonline.com>
- Burgess J (2006) Blogging to Learn, learning to blog in A Bruns, J Jacobs (eds), *Use of blogs*, Peter Lang, New York pp. 91-103

Burns A 2005 Action Research: an evolving paradigm? *Language Teaching* 38 (2): 57-74 Available from: <http://www.journals.cambridge.org>

Chapman T, Dunkerley E (2012) *Building Young People's Resilience in Hard Times: an evaluation of Telefónica O2 Think Big Programme in the UK* London. Available from: <https://www.dur.ac.uk/>

Charsky D 2010 From Edutainment to Serious Games: A Change in the Use of Game Characteristics *Games and Culture* 5 (2) 177-198. Available from: <http://www.sagepub.com>.

Cheong C, Filippou J, Cheong F (2014) Towards the Gamification of Learning: Investigating Student Perceptions of Game Elements, *Journal of Information Systems Education* 2(53) 233. Available from: <http://www.ebscohost.com>

Christenson S, Reschly A, Wylie C (2012) *Handbook of research on student engagement*. Dordrecht: Springer

Cooper S, Treuille A, Barbero J, Leaver-Fay A, Tuite K, Khatib F, Snyder A, Beenen M, Salesin D, Baker D, Popović Z (2010) The challenge of designing scientific discovery games. ACM 40. Available from: <http://www.dl.acm.org>

Conole, G, Alevizou P (2010) A literature review of the use of Web 2.0 tools in higher education. York, UK: Higher Education Academy Available from: <http://www.heacademy.ac.uk>

Davis B, Sumara D (2006) *Complexity and education: inquiries into learning, teaching, and research*. New York: Routledge

Dieleman H, Huisingh D (2006) Games by which to learn and teach about sustainable development: exploring the relevance of games and experiential learning for sustainability, *Journal of Cleaner Production* 14 (9), 837-847. Available from: <http://www.sciencedirect.com>

Drayson R (2015) *Employer attitudes towards, and skills for, sustainable development*. Higher Education Academy Available from: <http://www.heacademy.ac.uk>

Ellison N, Wu Y (2008) Blogging in the Classroom: A Preliminary Exploration of Student Attitudes and Impact on Comprehension. *Journal of Educational Multimedia and Hypermedia*, 17(1), 99-122. Available from: <http://www.aace.org>

Fabricatore C, López X (2012) Sustainability Learning through Gaming: An Exploratory Study, *Electronic Journal of E-Learning* 10 (2), 209. Available from: <http://www.tandfonline.com>

Fazey D, Fazey J (2001) The potential for autonomy in learning: Perceptions of competence, motivation and locus of control in first-year undergraduate students. *Studies in Higher Education* 26 (3) 245-61. Available from: <http://www.tandfonline.com>

Frymier A B, Schulman G.M (1995) What's in it for me? Increasing content relevance to enhance students' motivation. *Communication Education*, 44 (40-50) Available from: <http://www.tandfonline.com>

Gee J P (2007) *What video games have to teach us about learning and literacy*, Rev. and updat edn, Palgrave Macmillan, Basingstoke; New York.

Higher Education Academy (2015) Education for sustainable development (ESD). Available from: <https://www.heacademy.ac.uk/workstreams-research/themes/education-sustainable-development>

Higher Education Academy (2016) Higher Education Academy frameWORKS, 04 Essential frameworks for enhancing student success. Available from: <http://www.heacademy.ac.uk/transform>

HEFCE (2013) Sustainable Development in higher education: consultation on a framework for HEFCE. Higher Education Funding Council for England Available from: <http://www.hefce.ac.uk>

Iten N, Petko D (2016) Learning with serious games: Is fun playing the game a predictor of learning success? Learning with serious games. *British Journal of Educational Technology* 47(1)

Kafai Y B (2006) *Playing and making games for learning: Instructionist and constructionist perspectives for game studies*. Games and Culture 1(1) 34-40. Available from: <http://faculty.arts.ubc.ca>

Katsaliaki K, Mustafee N (2015) Edutainment for Sustainable Development: A Survey of Games in the Field. *Simulation & Gaming* 46 (6) 647. Available from: <http://www.sagepub.com>

Kolb D A (1984) *Experiential Learning - Experience as the Source of Learning and Development*. Prentice- Hall. New Jersey.

Krause K, Coates H (2008), Students' engagement in first-year university, *Assessment & Evaluation in Higher Education*, 33 (5), 493-505. Available from: <http://www.tandfonline>

Kuh, G, Kinzie, J, Buckley J (2006). What matters to student success: A review of the literature. Commissioned Report [Online]. Available from: http://nces.ed.gov/IPEDS/research/pdf/Kuh_Team_Report.pdf

Leach L (2016) Exploring discipline differences in student engagement in one institution. *Higher Education Research & Development* 35(4) 772-786. Available from: <http://onlinelibrary.wiley.com>

Lizzio A, Wilson K (2008) Feedback on assessment: students' perceptions of quality and effectiveness. *Assessment & Evaluation in Higher Education* 33 (3) 263-275. Available from: <http://www.tandfonline>

Mayer R (1996) Learners as information processors: Legacies and limitations of educational psychology's second metaphor *Educational Psychologist*. 31 (3):151-161

McGrath N, Bayerlein L (2013) Engaging online students through the gamification of learning materials: The present and the future. In H. Carter, M. Gosper and J. Hedberg (Eds.), *Electric Dreams*. Proceedings Ascilite 2013 Sydney, pp.573-577

Miller J, Page S (2007) *Complex Adaptive Systems: An Introduction to Computational Models of Social Life*. Princeton University Press, Princeton.

Nagle A, Wolf P, Riener R, Novak D (2014) The Use of Player-centered Positive Reinforcement to Schedule In-game Rewards Increases Enjoyment and Performance in a Serious Game. *International Journal of Serious Games* 1 (4) 35-47. Available from: <http://dx.doi.org>.

- Oblinger D, Oblinger J (2005) *Educating the Net Generation.*, Available from: <http://www.educause.edu/educatingthenetgen/>
- Pelosi J, Shang J (2011) Investing in CSR to Enhance Customer Value. The Conference Board, Canada.
- Riel M, Lepori K (2011) *A Meta-Analysis of the Outcomes of Action Research.* American Educational Research Association conference, April 2011, New Orleans.
- Riding, P, Fowell S, Levy P (1995). An action research approach to curriculum development. *Information Research*, vol. 1 no. 1. Available from: <http://www.informationR.net>
- Schell J (2008) *The Art of Game Design: a Book of Lenses.* Morgan Kaufmann. Burlington, Massachusetts.
- Schön D (1987) *Educating the reflective Practitioner: Towards a New Design for Teaching and Learning in the professions.* San Francisco, CA: Jossey:Bass.
- Scott, B, Amel E, Koger S, Manning C (2016) *Psychology for Sustainability: 4th edn.* Routledge. Oxford
- Sterling S (2012) *The Future Fit Framework: An introductory guide to teaching and learning for sustainability in HE.* York. The Higher Education Academy
- Tilbury D, Wortman D (2008) How is Community Education Contributing to Sustainability in Practice? *Applied Environmental Education & Communication* 7 (3) 83-93. Available from: <http://www.tandfonline>
- Vanderstraeten R (2004) Education and Society: a plea for a historical approach. *Journal of Philosophy of Education* 38 (2) 195-206. Available from: <file://localhost/http://www/http://onlinelibrary.wiley.com>
- Wang H, Sun C (2011) Game Reward Systems: Gaming Experiences and Social Meanings. Presented at: 5th DiGRA Conference: Think Design Play, Hilversum, The Netherlands, September 2011
- Wolfe D, Byrne E (1975) Research on Experiential Learning: Enhancing the Process, in Buskirk, R. (ed.) *Simulation Games and Experiential Learning in Action.* The Proceedings of the Second National ABSEL Conference, Bloomington, Indiana, April 9-11, 1975
- Zepke N, Leach L (2010) Improving student engagement: Ten proposals for action. *Active Learning in Higher Education*, 11(3), 167-177. Available from: <http://www.sagepub.com>

Author's Biography

Dr Kay Emblen-Perry has several years' senior environmental and ecology consultancy experience delivering consultancy projects in renewable energy technologies, contaminated land remediation, biodiversity offsetting and ecological assessment for UK organisations. She is qualified as an environmental and quality lead auditor, has implemented environmental management systems for both UK and multinational organisations and has trained environmental and quality assessors. In

previous roles Kay gained senior project management and purchasing management experience in international automotive companies. She project managed the implementation of sustainable supply chain strategies, new vehicle projects and EU REACH Regulations. Kay's specialisation is in Sustainable Management including Environmental Management and Justice, Social Responsibility and Economic Sustainability. Her latest research project involves improving energy efficiency and conservation activities within small and medium businesses.