



International Journal of Sustainability in Higher Education

Enhancing Student Engagement in Business Sustainability Through Games

Journal:	<i>International Journal of Sustainability in Higher Education</i>
Manuscript ID	IJSHE-05-2017-0075.R2
Manuscript Type:	Research Paper
Keywords:	Student Engagement, Game-based Learning, Business Sustainability, Education for Sustainability, EfS, Games

SCHOLARONE™
Manuscripts

Enhancing Student Engagement in Business Sustainability Through Games

Dr Kay Emblen-Perry

University of Worcester, Business School, Worcester, UK

City Campus, Castle Street, Worcester, WR1 3AS. Tel: 01905 855253

Email: k.emblenperry@worc.ac.uk

Paper Submitted 30 May 2017

Paper Revised 02 November 2017

Abstract

Purpose: This practice-focused study explores the value students place on the Sustainable Strategies Game which seeks to improve student engagement in business sustainability through enhanced game-based learning. This game provides an alternative collaborative learning environment to the traditional instructivist approach in order to enrich Education for Sustainability learning experiences and enhance student engagement.

Design/Methodology/Approach: Students' reflections on their game-based learning experiences and suggestions for game development were collected through a short qualitative survey. Results are explored through three frameworks, the Multifaceted Student Value Model, the Dimensions of Engagement Framework and the UK Higher Education Authority Framework for Engagement Through Partnership.

Findings: Research findings suggest the Sustainable Strategies Game provides game-based learning within Education for Sustainability that delivers 'edutainment' within an active, collaborative and experiential learning environment that the students value. It is also able to challenge thinking and emotionally engage students with the fundamentals of business sustainability. Reflection-on-action and the students' role as co-researchers in game development allow students to become active participants in their learning as well as knowledge producers and evaluators. These outcomes deliver the UK Higher Education Authority's core facets of student engagement through partnership.

Research limitations/implications: This practice-focused study presents the self-reported results of a one-time, small study which does not offer generalised, independently validated

1
2
3 responses. However, the findings may be of interest to educators considering the adoption
4 of game-based learning and those seeking new learning cultures for EfS.
5

6
7 **Practical Implications:** Game-based learning and teaching approaches can achieve a
8 learner-centred active, collaborative learning environment that enhances student
9 engagement with business sustainability.
10

11
12 **Originality/Value:** Experiences gained from this study should assist others in the
13 implementation of game-based learning to engage students in business sustainability.
14

15
16 **Key words:** Student Engagement, Game-based Learning, Business Sustainability,
17 Education for Sustainability, EfS, Games.
18

19
20 **Paper Type:** Research Paper
21
22
23
24
25
26

27 **Introduction**

28
29 Learners' preferences for experiential, collaborative learning activities are now rapidly
30 evolving and the need to develop students' literacy skills in sustainability to prepare them for
31 the workplace are reshaping the practice of Education for Sustainability (EfS) in the Higher
32 Education (HE) environment (HEFCE, 2013; Higher Education Academy, 2015). These
33 trends are shifting traditional instructivist approaches to learning and teaching towards
34 participatory user interactions (Conole and Alevizou, 2010).
35
36
37
38
39
40

41
42 To address these demands the author utilises a role-based game to offer
43 participatory approaches to EfS learning and teaching for Level 5 and Level 6 students; the
44 Sustainable Strategies Game (SSG). This is one of a variety of active, collaborative
45 approaches to business sustainability learning and teaching that are implemented by the
46 author. SSG underpins the ethos of sustainability that is taught within the business
47 curriculum: environmental and social impact mitigation, collaboration, resilience etc.
48 Frequently these require ethical and moral sensitivities to be included. Embedded within the
49 game is the expectation that students will challenge their own, as well as organisational
50
51
52
53
54
55
56
57
58
59
60

1
2
3 sustainability values.
4

5
6 SSG is designed to encourage experiential learning and engage students in business
7 decision-making within the complexity of sustainability. This requires them to consider
8 economic growth, prudent use of natural resources, protection of the environment and
9 influence on the local communities. The game seeks to develop students' understanding of
10 the potential impacts that businesses can have on the environment and society and
11 encourages their investigation of alternative strategic responses. It also supports students'
12 engagement with the softer skills of business management such as negotiation,
13 collaboration and influencing in the safe environment of a lecture room and group activity.
14
15
16
17
18
19
20
21

22
23 Leach (2016) suggests student engagement is one of the most important issues
24 currently facing the HE community. There is considerable research evidence to suggest
25 playing games can improve students' learning and engagement (Cooper et al. 2010;
26 Fabricatore and Lopez, 2012; McGrath and Bayerlein, 2013; Nagle et al. 2014; Cheong
27 Filippou and Cheong, 2014) hence SSG has been introduced. It seeks to meet Net'geners
28 preferences for experiential and collaborative learning (Oblinger and Oblinger, 2005) and
29 deliver student-centred learning for insight rather than learning for technique (Beech and
30 MacIntosh, 2012). This can enhance students' experience and engagement through peer-to-
31 peer learning, collaboration, negotiation and problem solving. Problem solving may involve
32 cognitive investment, emotional commitment and active participation for engagement and
33 deeper learning (Chapman, 2012). Tilbury and Wortman (2008) consider that games
34 promote new ways of learning and thinking, which is considered vital within EFS (HEFCE,
35 2013).
36
37
38
39
40
41
42
43
44
45
46
47
48

49 SSG aims to engender the individual and collective sense of responsibility that
50 Burgess (2006) and Ellison and Wu (2008) consider able to motivate learning for good
51 practice, which is a fundamental requirement of EfS. Its ability to develop self-perceived
52 competence may be a key motivator for engagement (Fazey and Fazey, 2001).
53
54
55
56
57
58
59
60

1
2
3 The game offers a different environment to the more familiar instructivist approaches
4 frequently used within business management, such as tutor led, slide-based lectures. It
5 provides an alternative, interactive, experiential perspective to learning and teaching in
6 which students may engage in deeper learning as they are actively involved in a learning
7 task rather than being passive recipients of information (Cross, 1987). Active participation in
8 the game seeks to engage students through education, entertainment, challenging their
9 thinking, and generating an emotional response. These are used as indicators of
10 engagement in this research.
11
12
13
14
15
16
17
18

19 The research presented here is taken from the first cycle of action research into
20 improving students' engagement with EfS in the business context. Students' experiences of
21 playing SSG are explored and assessed in relation to the game's ability to engage students
22 in EfS. This level of engagement is evaluated in two dimensions: firstly, through students'
23 perceptions of the game as an educational and entertaining learning experience that is able
24 to challenge thinking and generate an emotional response and secondly, through students'
25 suggestions for future developments of the game that are an indicator of their cognitive
26 investment and engagement.
27
28
29
30
31
32
33
34
35

36 This paper provides an evidence-based case study that contributes to the debate
37 over pedagogical approaches to EfS and offers an insight into experiences of students,
38 which may be of use to others in the sustainability community considering similar game
39 based learning and teaching opportunities.
40
41
42
43
44
45
46
47

48 **Sustainability in business education**

49

50
51 For the last two decades, sustainability has been gaining an increasing focus in Higher
52 Education (Figuro and Raufflet, 2015) and the potential for universities to address global
53 sustainability issues through learning, teaching and research is now well recognised
54
55
56
57
58
59
60

(HEFCE 2013; Higher Education Academy 2015). Business Schools have particular a responsibility to prepare students to make responsible and ethical management decisions and meet the needs of future business leaders (Stough et. al., 2017). However, Business School educators are increasingly challenged to establish new learning cultures that initiate new ways of learning and thinking in a reflexive and participative process (Rieckmann, 2011; Molthan-Hill, 2014), which empower learners to transform the way they think and act (UNESCO, 2017). Universities' most valuable contributions to achieving a sustainable future are to develop students with appropriate knowledge, skills and values (Rieckmann, 2011; Chalkley (2006) and engage with business to solve real-life problems for both businesses and society (Molthan-Hill, 2014).

The game and game-based learning and teaching context

Incorporating games as a learning and teaching approach is gaining prominence within business EfS to achieve the new learning culture advocated by Rieckmann (2011) and Molthan-Hill (2014). Serious games such as Fishbanks (Meadows, Sterman and King, 2017), the Orange Trading Game (Traidcraft, 2017)), SIM Sweatshop (Norridge, 2017) and the Green and Great (Centre for Systems Solutions, 2017) present interactive opportunities to explore multiple facets of sustainability within the work environment. SSG adds to this portfolio of learning and teaching tools and offers the opportunity for students and educators to explore sustainable decision making within the manufacturing sector.

The wider context of game based learning and teaching

The value of game-based learning as a type of game play with defined learning outcomes (Shaffer, Halverson, Squire and Gee, 2005) is widely accepted within literature to generate positive effects on learning (Gee, 2007; Davis and Sumara, 2006; Annetta et al., 2009; Katsaliaki and Mustafee, 2015). Some studies, however, temper this view and suggest that

1
2
3 whilst games have value within teaching and learning, their effectiveness for enhancing
4 student achievement is influenced by the game's design and specific instructional purpose
5 (Hays, 2005; Gee, 2007). Young et al., (2012) argue the positive effect on student
6 achievement may not be achieved if games are presented as short activities that lack
7 relevance for players. These conflicting views on the impact of games may be determined by
8 the theoretical approach taken; a cognitive perspective suggests games are motivating but
9 outcomes are likely to be influenced by the game-play processes whereas a socio-cultural
10 perspective suggests games will only provide positive outcomes if they are embedded in
11 relevant in-game information and interactions (Plass, Homer and Kinzer, 2015).
12
13
14
15
16
17
18
19
20

21 Although more research is required to establish long-term outcomes of games on
22 student achievement (Young *et al.*, 2012) and deeper learning, initial evidence exists to
23 suggest games are able to engage and motivate students who no longer find traditional
24 approaches engaging (Wrzesien and Raya, 2010; Cheong, Filippou and Cheong, 2014;
25 Nagle *et al.*, 2014). Cooper *et al.*, (2010) considers this is because they harness collective
26 problem-solving abilities of players. Consequently, games provide a valuable learning
27 environment for EfS as they engage players in cognitively demanding tasks that require
28 problem-solving and decision-making skills (Fabricatore and Lopez, 2012). Tsai, Yu and
29 Hsaio, (2011), however, caution that games' ability to motivate learning may be disrupted by
30 the distraction of game-playing and players' lack of desire to learn. Incorporation of games
31 into a variety of teaching methods, so that they are not the sole instructional strategy, may
32 therefore be more effective for ongoing engagement (Tsai, Yu and Hsaio, 2011, Young *et*
33 *al.*, 2012),
34
35
36
37
38
39
40
41
42
43
44
45
46

47
48 Dieleman and Huisinigh (2006), however, consider games are valuable for EfS as
49 they are able to shift players' ideas through increasing their awareness of personal values
50 and environmental behaviours. Kafai, (2006) supports this, considering the quality of
51 engagement in a game a significant indicator of its ability to energise behaviour change.
52 Consequently, this research explores the ability of SSG to challenge students' thinking.
53
54
55
56
57
58
59
60

1
2
3 Features within games can generate adaptive responses by challenging behaviours
4 if they are specific problem solving activities (Schell, 2008). Gee (2007) suggests
5 contextualisation of these features within the game will generate experiential learning that
6 can motivate players to engage in rethinking game-playing strategies, whilst Miller and Page
7 (2007) consider unexpected events introduced to a game's environment encourage students
8 to understand and adapt their behaviours. Such unexpected events may require adaptive
9 responses to cope with added complexity introduced (Bloom, 2010). Thus this research
10 seeks to use the potential interventions identified by students as indicators of cognitive
11 investment, emotional response and active participation, to explore student engagement in
12 SSG.
13
14
15
16
17
18
19
20
21
22

23 Core traits within games offer opportunities to change behaviours and develop
24 learning (Fabricatore and Lopez, 2012). These include uncertainty, i.e. the inability to fully
25 predict or control processes related to outcomes, and non-linearity, i.e. the interaction
26 among games elements that can generate different outcomes. Lizzio and Wilson (2008)
27 consider game-problems valuable as they provide opportunities to change behaviours,
28 develop ideas and encourage collaboration in the safe environment of a game.
29
30
31
32
33
34
35

36 Game-problems may generate the individual and collective sense of responsibility
37 within players that is able to drive learning for good practice (Ellison and Wu, 2008). The
38 author considers this learning for good practice needs to address the learning expectations
39 of students and their future employers as well as to engage students in sustainable futures
40 and advocacy for sustainability within the workplace. SSG attempts to engage students with
41 EfS and challenge their thinking to develop learning for insight (Beech and MacIntosh, 2012)
42 rather than providing the frequently accepted instructivist environment in which students
43 employ just-in-time learning for technique that Zepke and Leach (2010) consider as a route
44 to gain a passport to employment. Annetta *et al.*, (2009) suggests a sense of responsibility
45 comes from implementing game-features that reward or challenge behaviours to achieve
46 compromise between stimulating engagement and maintaining focus on learning.
47
48
49
50
51
52
53
54
55
56
57
58
59
60

The Sustainable Strategies Game

SSG is a role-based game in which groups of students (self-selected) act as the management teams of manufacturing businesses sited around a body of fresh water.

Several hundred thousand people live in villages and small towns in close proximity to the production plants and also rely on this common water resource. Each company depends on the local communities to provide a workforce.

The game is played within a three-hour taught session with the author acting as facilitator. Playing SSG takes around two hours which allows time for an initial briefing and post-game debriefing. The initial briefing incorporates the theory of the Tragedy of the Commons; individuals' rational behaviour maximises personal gain from exploiting natural resources but causes widespread harm to the community as those involved exist in an environment of finite resources (Hardin, 1968). This concept is presented in the context of SSG to highlight the challenge players will face in operating manufacturing processes that depend on obtaining the critical production input of clean, fresh water from the common water source. The post-game debrief encourages players to revisit the challenges presented by SSG and reflect on behaviours, strategic choices and sustainability values.

At the start of the game the groups are given a game playing brief which provides cues to learning along with details of their business and its' social, natural and economic environment. They are also advised the winning team will receive a prize but are not told what the prize is. The winning team is the company with the highest bank balance at the end of the game.

Throughout the game, the groups are tasked with addressing a number of problems including how to operate a plant profitably whilst considering the prudent use of the shared natural resource and impact on the local environment and communities. As each plant operates it utilises water from the common water source and releases pollutants back into it. The successful operation of each business, and therefore profitability, relies on the quality of

1
2
3 the water available. There is no environmental regulation in place to control emissions or
4 water abstraction. This is deliberately excluded to encourage players to consider their
5 personal values, which are vital for sustainability advocacy, rather than constraining their
6 thinking with regulatory parameters.
7
8
9

10
11 SSG is played over a series of rounds in which the players must make strategic
12 operational decisions: to limit their pollution through reducing discharges to the water body
13 or continue to pollute by conducting business as usual. There is no set number of rounds;
14 SSG is generally played over 18-20 rounds although the rounds can be tailored to the time
15 available.
16
17
18
19
20

21
22 At the end of each round, the facilitator collects and records each groups' strategic
23 decision and presents the class position, i.e. the number of teams choosing to conduct
24 business as usual and therefore exacerbate pollution and the number choosing to limit
25 pollution. All choices are anonymous to ensure students are able to test out strategies and
26 maintain their income (gains and losses) privately and without fear of embarrassment. Each
27 group maintains a record of their decisions and the payoff received
28
29
30
31
32
33
34

35 The payoff from the players' decisions in each round is an income that is related to
36 the quality of the water. Water quality is determined by the combined strategic choices made
37 by all manufacturing plants; the more groups that choose to pollute the water the more the
38 water quality decreases. The key to maintaining water quality is to maximise the number of
39 groups limiting their pollution. If the water quality declines the manufacturing plants'
40 production processes are negatively impacted; costs increase so that income falls.
41
42
43
44
45
46
47

48 The players' decision making in each round requires groups to consider their
49 potential income, risks and rewards of their chosen strategy and the choices of all other
50 groups. These decisions are taken within the game environment of other groups' behaviours
51 and the players' personal perspectives on sustainability.
52
53
54
55
56
57
58
59
60

1
2
3 After eight rounds, additional game-features and interventions are introduced to
4 challenge and potentially provoke changes to students' game-play strategies. From round 9
5 onwards the management teams can negotiate and collaborate prior to making their
6 strategic decisions. This is incorporated to encourage students to engage in collaborative
7 decision making, which is vital to achieve sustainable futures. In addition, players are given
8 the choice to pay to prosecute the most polluting company (a one off payment). As with the
9 general success rate of environmental prosecution, teams have a 1-in-3 chance of being
10 fined which is determined on the role of a dice. If successfully prosecuted the guilty party is
11 financially penalised.
12
13
14
15
16
17
18
19
20

21 A series of game-features that introduce the community's voice into the game are
22 also introduced after the initial rounds. At the start of round 10 the facilitator announces that
23 the Mayor of a local town has made a plea for manufacturers to improve their protection of
24 the water as there are plans to develop community leisure facilities at the lake. If groups
25 continue to pollute the water a social media campaign is then raised against the most
26 polluting company (the group that has voted to continue polluting through conducting
27 business as usual most often) to encourage students to explore the challenges of profit
28 maximisation versus environmental protection and encourage consideration of businesses'
29 impacts on the local communities. The game provides a structure for learning how
30 businesses may deal with this complex environment for decision making.
31
32
33
34
35
36
37
38
39
40
41
42
43

44 *Factors influencing students' gaming experience*

45

46 Frymier and Schulman (1995) suggest students should recognise the relevance and value in
47 the learning to engage with it. Pelozzi and Shang (2011) define this value for consumers as
48 their perception of the return from interactive and relativistic experiences. As students are
49 consumers of educational output (Vanderstraeten, 2004) they can be considered to act as
50 customers showing evolving preferences for interactive and relativistic learning and teaching
51 experiences, i.e. collaborative, interactive, experiential learning activities. Students respond
52
53
54
55
56
57
58
59
60

1
2
3 to the learning and teaching experience, in a similar way to customers reacting to a service
4 or product, that is they make a judgement whether to engage or not based on the perceived
5 expectation of the value the experience offers. Students' experience from game-based
6 learning and teaching may therefore depend on their level of education, their familiarity with
7 edutainment, and their experiential exposure to the issues within the game.
8
9
10
11
12

13
14 Interacting in-game processes within the game may influence the students' gaming
15 experience (Iten and Petko, 2016). For SSG these include the introduction to the game, the
16 game process itself, players' confidence in their understanding of the game and the post-
17 game debriefing. When introduced to the game students are provided with both written and
18 verbal game-play instructions to ensure different learning styles are addressed as
19 recommended by Kolb (2014). At the end of the game students are debriefed. This uses a
20 constructivist approach to learning that allows the construction of knowledge through
21 reflection on game-play experience recommended by Krause and Coates (2008). This
22 debriefing may also help students engage in a community of learning, enabling them to
23 share and explore group-generated strategies and provide and receive peer feedback and
24 reflection that promotes student engagement (Kuh, Kinzie and Buckley, 2006). Additionally,
25 the individual and group behaviours and expectations that are generated within the game
26 may contribute to players' experiences, for example the potential status-rewards from
27 winning, team members' willingness to collaborate or cooperate and team members'
28 personal attitudes towards business responsibilities. The opportunity to collaborate after
29 round eight of SSG may present challenges to groups' and individual students' behaviours
30 and inspire development of alternative and/or combined operating strategies.
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

48 During each round of SSG the groups appraise the encountered and perceived risks
49 and rewards within the game, which are able to affect players' gaming experiences and in
50 turn encourage behaviour changes (Wang and Sun, 2011). In-game rewards include the
51 maximisation of financial returns which are generated by groups' strategic choices and
52 decisions to spend capital to increase future returns, investment for technological
53
54
55
56
57
58
59
60

1
2
3 improvement or investment to potentially penalise others. Game risks encountered by each
4 group are affected by external factors such as other groups' strategic choices, which
5 influence the income received, and the players' assessment of the likelihood of being fined
6 for being the most polluting company.
7
8
9

10 11 12 13 14 **Research methodologies** 15

16 This article presents the findings from the initial cycle of action research to investigate the
17 value SSG has for generating student engagement through experiential game based
18 learning and teaching within business EfS. It fits into a larger longitudinal study exploring the
19 impact of innovative, active learning approaches to EfS. Action research offers a systematic
20 approach to identifying innovations (Braun and Clark, 2006) which Riding, Fowell and Levy
21 (1995) consider an opportunity to improve learning and teaching practice. It combines
22 evidence from a survey conducted with nineteen Level 6 and eleven Level 5 students after
23 they played a single game and reflections from the author. Students had a range of
24 experience of business sustainability learning. Some Level 6 students had taken a business
25 sustainability module at Level 5 (but had not played SSG previously); no Level 5 students
26 had previously studied business sustainability within WBS or played the game. This small
27 study presents the initial findings as an example of game-based learning and teaching that
28 offers a learner centred, collaborative learning environment that may engage students with
29 business sustainability.
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44

45 The author employed a short qualitative survey to explore student engagement that
46 allowed students to reflect on the quality of their learning experience. This survey asked
47 three questions: 1) What was your experience of playing the Sustainable Strategies Game?
48 2) If you were to be involved in revising the game what changes would you make? 3) What
49 features could be included within the game to further challenge you to change your
50 company's business strategy? The questions were deliberately open ended to encourage
51
52
53
54
55
56
57
58
59
60

1
2
3 students to reflect on both what was learned and the learning process. This can inspire
4 learners to develop attitudes through reflection on values and behaviours encountered to
5 generate deeper learning (Stubbs, 2011) and encourage them to process external
6 information which leads to understanding and productive thinking, not just the reproduction
7 of information (Mayer, 1996).
8
9
10
11
12

13
14 The survey collected evidence to explore two indicators of engagement: firstly,
15 students' testimonies as to SSG's ability to provide both learning and entertainment and
16 secondly students' recommendations for enhancements to SSG as an indicator of their
17 engagement. These two evidence bases will establish the potential for SSG to educate,
18 entertain, challenge thinking and elicit an emotional response, which demonstrate students'
19 cognitive investment, emotional commitment and active participation; the three factors that
20 Chapman and Dunkerley (2012) suggest generate engagement.
21
22
23
24
25
26
27

28
29 The questionnaire was distributed at the end of the game prior to the debriefing
30 session to ensure individuals' experiences were not biased by group discussion. It
31 emphasised reflection-on-action (Schön, 1987) and asked students to mentally revisit their
32 personal feelings and events to gain insights into their intellectual and emotional
33 engagement with the game and EfS. All students were given participant numbers and are
34 used within the analysis of findings below. Codes P1 to P19 identify Level 6 students and
35 P20 to P31 Level 5 students. The author's reflections on game play interactions and
36 outcomes and student behaviours are also included.
37
38
39
40
41
42
43
44

45 This qualitative, reflective approach also encouraged students to engage deeply with
46 sustainability concepts, which are frequently moral and ethical in nature, and think about
47 their learning. Barnett (2007) suggests that such complex open-ended ideas, perspectives,
48 values, beliefs and interpretations, which require students to engage intellectually and
49 emotionally, will generate engagement and deep learning.
50
51
52
53
54
55

56 Two deductive methodologies were employed to analyse the research findings and
57
58
59
60

1
2
3 further investigate students' experiences of playing SSG: Thematic Analysis and
4 Multifaceted Student Value Modelling. Thematic Analysis produces qualitative analyses of
5 responses to questions related to people's experiences, views and perceptions (Burns,
6 2005; Braun and Clark, 2006), a key focus of this research. Initially students' values of the
7 game for learning and teaching were used to explore levels of engagement with SSG. This
8 was undertaken through a Thematic Analysis of students' survey responses using core
9 words related to learning (e.g. 'educational' 'insightful' 'informative') and entertainment (e.g.
10 'fun', 'enjoy') to establish students learning experiences. Findings from the Thematic
11 Analysis were collated both qualitatively and quantitatively and where appropriate, findings
12 were related to the students' level of study.

13
14
15
16
17
18
19
20
21
22
23 Survey responses were also explored through the Multifaceted Student Value Model.
24 This adapted version of the Multifaceted Customer Value Model (Pelozzi and Shang, 2011)
25 examined the potential that SSG has for creating value for students from their game-playing
26 experience of learning thus enhancing engagement. This value is interactive and relativistic;
27 interactive as it is created when the student and game come together and relativistic as each
28 player's perception is influenced by external factors relative to the learning environment. The
29 potential for engagement was assessed along two value orientation dimensions (vertical
30 axis) and two spatial orientation dimensions (horizontal axis). This provided four potential
31 value streams that can define the type of value for engagement offered: educational value
32 (Quadrant 1), entertainment value (Quadrant 2), expression value (Quadrant 3) and
33 performance value (Quadrant 4).

34
35
36
37
38
39
40
41
42
43
44
45
46 To assess the strength of student engagement the Dimensions of Engagement
47 Framework (Emblen-Perry, 2017), based on Chapman and Dunkerley's three generators of
48 engagement, was used. Players feedback that indicated their reaction to, or feeling towards
49 the game, was categorised as 'cognitive investment', 'emotional commitment' or 'active
50 participation' which Chapman and Dunkerley (2012) suggest generate engagement.
51 Students' responses were located on the framework according to the degree of engagement

1
2
3 indicated by expressions of commitment and participation. The overall distribution of
4
5 feedback on the Dimensions of Engagement Framework indicates the strength of
6
7 engagement achieved. Recognising whether SSG is able to engage students through their
8
9 emotions as well as through learning and entertainment is valuable as emotional triggers are
10
11 able to induce sustainable behaviour (Scott et al. 2016), and potentially develop much
12
13 needed advocates for sustainability.
14

15
16 Finally, SSG's performance against the HEA Framework for Engagement through
17
18 Partnership (Higher Education Academy, 2016) was established. It was used to assess
19
20 opportunities to enable and empower students through learning, staff engagement and
21
22 sustainability to create deep engagement; the aims of the HEA Framework for Engagement
23
24 through Partnership and EfS. The framework focuses on four overlapping factors: learning,
25
26 teaching and assessment; subject based research and enquiry; curriculum design and
27
28 pedagogic consultancy and scholarship of teaching and learning. By comparing the
29
30 outcomes of the students' learning experience to these four factors, the value of SSG for
31
32 engagement can be established.
33
34
35
36

37 **Results**

38 39 40 *Students' experience of playing*

41
42 Participants' responses to the survey indicate the majority of students consider SSG
43
44 both educational and entertaining; 96% of students confirm that playing SSG engaged them
45
46 in learning and 77% confirmed that they found the game entertaining. For example:
47
48

49 *I learned companies that have concern over resources, environment and pollution*
50
51 *usually lose out in terms of profit (P6, Level 6)*
52

53
54 *It was a good way of understanding the point of sustainable thinking (P26, Level 5)*
55
56
57
58
59
60

1
2
3 *The game was enjoyable (P4, Level 6)*
4

5
6 *I had a fun experience playing the game, trying to suss out what other groups*
7
8 *responses would be in order to choose our strategies (P11, Level 6)*
9

10 Over two thirds of Level 6 students and 62% of Level 5 students use core words for
11 both education and entertainment in their survey responses. For example:
12

13
14
15 *Eye-opener, enjoyable, educational (P1, Level 6)*
16

17
18 *I really enjoyed it and found it informative (P15, Level 6)*
19

20
21 *I learned new things by enjoying a team game (P30, Level 6)*
22

23
24 *Fun interactive experience which enabled me to think about how sustainability would*
25
26 *impact businesses in real life situations (P22, Level 5)*
27

28
29 Charsky (2010) considers that if education and entertainment can be seamlessly
30 combined within learning and teaching the resulting experience is 'edutainment'. The
31 findings of this research suggest that students consider SSG offers 'edutainment' that has
32 engaged them. For example, one student considers SSG to be,
33

34
35
36
37
38 *An excellent game that kept me fully engaged (P31, Level 5)*
39

40
41 The survey responses indicate students develop a high level of self-perceived game
42 competence when playing SSG, which Fazey and Fazey (2001) suggest is a key motivator
43 for engagement. For example:
44

45
46
47
48 *It was fun and a different experience to the lecture. I enjoyed working with my team*
49
50 *to make conscious sustainable decisions (P24, Level 5)*
51

52
53 *It was good working together and coming up with a strategy (P11, Level 6)*
54

55
56 The author notes that SSG engenders students' competitive nature and it appears
57

1
2
3 that success with the competitive elements of the game (particularly if their competitors were
4 penalised by their actions) added to their self-perceived competence and enjoyment of
5 playing.
6
7

8
9
10 When explored in more detail the research findings indicate both Level 6 and Level 5
11 students recognise SSG as a valuable source of learning whilst being entertained. 100% of
12 Level 6 students and 92% of Level 5 students indicate that they engaged in learning; 74%
13 and 83% respectively reported being entertained. This suggests that more Level 6 students
14 recognise the learning delivered through SSG than Level 5 students.
15
16
17
18

19
20 However, more Level 5 students identified their enjoyment, suggesting that this
21 cohort were more engaged in the entertainment of game playing. This may be due to
22 differences in students' academic experience, exposure to business strategy making and/or
23 experience of game-based learning. The author notes that 5 weeks after playing the game
24 (which included the Easter break) Level 5 students were still talking about their enjoyment of
25 SSG and what they would do differently if they were to play again e.g. collaborating earlier in
26 the game, adopting different business strategies etc.; Level 6 students asked to play more
27 games and some even brought their own games into the taught sessions.
28
29
30
31
32
33
34
35
36

37 The research findings show that over two thirds of students at both Level 6 and Level
38 5 felt their thinking was challenged by playing SSG. Students' responses suggest that
39 through this game 68% of Level 6 and 66% of Level 5 students engaged cognitively with
40 game based learning and teaching. For example:
41
42
43
44
45

46 *Positive and insightful [experience] about other people's behaviour and business*
47
48 *(P13, Level 6)*
49

50
51 *[It] made me think about the needs and wants of the game in comparison to*
52
53 *individual vs. collective rationale (P12, Level 6)*
54

55
56 *It also opened my mind how difficult it is to make a change in the right direction if you*
57
58
59
60

1
2
3 *are alone (P21, Level 5)*
4

5
6 *[It] made me understand that it is so complex to act sustainable for a company*
7
8 *thinking about profit and environment at the same time (P26, Level 5)*
9

10
11 *[It] taught me the complexity of making such sustainability decisions within a real life*
12
13 *study (P28, Level 5)*
14

15
16 Although the majority of students' responses suggest that playing SSG had
17
18 challenged their thinking, fewer appear to have developed an emotional response to the
19
20 game. However, whilst this impact is lower, SSG has still managed to emotionally engage
21
22 almost 50% of the players. Examples of evidence for this include:
23

24
25 *It made you think about the importance of sustainability, and whether the prize was*
26
27 *more important than being sustainable (P4, Level 6)*
28

29
30 *We made the most profit out of all the businesses – so from a business perspective*
31
32 *we were successful. However, from someone who is concerned about the*
33
34 *environment then the 'limit pollution' action should have been considered more often*
35
36 *(P6, Level 6)*
37

38
39 *It was difficult to make the 'right decision' based on what we thought other groups*
40
41 *would do (P10, Level 6)*
42

43
44 *Helps boost understanding on what the actual effect on businesses, locals etc. of*
45
46 *pollution and regularly how business can get away with doing their own thing (P18,*
47
48 *Level 6)*
49

50
51 The author recognises that tension between a willingness to 'do the right thing' at the
52
53 expense of sacrificing potential maximum short-term returns developed between and within
54
55 groups. Research findings suggest some students recognise this and highlight the conflict
56
57 between their desire to win and knowing their group is not behaving sustainably. This aspect
58
59
60

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 engendered by SSG, players were asked to suggest opportunities that could be incorporated to enhance their experience of playing the game. This helps to embed the processes taking place within the game and makes them more relevant to the audience, which Wolfe and Byrne (1975) and Armier, Shepherd and Skrabut (2016) suggest further develops engagement. Analysis of survey responses indicates that 94% of students made at least one suggestion for a potential development of SSG, with 45% suggesting two or more opportunities for improvement.

The largest number of proposed developments involved additional game-features to challenge players' behaviours and rethink strategic choices: These additional features included:

Droughts or other natural disasters (P5, Level 6)

Tragic circumstances to illicit different responses (P11, Level 6)

A prize for the most sustainable company as well as for the most profitable will make teams decide what is most important to them (P24, Level 5)

Students considered additional game-features that increased penalties for the most polluting companies, or improving rewards for groups contributing the least pollution would increase the challenge of the game and provide more incentive to negotiate collaborative strategies. Students suggestions included:

Make sure that all businesses are punished for continued use of business as usual (P2, Level 6)

More sanctions for polluters/rewards for sustainable choices (L30, Level 5)

1
2
3 *Add bad publicity and reduce revenue able to be made by polluting companies (P14,*
4 *Level 6)*

5
6
7 *Increase the chance to get fined to 50% (P31, Level 5)*

8
9
10 *Include random mechanisms to trigger changes to strategy played e.g. visit by*
11 *Environment Agency and deductions for most polluting company id last three rounds*
12 *(P27, Level 5).*

13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
These suggestions were accompanied by preferences for clear naming and shaming of the groups demonstrating unsustainable practices. The author notes students' enjoyment of the competitive elements of the game, highlighted by their game-play behaviour, may indicate this suggestion has been made to improve their chance of beating other teams rather than challenging behaviours. Further research will explore which of the proposed game-play additions could appropriately enhance the purpose of SSG.

31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
Six students suggested the game instructions could be simplified as they appear to over complicate the rules. One recommended utilising a video to explain the game requirements and suggested it could be watched independently before the in-class session to speed up, and potentially enhance, players' engagement in the games' purpose and rules (P2, Level 6).

42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
Only three students suggested SSG could be digitised and played online. They suggested digitisation would make the game more anonymous and speed up the game. This was framed by students P18 (Level 6) and P5 (Level 6) as an opportunity to play more rounds of SSG rather than play for a shorter period of time. One student reflected:

51
52
53
54
55
56
57
58
59
60
I completed simulations games whilst studying in Germany. These games were computerised and we did not physically see the decisions of other groups. This might be a good thing to do with this game. (P8 Level, 6)

The number of improvement suggestions made and the detail of the development provided emphasises students' engagement with the learning outcomes, purpose and rules of the game. They also highlight that players engaged sufficiently with the game-play interactions and in-game problems that needed to be overcome to be able to recognise potential improvements.

Multifaceted Student Value Model for student engagement

The findings of the Multifaceted Student Value Model (Figure 1) suggest that SSG offers considerable levels of value to both individual players and groups (self-oriented and other oriented values).

	Intrinsic value	Extrinsic value
Self-oriented value	<p>Quadrant 1: Efficiency (e.g. SSG engaged students by offering value as an efficient educational tool) Evidence for this value is included in the student responses from: P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P13, P15, P16, P18, P19, P20, P21, P22, P23, P24, P26, P28, P29, P30, P31</p>	<p>Quadrant 3: Status (e.g. SSG engaged students by offering value through allowing demonstration concern for wellbeing of others/nature) Evidence for this value is included in the student responses from: P2, P3, P5, P10, P11, P12, P14, P16, P18, P19, P26, P28, P31</p>
Other oriented value	<p>Quadrant 2: Joy (e.g. SSG engaged students by offering value as entertainment and in-game gain) Evidence for this value is included in the student responses from: P1, P2, P3, P4, P7, P8, P10, P11, P12, P14, P15, P16, P17, P19, P21, P22, P24, P25, P26, P27, P28, P30, P31</p>	<p>Quadrant 4: Ethics (e.g. SSG engaged students by offering value as opportunity to act ethically/sustainably) Evidence for this value is included in the student responses from: P4, P5, P6, P8, P10, P17, P18, P19, P21, P22, P23, P26</p>

Figure 1: The Multifaceted Value Model assessing SSG's value for student engagement [adapted from Multifaceted Customer Value Model, Pelozo and Shang (2011)]

1
2
3 The student responses within Quadrant 1 (Educational Value) highlight the value SSG offers
4 for learning and the likelihood of engaging individual students with the learning offered.

5
6 Similarly, the responses in Quadrant 2 (Entertainment value) show the students' perceptions
7 of value of SSG for engagement through entertainment and the game's ability to engage
8 groups of players. Quadrant 3 (Expression value) and Quadrant 4 (Performance value)
9 suggest a lower, but still relevant number of students, perceived SSG valuable for showing
10 concern for their wellbeing of others and the environment and an opportunity to act
11 sustainably. The largest number of students' reflections on their game playing experiences
12 are positioned in Quadrants 1 or 2 of the Multifaceted Student Value Model with many of the
13 same students appearing within both quadrants. This further reinforces players' perceptions
14 of the value of SSG for 'edutainment'.
15
16
17
18
19
20
21
22
23

24
25 The students' feedback located in Quadrant 1 suggests both Level 5 and Level 6
26 students consider that SSG has provided them with sustainability literacy skills. However,
27 Level 6 students appear more likely to recognise the value the game offers individuals and
28 groups to demonstrate their sustainability thinking and the game's extrinsic opportunities for
29 learning. This may be due to their experience and level of education. The Multifaceted
30 Student Value Model's findings indicate that there is an opportunity to further develop the
31 value offering of the game in advocacy for sustainability, demonstrating concern and acting
32 sustainably, which will be addressed in future research.
33
34
35
36
37
38
39
40
41
42
43
44

45 **Discussion of research findings**

46
47
48 The research findings suggest that SSG provides an opportunity to engage students within
49 learning and teaching for EfS and develop sustainability literacy skills through game-based
50 edutainment and participatory interaction. These findings can be further assessed against
51 the Dimensions of Engagement Framework (Emblen-Perry, 2017) and the HEA Framework
52 for Engagement Through Partnership (Higher Education Academy 2016) to the evaluate the
53
54
55
56
57
58
59
60

extent of this engagement.

Mapping evidence from the students' survey responses against the Dimensions of Engagement Framework (Emblen-Perry, 2017) shown in Figure 2 suggests students have engaged strongly with the game to cognitively invest in their learning and have actively participated. Although fewer comments indicate an emotional response to the sustainability concepts in the game, those students commenting on this demonstrate high levels of engagement.

	Weak engagement	Medium engagement	Strong engagement
Cognitive investment		It was an interesting game It was valuable to see the results	Eye-opener... Insightful... It was valuable... Fun and challenging... Helpful and challenging... Helps to boost understanding Made you think... It opened my mind... Very challenging game... Taught me... The game was highly educating... I learned new things... I learned a lot... You understand how... Educational...
Emotional commitment			Good game even though we lost I enjoyed working with my team to make conscious sustainable decisions Excellent game that kept me entertained and fully engaged It is a shame destroying the environment is a profitable activity
Active		A different experience to	Great experience...

participation		the lecture	Using our tit-for-tat strategy.... It was good working together... Fun, interactive experience... Engaging experience in comparison to normal lectures as it required me to be more involved Played in class as a group I really enjoyed playing the game and I would be interested in playing more games like this The game was easy to understand Enjoyable... An engaging experience... Challenging... Different to normal lecture and more understanding...
---------------	--	-------------	---

Figure 2: Students' experiences of playing SSG mapped against the Dimensions of Engagement Framework

Relating the research findings to the HEA Framework for Engagement through Partnership (Higher Education Academy, 2016) allows SSG to be evaluated against established factors proven to deliver deep engagement (Figure 3). Figure 3 shows that being involved in playing, reflecting on the game playing experience and considering opportunities to improve the game, SSG 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 for Engagement Through Partnership.

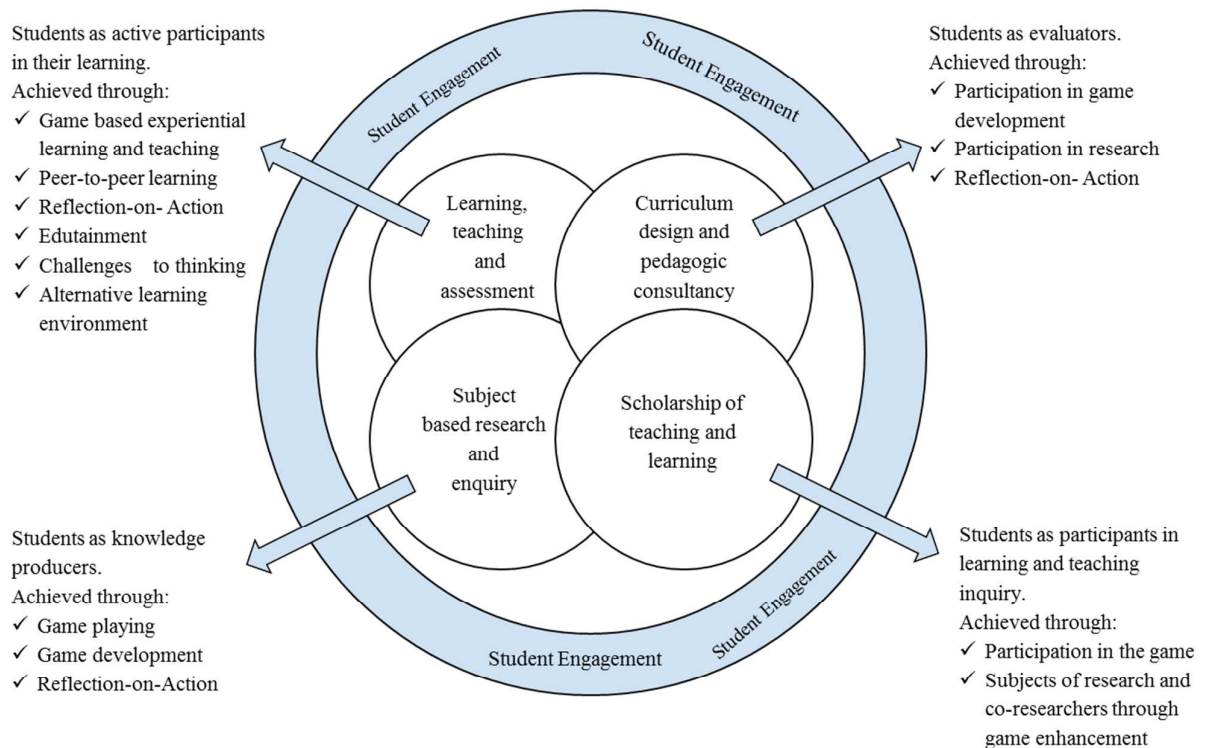


Figure 3: Students' experiences of playing SSG mapped against the HEA Framework for Engagement through Partnership (Higher Education Academy: 2016)

The intrinsic and extrinsic value identified from the Multifaceted Student Value Model highlights SSG's ability to generate active participation in EfS through the edutainment of game based learning and reflection on action, both of which challenge sustainability thinking within an alternative learning environment. Game playing and game development engage students as producers of knowledge, rather than receivers of information, and subjects of research who contribute to scholarship. Students' roles as co-researchers, game participants and game developers also allow students to evaluate the module content and participate in future curriculum design thus achieving the drivers of engagement incorporated within the HEA framework.

Implications for Practice

The results of this research confirm that using SSG as an alternative approach to learning and teaching can positively influence students' engagement EfS. Thus games, if appropriately designed and implemented, can make a difference to learning outcomes and students' value of the learning experience. The fun, interactive and experiential nature of the game appears to generate this value and, even though the student cohort becomes a community of competition, it engenders further engagement. Advocacy for sustainability may result from the cognitive investment, emotional engagement and deep learning achieved.

To make a difference to student engagement it appears that investing in games repays the investment in EfS curriculum design. This is because games are able to address learning expectations of students, develop a focus on learning for insight within EfS and highlight the tensions between profitability and good practice that may engender a sense of personal and business responsibility; a key for sustainable business futures. Games appear to provide an opportunity to provide learning support without simply providing information.

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 contributes to the development of such skills including an understanding of how business decision making conflicts with the most environmentally and socially sustainable actions. SSG also provides an opportunity to engage 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. Participation in the game therefore contributes to employability skills development.

Although this practice-focused study presents the self-reported results of a one-time, small study which does not offer generalised, independently validated responses, the findings may be of interest to educators considering the adoption of game-based learning and those seeking new learning cultures for business sustainability. In order to progress this

1
2
3 research further, including building the response rate to further validate the findings,
4 additional cycles of action research will be implemented following future game-playing
5 events. This will allow the author to obtain further suggestions for specific interventions as
6 well continuing to explore student engagement through game-based learning and teaching.
7 To ensure future research obtains greater levels of feedback on potential interventions,
8 survey questions 2 and 3 will be amended to overcome the misunderstandings that may
9 have occurred within this cycle of research. Responses to questions 2 and 3 generally
10 focused on changes to game-play processes with fewer interventions that students
11 perceived would challenge in-game behaviours provided. The author considers this has not
12 devalued this research and will obtain additional student suggestions before implementing
13 changes to SSG game-features to further improve its value for student engagement and
14 experiential learning in EfS. Additional questions to encourage players to reflect on team
15 strategies and negotiation techniques will further support validation of the game as a
16 learning tool.
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33

34 **Conclusions**

35
36 The research presented here has provided evidence to confirm that the game-based
37 learning and teaching offered by SSG has achieved strong engagement from cognitive
38 investment, emotional commitment and active participation. This has been generated by the
39 entertainment and interactive experiential learning encapsulated in the game. The
40 Multifaceted Student Value Model confirms the value students have placed on the
41 edutainment offered by this approach to learning, a feature supported by the Thematic
42 Analysis of survey responses. The engagement that SSG generates has helped the
43 students recognise they have developed sustainability skills including an understanding of
44 how business decision making conflicts with the most environmentally and socially
45 sustainable actions. SSG has proved able to challenge students' thinking and has provided
46 experience of the softer skills required for a business career such as negotiation,
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 collaboration and influencing. These have been practiced in the safe environment of a
4 lecture room. Group interaction (including the community of competition created by students)
5 and learning support experienced during game-play may have contributed the levels of
6 student engagement, bolstering the entertainment and learning the game clearly provides.
7
8 Further development of the game may encourage an element of collaboration as well as
9 competition.
10
11
12
13
14
15

16 This research into game-based learning has offered an evidence-based, practical
17 and theoretical example of students' evolving preferences for experiential activities. This is
18 now influencing the author's design and planning of learning activities to support student
19 learning, both in existing modules and potential new programmes for EfS. Additional action
20 research into the effectiveness of this innovative approach to learning and teaching will allow
21 further consolidation of research and scholarship into the professional practice of EfS.
22
23
24
25
26
27
28
29

30 **References**

- 31 Annetta, L., Minogue, J., Holmes, S.Y., and Cheng, M. (2009), "Investigating the impact of
32 video games on high school students' engagement and learning about genetics", *Computers
33 and Education*, Vol. 53 No. 1, pp. 74-85.
- 34 Armier, D., Shepherd, C., and Skrabut, S. (2016), "Using Game Elements to Increase
35 Student Engagement in Course Assignments". *College Teaching* 64(2). pp. 64-72.
- 36 Barnett, R. (2007), *A will to learn: Being a student in an age of uncertainty*, McGraw Hill,
37 New York.
- 38 Beech, N. and MacIntosh, R., (2012), *Managing Change: Enquiry and Action*, Cambridge
39 University Press, Cambridge.
- 40 Bloom, J. (2010), "Systems Thinking, Pattern Thinking, and Abductive Thinking as the Key
41 Elements of Complex Learning", Denver, Annual Meeting of the American Educational
42 Research Association.
- 43 Braun, V. and Clarke, V. (2006), "Using thematic analysis in psychology", *Qualitative
44 Research in Psychology*, Vol. 3, pp. 77-101.
- 45 Burgess, J. (2006), "Blogging to Learn, learning to blog", in: Burns, A. and Jacobs, J. (Eds.)
46 *Use of Blogs*, Peter Lang, New York, NY, pp. 105-114.
- 47 Burns, A. (2005), "Action Research: an evolving paradigm?" *Language Teaching*, Vol. 38
48 No. 2, pp. 57-74.
- 49 Centre for Systems Solutions, (2017), Green&Great, available at:
50 <https://greenandgreat.games4sustainability.com> (accessed 08 October 2017).
51
52 Chalkley, B., (2006), Education for Sustainable Development: Continuation *Journal of
53 Geography in Higher Education*, Vol. 30, No. 2, pp. 235-236.
54
55
56
57
58
59
60

- 1
2
3 Chapman, T. (2012), "Building Young People's Resilience in Hard Times: an evaluation of
4 Telefónica O2 Think Big Programme in the UK", Middlesbrough, Social Futures Institute,
5 available at: [https://www.stchads.ac.uk/wp-content/uploads/2015/09/Building-young-people-](https://www.stchads.ac.uk/wp-content/uploads/2015/09/Building-young-people-resilience-in-hard-times-O2-Think-Big-Evaluation-Report-May-2012.pdf)
6 [resilience-in-hard-times-O2-Think-Big-Evaluation-Report-May-2012.pdf](https://www.stchads.ac.uk/wp-content/uploads/2015/09/Building-young-people-resilience-in-hard-times-O2-Think-Big-Evaluation-Report-May-2012.pdf) (accessed 05
7 October 2017).
- 8 Charsky, D. (2010) "From Edutainment to Serious Games: A Change in the Use of Game
9 Characteristics", *Games and Culture*, Vol. 5 No. 2, pp. 177-198.
- 10 Cheong, C., Filippou, J., and Cheong, F. (2014), "Towards the Gamification of Learning:
11 Investigating Student Perceptions of Game Elements", *Journal of Information Systems*
12 *Education*, Vol. 2 No. 53, pp. 233.
- 13 Cooper, S., Treuille, A., Barbero, J., Leaver-Fay, A., Tuite, K., Khatib, F., Snyder, A.,
14 Beenen, M., Salesin, D., Baker, D. and Popović, Z. (2010), "The challenge of designing
15 scientific discovery games", California: Proceedings of the Fifth International Conference on
16 the Foundations of Digital Games; Monterey; 2010. pp. 40-47.
- 17 Conole, G., and Alevizou, P. (2010), "A literature review of the use of Web 2.0 tools in higher
18 education", available at: [https://www.heacademy.ac.uk/system/files/conole_alevizou_](https://www.heacademy.ac.uk/system/files/conole_alevizou_2010.pdf)
19 [2010.pdf](https://www.heacademy.ac.uk/system/files/conole_alevizou_2010.pdf) (accessed 20 March 2017)
- 20 Cross, P. (1987), "Teaching for learning", *AAHE Bulletin*, Vol. 39 No. 8, pp. 3-7.
- 21 Davis, B., and Sumara, D. (2006), *Complexity and education: inquiries into learning,*
22 *teaching, and research*, Routledge, New York.
- 23 Dieleman, H. and Huisingsh, D. (2006), "Games by which to learn and teach about
24 sustainable development: exploring the relevance of games and experiential learning for
25 sustainability", *Journal of Cleaner Production*, Vol. 14 No. 9, pp. 837-847.
- 26 Drayson, R. (2015), "Employer attitudes towards, and skills for, sustainable development",
27 available at: [https://www.heacademy.ac.uk/knowledge-hub/student-attitudes-towards-and-](https://www.heacademy.ac.uk/knowledge-hub/student-attitudes-towards-and-skills-sustainable-development-2015)
28 [skills-sustainable-development-2015](https://www.heacademy.ac.uk/knowledge-hub/student-attitudes-towards-and-skills-sustainable-development-2015) (accessed 10 October 2017).
- 29 Ellison, N. and Wu, Y. (2008), "Blogging in the Classroom: A Preliminary Exploration of
30 Student Attitudes and Impact on Comprehension", *Journal of Educational Multimedia and*
31 *Hypermedia*, Vol. 17 No. 1, pp. 99-122.
- 32 Emblen-Perry, K. (2017), "*Promoting Education for Sustainable Development through Game*
33 *Based Learning*", in: Leal Filho W. (eds) *Handbook of Sustainability Science and Research.*
34 *World Sustainability Series*, Cham, Springer.
- 35 Fabricatore, C. and López, X. (2012), "Sustainability Learning through Gaming: An
36 Exploratory Study", *Electronic Journal of E-Learning*, Vol. 10 No. 2, pp. 209.
- 37 Fazey, D., and Fazey, J. (2001), "The potential for autonomy in learning: Perceptions of
38 competence, motivation and locus of control in first-year undergraduate students", *Studies in*
39 *Higher Education*, Vol. 26 No. 3, pp. 245-61.
- 40 Figuero, P. and Raufflet, E. (2015), "Sustainability in Higher Education: A systematic review
41 with focus on management education", *Journal of Cleaner Production*, Vol. 106, pp.22-33.
- 42 Frymier, A.B., and Schulman, G.M. (1995), "What's in it for me? Increasing content
43 relevance to enhance students' motivation", *Communication Education*, Vol. 44, pp. 40-50.
- 44 Gee, J.P. (2007), *What video games have to teach us about learning and literacy*, Palgrave
45 Macmillan, New York.
- 46 Hardin, G. (1968), "The Tragedy of the Commons", *Science*, Vol. 162, No. 3859, pp. 1243-
47 1248.
- 48
49
50
51
52
53
54
55
56
57
58
59
60

- 1
2
3 Hays R.T. (2005), "The effectiveness of instructional games: a literature review and
4 discussion", available at: <http://handle.dtic.mil/100.2/ADA441935> (accessed 10 October
5 2017).
- 6 HEFCE (2013). "Sustainable Development in Higher Education: consultation on a framework
7 for HEFCE. Higher Education Funding Council for England", available at:
8 <http://www.hefce.ac.uk>. (accessed 23 March 2017).
- 9
10 Higher Education Academy (2015), "Education for sustainable development (ESD)",
11 available at: [https://www.heacademy.ac.uk/workstreams-research/themes/education-](https://www.heacademy.ac.uk/workstreams-research/themes/education-sustainable-development)
12 [sustainable-development](https://www.heacademy.ac.uk/workstreams-research/themes/education-sustainable-development) (accessed 04 April 2017).
- 13 Higher Education Academy (2016), "Higher Education Academy frameWORKS, 04 Essential
14 frameworks for enhancing student success", available at: [http://www.heacademy.ac.uk](http://www.heacademy.ac.uk/transform)
15 [/transform](http://www.heacademy.ac.uk/transform) (accessed 04 April 2017).
- 16
17 Iten, N, and Petko, D. (2016), "Learning with serious games: Is fun playing the game a
18 predictor of learning success?" *British Journal of Educational Technology*, Vol. 47 No. 1.
- 19 Kafai, Y. B. (2006), "Playing and making games for learning: Instructionist and
20 constructionist perspectives for game studies", *Games and Culture*, Vol. 1 No.1, pp. 34-40.
- 21 Katsaliaki, K. and Mustafee, N. (2015), "Edutainment for Sustainable Development: A
22 Survey of Games in the Field", *Simulation and Gaming*, Vol. 46 No. 6, pp. 647.
- 23
24 Kolb, D. A. (2014), *Experiential Learning - Experience as the Source of Learning and*
25 *Development*, 2nd edn. Pearson Education Inc, Upper Saddle River, New Jersey.
- 26
27 Krause, K. and Coates, H. (2008), "Students' engagement in first-year university,
28 *Assessment and Evaluation in Higher Education*", Vol. 33 No. 5, pp. 493-505.
- 29
30 Kuh, G., Kinzie, J. and Buckley, J. (2006), "What matters to student success: A review of the
31 literature", available at: http://nces.ed.gov/IPEDS/research/pdf/Kuh_Team_Report.pdf
(accessed 20 March 2007).
- 32
33 Leach L (2016), "Exploring discipline differences in student engagement in one institution.
34 *Higher Education Research and Development*", Vol. 35 no. 4, pp. 772-786.
- 35
36 Lizzio, A. and Wilson, K. (2008), "Feedback on assessment: students' perceptions of quality
37 and effectiveness, *Assessment and Evaluation in Higher Education*, Vol. 33 No. 3, pp. 263-
38 275.
- 39
40 McGrath, N. and Bayerlein, L. (2013), "Engaging online students through the gamification of
41 learning materials: The present and the future", in: H. Carter, M. Gosper and J. Hedberg
(Eds) *Electric Dreams*, Macquarie University, Sydney.
- 42
43 Mayer, R. (1996), "Learners as information processors: Legacies and limitations of
44 educational psychology's second metaphor", *Educational Psychologist*, Vol. 31 No. 3, pp.
45 151-161.
- 46
47 Meadows, D., Sterman, J. and King, A. (2017) "Fishbanks: A Renewable Resource
48 Management Simulation", available at: [https://mitsloan.mit.edu/LearningEdge/simulations/](https://mitsloan.mit.edu/LearningEdge/simulations/fishbanks/Pages/fish-banks.aspx)
49 [fishbanks/Pages/fish-banks.aspx](https://mitsloan.mit.edu/LearningEdge/simulations/fishbanks/Pages/fish-banks.aspx) (Accessed 10 October 2017).
- 50
51 Miller, J. and Page, S. (2007), *Complex Adaptive Systems: An Introduction to Computational*
52 *Models of Social Life*, Princeton University Press, Princeton, New Jersey.
- 53
54 Molthan-Hill, (2014), *The business student's guide to sustainable management: principles*
55 *and practice*, Greenleaf Publishing, Sheffield.
- 56
57 Nagle A., Wolf, P., Riener, R. and Novak, D. (2014), "The Use of Player-centered Positive
58 Reinforcement to Schedule In-game Rewards Increases Enjoyment and Performance in a
59 Serious Game", *International Journal of Serious Games*, Vol. 1 No. 4, pp. 35-47.
- 60

- 1
2
3 Norridge, J. (2017), "SIM Sweatshop", available at: <http://www.simsweatshop.com/game/>
4 (accessed 10 October 2017).
- 5 Oblinger, D., and Oblinger, J. (2005), "Educating the Net Generation", available at:
6 <http://www.educause.edu/educatingthenetgen> (accessed 01 April 2017)
- 7
8 Pelozzi, J. and Shang, J. (2011), "Investing in CSR to Enhance Customer Value", available
9 at: [https://corpgov.law.harvard.edu/2011/02/28/investing-in-corporate-social-responsibility-](https://corpgov.law.harvard.edu/2011/02/28/investing-in-corporate-social-responsibility-to-enhance-customer-value/)
10 [to-enhance-customer-value/](https://corpgov.law.harvard.edu/2011/02/28/investing-in-corporate-social-responsibility-to-enhance-customer-value/) (accessed 10 October 2017).
- 11 Plass, J., Homer, B. & Kinzer, C. (2015) Foundations of Game-Based Learning, *Educational*
12 *Psychologist*, Vol. 50 No. 4, pp. 258-283.
- 13 Riding, P., Fowell, S. and Levy, P., (1995), "An action research approach to curriculum
14 development", *Information Research*, Vol. 1 No. 1, pp. 1-7.
- 15
16 Rieckmann, M. (2011), "Future-oriented higher education: Which key competencies should
17 be fostered through university teaching and learning?" *Futures*, Vol. 44, pp.127–135.
- 18 Schell, J. (2008), *The Art of Game Design: A Book of Lenses*, Morgan Kaufmann
19 Massachusetts.
- 20
21 Schön, D. A. (1987), "*Educating the Reflective Practitioner: Towards a New Design for*
22 *Teaching and Learning in the professions*", Jossey-Bass, San Francisco, CA.
- 23 Scott, B., Amel, E., Koger, S. and Manning, C. (2016), *Psychology for Sustainability* (4th
24 edn.) Routledge, Oxford.
- 25
26 Shaffer, D., Halverson, R., Squire, K. and Gee, J. (2005), "Video games and the future of
27 learning", *Phi Delta Kappan* Vol. 87 No. 2, pp. 105-111.
- 28 Stough, T., Ceulemans, K. Lambrechts, W. and Cappuyns, V. (2017) Assessing
29 sustainability in higher education curricula: A critical reflection on validity issues, *Journal of*
30 *Cleaner Production* 2017 pp. 1-11.
- 31 Stubbs, W. (2011). Addressing the business-sustainability nexus in postgraduate education
32 *International Journal of Sustainability in Higher Education*, Vol. 14 No. 1, pp. 25-41.
- 33
34 Tilbury, D. and Wortman, D. (2008), "How is Community Education Contributing to
35 Sustainability in Practice?", *Applied Environmental Education and Communication*, Vol. 7
36 No. 3, pp. 83-93.
- 37
38 Traidcraft (2017), "The Orange Trading Game", available at: [http://www.traidcraftschools](http://www.traidcraftschools.co.uk)
39 [.co.uk](http://www.traidcraftschools.co.uk) (accessed 09 October 2017).
- 40 Tsai, F., Yu K. and Hsaio, H. (2011). "Exploring the Factors Influencing Learning
41 Effectiveness in Digital Game-based Learning". *Educational Technology and Society*, Vol.
42 15, no. 3, pp. 240-250.
- 43 UNESCO (2017). Education for Sustainable Development Goals Learning Objective,
44 available at: <http://unesdoc.unesco.org/images/0024/002474/247444e.pdf>.
- 45
46 Vanderstraeten, R. (2004), "Education and Society: a plea for a historical approach", *Journal*
47 *of Philosophy of Education*, Vol. 38 No. 2, pp. 195-206.
- 48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 Wang H, and Sun C (2011), "*Game Reward Systems: Gaming Experiences and Social*
4 *Meanings*". Presented at 5th DiGRA Conference: Think Design Play, Hilversum, The
5 Netherlands, 14-17 September 2011.

6 Wolfe, D. and Byrne E. (1975), "Research on Experiential Learning: Enhancing the
7 Process", *Business Games and Experiential Learning in Action*, Vol. 2, pp.325-326.

8 Wrzesien M. and Raya M. (2010), "Learning in serious virtual worlds: evaluation of learning
9 effectiveness and appeal to students in the E-Junior project", *Computers and Education*, Vol.
10 55 No. 1, pp. 178-187.

11 Young, M., Slota, S., Cutter, A., Jalette, G., Mullin, G., Lai, B., Simeoni, Z., Tran, M., and
12 Yukhymenko, M. (2012), "Our Princess Is in Another Castle: A Review of Trends in Serious
13 Gaming for Education", *Review of Educational Research* Vol. 82, No. 1, pp. 61–89 .

14 Zepke, N. and Leach, L. (2010), "Improving student engagement: Ten proposals for action",
15 *Active Learning in Higher Education*, Vol. 11 No. 3, pp. 167-177.

16 17 18 19 20 21 22 23 **About the Author**

24
25 Dr Kay Emblen-Perry is Senior Lecturer in Sustainable Management at the University of
26 Worcester Business School. Her research interests include innovative teaching and learning
27 approaches to business sustainability and behavioural aspects of energy consumption and
28 efficiency in SMEs. In previous roles Kay gained senior project management and purchasing
29 management experience in international automotive companies and has several years'
30 senior environmental and ecology consultancy experience delivering consultancy projects in
31 renewable energy technologies, contaminated land remediation, and ecological assessment
32 for UK organisations.

33 34 35 36 37 38 **Disclosure statement**

39
40 No potential conflict of interest was reported by the author.
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60