

iPlay, iLearn, iConserve: Digital Game-based Learning for Sustainable Tourism Education

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ABSTRACT

There has been increased global advocacy in recent years for the need to integrate sustainability agendas in tourism education and practice. Concurrently, there is growing interest and research on game-based learning (GBL), and its effectiveness in achieving pedagogical and learning outcomes in higher education. While there have been a number of studies about GBL across diverse educational disciplines and contexts, there has been no significant study to date investigating the application and effectiveness of Digital Game-based Learning (DGBL) for sustainable tourism education. The aim of this conceptual paper is to examine the key attributes influencing learning effectiveness (knowledge acquisition outcomes) of DGBL within the context of sustainable tourism education. The study will review current research agendas within the dimensions of (1) sustainable tourism education, and (2) gamification and game-based learning. These will be discussed within the context of a Sustainable Tourism Simulation Game, which was developed to incorporate game-based strategy as part of the blended learning curriculum in an undergraduate sustainable tourism unit. A proposed conceptual framework recommends key assessment indicators for measuring DGBL outcomes in sustainable tourism education.

Key words: Digital Game-based Learning, Gamification, Sustainable Tourism, Sustainability Education

INTRODUCTION

In the last three decades, sustainable development has emerged as a core concern in tourism, prompting the operationalization of sustainable tourism (hereafter ST) efforts in business, destination planning and management (Hall, Gössling, & Scott, 2015). Whilst tourism development can bring positive outcomes (e.g., economic prosperity, environmental and cultural sensitivity and awareness), it also depletes sociocultural, environmental and economic resources (Dwyer, 2005; Higgins-Desbiolles, 2006). Given the sheer scale and double-edged nature of tourism, there is a need to ensure positive developments and advocacy towards the conceptualization and implementation of ST. Subsequently, there have been increased efforts in recent years to integrate ST into tourism education curriculum and design

(Boyle, Wilson, & Dimmock, 2014). Concurrently, with rapid advancements in gaming, entertainment and educational technologies, there is an upsurge in interest and discourse on the impacts of gamification, serious games and game-based learning; and its effectiveness in achieving educational, pedagogical and learning outcomes (All, Castellar, & Van Looy, 2015; Plass, Homer, & Kinzer, 2015; Wilson et al., 2009). Within the context of blended learning curriculum in higher education, digital learning games may be adopted to enhance deep learning and knowledge acquisition (Tsai, Yu & Hsiao, 2012); and consequently, the achievement of cognitive (i.e., knowledge transfer), affective (i.e., attitudinal/behavioral), and skill-based (i.e., skill acquisition) learning outcomes (All, Castellar, & Van Looy, 2016).

While there have been a myriad of empirical research and systematic evaluations of game-based learning (hereafter GBL) and gamification across diverse educational disciplines and contexts, there has been no significant study to date investigating the application and learning effectiveness of digital game-based learning (hereafter DGBL) for ST education. Consequently, there is a dearth of information correlated to the evaluation of learning outcomes (and measurement indicators) derived from the implementation of DGBL strategies within the context of ST education and programs. With the increased adoption of technology-enhanced learning and digitization of learning content in higher education, there is a need to evaluate appropriate integration of such technologies and learning environments vis-à-vis student learning abilities and outcomes (Goodyear & Retalis, 2010; All et al., 2016). Thus, the aim of this conceptual paper is to investigate the key elements influencing learning effectiveness (knowledge acquisition outcomes) of DGBL in ST education. Specifically, it aims to investigate the efficacy of game-based strategies adopted for sustainability education within the dimensions of (1) ST education, and (2) gamification and DGBL. These will be applied and discussed within the context of an online digital game: The Sustainable Tourism Simulation Game, which was developed to incorporate game-based strategy as part of the blended learning curriculum in an undergraduate sustainable tourism unit. Finally, a conceptual model of DGBL for ST education is proposed, in which assessment indicators for measuring effectiveness of DGBL in achieving ST learning outcomes (cognitive, affective and behavioral) are recommended.

LITERATURE REVIEW

Education for Sustainability and Education About Sustainability

Sustainability concerns and advocacy for sustainable development have become prevalent subject fields in the curriculum space of tourism education (Ring, Dickinger, & Wober, 2008; Wang, Ayres, & Huyton, 2010). However, whilst the fundamental ideologies about ST are well acknowledged across education sectors, its constantly evolving, flexible and complex nature as a ‘wicked problem’ (Hall et al., 2015), has rendered the effective integration of ST into tourism curriculum challenging (Junyent & De Ciurana, 2008). Specifically, there are debates within the academic community on issues concerning: (1) content and pedagogy; (2) whether to teach ST as an independent subject or an embedded element in all subjects; and (3) divergent definitions of sustainability across disciplines (Boyle et al., 2014; Wilson & von der Heide, 2013). Consequently, academics and international organizations have developed various models and tools for implementing meaningful sustainability/ST programs. These frameworks generally aim to identify learning outcomes as well as pedagogical approaches to sustainability education.

Within the context of ST curricula, Education about Sustainability (EaS) and Education for Sustainability (EfS) are two contrasting approaches to sustainability education. EaS refers to teaching students about the content matter of sustainable development and “declarative

knowledge sets associated with sustainability” (Jennings, Cater, Hales, Kensbock, & Hornby, 2015, p.381). Hence, it is a value-free, objective approach to sustainability education that creates awareness about sustainability-related issues such as global warming and its related impacts. Conversely, EfS is a pedagogical concept that aims to motivate and equip individuals to make reflective, informed decisions towards a more sustainable world (Huntin, Mah, & Tilbury, 2006). It is, therefore, a value-laden approach to sustainability education that aims to encourage behavioral and lifestyle change for a sustainable future (ARIES, 2009). In an effort to forward the sustainability agenda in tourism education, the Tourism Education Future Initiative (TEFI) was established, wherein a set of value-based dimensions for tourism education (the TEFI Values) were developed to “provide more responsible graduates and better stewardship for destinations, and their environmental and socio-cultural resources” (Sheldon, Fesenmaier, & Tribe, 2011, p.21). These value sets include: (1) ethics, (2) stewardship, (3) knowledge, (4) professionalism, and (5) mutuality. Although the TEFI Values are not exclusively designed for ST education, many of the value sets have direct relevance.

Jamal, Taillon, and Dredge (2011) posit that there are six essential ST pedagogy literacies (STP) vital for educating ‘sustainable practitioners’: (1) technical literacy, (2) analytical literacy, (3) ecological literacy (4) multi-cultural literacy, (5) policy and political literacy, and (6) ethical literacy. They suggest that learners can develop “theoretical and practical knowledge [phronesis] and skills (through) interactive experience and engagement with environmental, economic, social, and cultural issues in the local community space and the wider regional/global tourism system” (p.138). Thus, they recommend that pedagogical approaches to ST education include “a critical, collaborative and praxis-oriented relationship with people, places, spaces and time” (p.137). Similarly, Junyent and De Ciurana (2008, p.768) propose ten characteristics of effective sustainability education, which include: (1) integrating the paradigm of complexity into the curriculum; (2) introducing flexibility and permeability into disciplines; (3) contextualizing the curricular project; (4) taking the subject into account in the construction of knowledge; (5) considering the cognitive, affective and action aspects of people; (6) consistent relationships between theory and practice; (7) working within prospective orientations of alternative scenarios; (8) methodological adaption of teaching and learning; (9) creating spaces for reflection and democratic participation; and (10) reinforcing commitment to transform relations between society and nature. Although these criteria and approaches are extremely diverse, they can be useful instruments for the development of course content and indicators for assessing learning effectiveness of ST education.

Digital Game-based Learning and Gamification in Education

In the last decade, games and digital online resources have evolved to become ubiquitous within social and educational contexts. Consequently, educators have increasingly begun to explore its use as a learning tool (Karagiorgas & Niemann, 2017). As digital natives, today’s learners extensively engage with, and play digital games in their individual and social lives (Tsai et al., 2012). With widespread consumption on digital games, it is estimated that 94-99% of youths play digital games, and spend 7-10 hours or more a week on game-play (Plass et al., 2015). In fact, Papastergiou (2009) observes a disparity between the intrinsic impetus and enthusiasm for gaming versus the apathy towards conventional academic curricular contents, wherein “the challenging world of games shape the learners’ cognitive abilities and expectations about learning, making scholastic content and practices seem tedious and meaningless” (p.1). This increased dissonance, and the evolution of games (digital and non-digital) as a learning medium has led to two prevalent game-based strategies in education: gamification and GBL.

There have been a myriad of definitions and interpretations about GBL, DGBL and gamification over the years. Generally, gamification refers to the application of game-design features applied to non-game learning contexts (rather than entertainment), whereas GBL refers to the deliberate use of games or simulations to enhance teaching and learning, based upon specific learning objectives (Karagiorgas & Niemann, 2017; Kiili, 2005; Plass et al., 2015; Wiggins, 2016; Tsai et al., 2012). Perrotta et al. (2013) explains that, GBL is

A form of experiential engagement in which people learn by trial and error, by role-playing and by treating a certain topic not as content, but as a set of rules, or a system of choices and consequences. In curricular terms, this means translating an element of a subject...into the mechanics of a game, which operates within a self-contained system based on choices and consequences". (p.7)

By applying the principles of game-design elements and strategy to curricula, courseware developers integrate gamified experiential activities, problem solving tasks and audience engagement to generate interest and hold attention (Abdul Jabbar & Felicia, 2015; All et al., 2015; Kiili, 2005). Developments in DGBL and its popularity reflect an "emergent awareness of the value of situated cognition to re-engage students who have lost interest in traditional instruction" (Wiggins, 2016, p.20). However, it should also be noted that GBL agendas should not just focus on the elements of game-play. To be effective, GBL should also ensure the accomplishment of specified learning outcomes; and balance game-play motivations with the required topic/subject coverage. Thus, rigorous assessment and a consistent approach for measuring learning effectiveness is necessary to improve the quality of DGBL and determine the most effective way digital games can be utilized to support learning (All et al., 2016). Plass et al. (2015) propose an integrated model of GBL, in which they posit that the interplay of (1) challenge, (2) response and (3) feedback elements within the game structure provide learning experiences that engage learners on a cognitive, affective, behavioral, and social-cultural level. By adopting a learner-centric approach, DGBL activities facilitate active participation and experiential learning; and help students develop their procedural, declarative and strategic knowledge within the subject field (Wilson et al., 2009).

THE SUSTAINABLE TOURISM SIMULATION GAME

This exploratory study is motivated by the desire to measure the learning outcomes and effectiveness of a Sustainable Tourism Simulation Game (hereafter STSG) within the curriculum of an undergraduate ST unit. This unit is offered transnationally in Australia and Singapore using the blended learning approach. Digital content developed within the curricula are designed to fulfil specific learning objectives aligned to topics within the syllabus; and to scaffold the learning outcomes from other units within the program. Therefore, there is a need to investigate the effectiveness of ST learning outcomes from this DGBL activity, and highlight areas for improvement and/or avenues for further development. With the assessment measures proposed in the conceptual framework (Figure 2), educators can better assess the specific learning outcomes of each student utilizing a set of key indicators aligned to ST agendas; and scaffold that with other aspects of the unit's learning activities and assessments.

The STSG was developed with the objective of enabling students to apply knowledge acquired in the ST curriculum to the implementation of ST practice at a virtual tourism destination. In the simulation, students review the destination case study and problem statement outlining key factors that may be affected by their decisions. They are able to hear from key team-members, advisors and local community stakeholders who provide feedback and opinions about tourism development options available. Thereafter, students may explore sub- options within each choice and resulting consequences in terms of the triple bottom-lines of

social, economic and environmental outcomes (Figure 1). At the end of the simulation, students obtain an individual report detailing the outcomes from their choice(s). These are then shared and debated in class. The STSG is played at the mid-point of the semester; and again, at the end of the semester. The aim is to determine if there has been a shift in their choices, based on their ST knowledge gained throughout the semester's learning journey. This reflective aspect of the learning exercise is essential to measure outcomes in transformative, experiential and collaborative learning within ST Pedagogy (Jamal et al., 2011).



Figure 1. Screen-shots of various game stages in the STSG

FINDINGS AND DISCUSSION

Based on the preliminary observations of game-based experience of the STSG and literature on ST education, gamification and GBL, it is evident that the application of game-based strategies in academic curriculum can offer interactive and engaging experiential elements in learning activities, and help encourage critical thinking, collaborative learning and knowledge acquisition through game-play (Kiili, 2005; Tsai et al., 2012). In particular, DGBL facilitates the engagement and motivational levels of learners through the use of augmented multisensory environments to stimulate critical thinking and create meaning (Abdul Jabbar &

Felicia, 2015). This complements the learning themes discussed in ST pedagogy that integrates both the EaS and EfS approaches (Jennings et al., 2015) in ST instruction. Appropriate utilization of DGBL strategies in ST education and curriculum can facilitate learner motivation and draw their attention towards the achievement of knowledge acquisition and retention.

Within the context of the STSG, the key principles of ST education and DGBL were considered during its storyboarding, design and implementation processes. In order to encourage participative engagement with the subject matter, learners are prompted to adopt specific ST management roles, logic, and sustainability principles to critically analyze ST destination management concerns. Moreover, to ensure effective application of DGBL, educators need to look beyond the elements of game-play, and determine the key DGBL attributes that substantiate knowledge acquisition and learning outcomes (All et al., 201; Tsai et al., 2012). Therefore, to determine the key elements influencing learning effectiveness and quantifiable learning outcomes from the STSG, a conceptual framework for DGBL in ST education is proposed (Figure 2). The assessment indicators for knowledge acquisition and demonstration of ST competencies are illustrated across two broad themes: (1) ST education dimensions, and (2) DGBL dimensions.

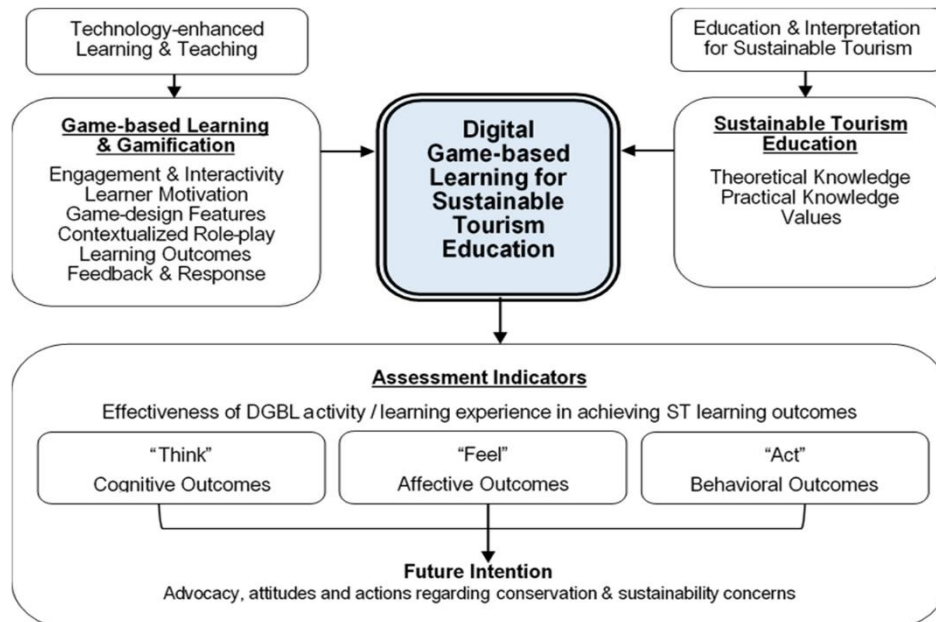


Figure 2. Conceptual Framework: Assessment Indicators for DGBL outcomes in ST Education

In terms of the ST Education dimensions, there are three key themes to be considered: (1) theoretical knowledge, (2) practical knowledge, and (3) values. Theoretical knowledge relates to the ‘what’ of ST. This dimension incorporates the EaS approach that focuses on developing awareness about the nature and broad issues of sustainability in tourism. The practical knowledge dimension relates to the ‘how’ of ST education. It is also a form of EaS that comprises knowledge, tools and instruments used to assess, measure and improve sustainability. The third dimension, values, relates to the ‘why’ of ST, whereby divergent views and perspectives of ST are debated, discussed, and challenged. This dimension incorporates the EfS approach, encouraging and empowering learners to develop their own moral and ethical standpoints in relation to ST.

Within the DGBL dimension, there are six themes reflecting the key elements of GBL and gamification in education: (1) engagement and interactivity, (2) learner motivation, (3) game-design features, (4) contextualized role-play, (5) learning outcomes, and (6) feedback and response. These thematic elements within the assessment framework illustrate the

relationship between game-based attributes and sustainability learning outcomes. As highlighted by Wilson et al. (2009), it is important to assess which components of the game are considered to be the key influencers of learning outcomes. They posit that the use of games and simulations in education virtually construct learning activities situated within specified rules, constraints and goals, framed within a specified context. These enable a learner to interact and engage in a range of complex processes and decision-making tasks representing a particular phenomenon. By synergizing essential game attributes with educational objectives situated within the subject matter, there is a potential for academic content to be more learner-centric, contextually relevant and enjoyable. Consequently, learning can also become more interesting and effective (Papastergiou, 2009). Table 1 summarizes the key attributes of DGBL for ST Education.

Table 1. Nine Elements of DGBL for ST Education

Themes	Attributes
ST Education Dimensions	
Theoretical knowledge	Triple bottom line (TBL) of ST; Short- (intragenerational) to long-term (intergenerational) impacts of tourism; Historical development of ST
Practical knowledge	Sustainable business practices and operations; ST policy and planning; ST indicators; visitor/site management strategies and techniques
Values	Sustainability ethics; Morality; Criticality; Collaboration; Reflective thinking
DGBL Dimensions	
Engagement and Interactivity	Learner engagement (cognitively, affectively, behaviorally and social-culturally); Interaction and social collaboration; ‘Playful’ experiences through game-play
Learner Motivation	Interest and willingness to participate; Goal orientation and self-determination; Challenge and recognition of achievement
Game-design Features	e.g., Narrative/story-telling, thematic elements, and game aesthetics; Multi-media composition and game mechanics; Flow and pacing; Incentives and rewards
Contextualized Role Play	Contextually-situated ‘quests’ (game context, roles and identities); Problem-solving through play; Specified tasks in the learning journey; ‘Graceful failure’ and risk-taking (including adaptability and creativity)
Learning Outcomes	Pedagogical foundation and objectives; Instructional design; Knowledge and skills acquisition; Learning mechanics and scaffolding
Feedback and Response	Assessment mechanics; Feedback on achievement of learning objectives /outcomes; Self-reflection and transfer of learning beyond the game

CONCLUSION

This paper is conceptual in nature and its objective is to investigate the dimensions of DGBL and its application in ST education. Specifically, it explores the key elements influencing learning outcomes of digital games and game-based strategies within a blended learning ST curriculum. Whilst there is no empirical data collected at this stage, the exploratory study reviews key attributes influencing learning effectiveness (knowledge acquisition outcomes) of DGBL applicable to an ST simulation game. These attributes established the conceptual framework through which key assessment indicators for measuring ST learning outcomes from DGBL activities are proposed. With increased digitization of learning content in blended learning classrooms, it is critical for the synergistic integration of educational technologies vis-à-vis student learning outcomes. Within the context of DGBL in ST education, the amalgamation of game-based features with sustainability education philosophy may indeed

prove valuable. The adoption of gamified experiential learning activities can help to re-engage and interest students who are discontented with traditional ST instruction. Notwithstanding the popularity of game-play, it is imperative that digital content/games developed for ST curriculum must also accomplish specified learning outcomes, ensure adequate topic coverage, and develop sustainability literacies and competencies.

In stage two of this research, the study will apply the assessment indicators to empirical data collected from learners undertaking the ST unit to evaluate which components of the game are key influencers of learning effectiveness and outcomes. This data can serve to provide in-depth user insights into the DBGL experiences/outcomes; providing feedback for further improvements in the ST curriculum. Additionally, there are also opportunities to further develop and adapt this conceptual framework to other forms of gamification in tourism – for example, gamification in mobile-driven trails and applications. It can also enable the evaluation of visitor learning and interpretive outcomes as a result of the game-based tourism experience at the destination.

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