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Teacher perceptions on the use of digital gamified learning in tourism education: The case of South African secondary schools

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ABSTRACT

With the global diffusion of digital gaming, there is an increasing call to establish to what extent games and their elements could be harnessed for learning and education. Most research in this field has been conducted in more economically advanced and developed regions, and there is a paucity of research in emerging country contexts. It is argued that gamification can be effectively utilised in these contexts to address learner engagement and motivation. The study investigated the extent to which six determined predictors (perceptions about playfulness, curriculum fit, learning opportunities, challenge, self-efficacy and computer anxiety) influence the advocacy to accept a gamified application by South African tourism teachers. Tourism education was selected for empirical study because of its popularity in developing countries and where the economy heavily depends on the sector. However, it is a highly under researched area. Data was obtained from 209 tourism teachers, and was tested against the research model using a structural equation modelling approach. Findings reveal that the constructs of perceived playfulness, curriculum fit have a positive, direct impact on the construct of behavioural intention. The exogenous constructs of challenge, learning opportunities, self-efficacy and computer anxiety have an indirect effect on behavioural intention via perceived playfulness or curriculum fit. The study may prove useful to educators and practitioners in understanding which determinants may influence the introduction of gamification into formal secondary education.

1. Introduction

The digital gaming industry is a powerful global business. Digital games have become a common and lucrative form of entertainment in contemporary culture (ESA, 2015; Curwood, 2014). Beyond purposes of pure entertainment, however, game mechanics and game thinking have been introduced and applied within a range of industries. This trend is generally referred

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to as 'gamification', defined by Deterding, Dixon, Khaled, and Nacke (2011:10) as "the use of game design elements in non-game contexts". Gamification has seen some utility in the education field, and has been shown to increase learner engagement and motivation (Hew, Huang, Chu, & Chiu, 2016; Da Rocha Seixas, Gomes, & De Melo Filho, 2016; Hanus & Fox, 2015).

While research related to gamification and education in economically developed regions (North America, Asia and Europe) is pervasive in the literature (Boyle, Hainey, Connolly, Gray, Earp & Ott et al., 2016; Dicheva, Dichev, Agre, & Angelova, 2015), few studies have been conducted in developing or emerging regions like the Global South (Da Rocha Seixas, Gomes, & De Melo Filho, 2016; O'Donovan, Gain, & Marais, 2013). In contrast, this research was conducted in South Africa, which is considered an emerging and newly industrialised economy (UNDP, 2015; IMF, 2015); one in which the digital game industry is growing annually (PricewaterhouseCoopers, 2015). However, the industry still lags behind mature markets such as those of Western Europe. This is mainly due to the low level of broadband access in South Africa as well as stark socio-economic inequalities in the country. As argued by Walton and Pallitt (2012), studying games in South Africa requires a more context-sensitive approach because youth in the country demonstrate highly differentiated adoption of technologies for gaming. Moreover, studies in gamification in education are mainly conducted in higher education institutions, typically involving computer science students (Dicheva et al., 2015). This study is proposed at the secondary education level and within the subject of tourism, which is an under-researched area (Adukaite, van Zyl, & Cantoni, 2016). Because of the sparse literature on the subject, the various and possible implications of digital gaming technology in the tourism education field in South Africa are unknown and require deeper examination.

Student engagement is usually the primary motivation to introduce gamified learning within formal education. Lack of engagement is also considered a key factor in poor graduation rates at secondary and tertiary institutions in South Africa (Strydom, Mentz, & Kuh, 2010; Titus & Ng'ambi, 2014). It is argued that increased engagement is likely to decrease apathy for specific subjects and even improve academic performance (Fitzgerald, Bruns, Sonka, Furco, & Swanson, 2012). As argued by Titus and Ng'ambi (2014:743), "to date, there is paucity of evidence within the South African education system with regards to games and its impact on student engagement". Several studies investigate digital games acceptance in the formal learning environment (e.g., Bourgonjon et al., 2013; Hamari & Nousiainen, 2015) and argue for the critical role of teachers in the adoption process. As argued by Teo, Milutinović, and Zhou (2016), if educators do not believe that using specific technology will help fulfil their needs, it is reasonable to assume that they will avoid adopting that technology. For the purposes of this study, South African in-service tourism teachers were asked to evaluate a specific gamified application. Respondents were asked to reflect on their behavioural intention to advocate for and accept the application for tourism teaching in the formal high school curriculum.

The literature points to various factors that affect the behavioural intention to adopt digital games or gamified applications for instructional purposes. This study specifically examined two types of factors. Firstly, constructs that pertain to the teacher's individual differences and experiences with the technology (self-efficacy, computer anxiety, and perceived playfulness), as they have been repeatedly emphasised in the literature as the main inhibitors of technology adoption for instructional purposes, which is especially the case in developing contexts (Agbatogun, 2010; Li & Huang, 2016). Secondly, influencers related to teachers' perceptions on whether the system addresses students' needs and may benefit them: the level of challenge the application provides (Padilla-Meléndez, Del Aguila-Obra, & Garrido-Moreno, 2013; Hamari et al., 2016), perceived curriculum fit (De Grove, Bourgonjon, & Van Looy, 2012), and learning opportunities offered by the application (Li & Huang, 2016). Thus, this study examined the structural relationships between selected individual differences and teachers' perceptions on how beneficial the specific gamified system could be to their students. This was done to enhance understanding of the effects that these relationships would have on the behavioural intention of teachers to advocate for the acceptance of a gamified application for tourism education.

The following research question guides our study:

> *To what extent do perceived playfulness, curriculum fit, learning opportunities, challenge, computer anxiety and self-efficacy influence the behavioural intention to advocate for and to adopt gamified learning applications for tourism education?*

This study contributes to the theoretical domain of gamified learning acceptance in education (e.g., Bourgonjon et al., 2013; De Grove et al., 2012; Hamari & Nousiainen, 2015). Moreover, there is still a paucity of quantitative research on gamification acceptance by educators, and this study will contribute new knowledge in this area. In addition, the study aims to enhance practitioner understanding in terms of how relationships of the tested variables may eventually inform the design of digital gamified learning systems.

2. Literature review

2.1. Gamification and learning

The relationship between digital games and learning has been studied from various perspectives, examining informal learning that happens during play (Sefton-Green, 2003; Williams, 2006) and exploring the incorporation of digital games in formal learning activities (De Freitas & Oliver, 2006). Yet, games, simulations, and gamification often bridge the distinctions

between formal and informal learning in order to support cognitive development (Davis & Singh, 2015; Koutromanos & Avraamidou, 2014). Some researchers primarily focus on the cognitive aspect (Mayer, 2014; Shute, Ventura, Kim, & Wang, 2014), underlining that games are capable of generating new information that is processed by the player. Others highlight socio-cultural characteristics (Bell, Bricker, Reeve, Zimmerman, & Tzou, 2013; De Freitas, Rebolledo-Mendez, Liarokapis, Magoulas, & Poulovassilis, 2010) and the importance of rich contextual information that is essential for learning to occur.

Many positive claims have been put forward regarding the aspect of gamified learning in education, such as that it affords increased motivation and engagement (Denny, 2013; Da Rocha Seixas et al., 2016; Su & Cheng, 2015), that it empowers students with low self-efficacy, and that it allows for increased autonomy over the learning process (Kebritchi, Hirumi, & Bai, 2010). Moreover, games can reinforce critical thinking and probe students to examine problems from multiple perspectives (Hew et al., 2016; Paraskeva, Mysirlaki, & Papagianni, 2010). In their systematic review of 143 papers of high quality evidence about the outcomes of games in education, Boyle et al. (2016:188) reported that the frequent most outcome was knowledge acquisition "followed by perceptual and cognitive, affective and behaviour change, with fewer papers reporting physiological, skills and soft and social skills outcomes". Furthermore, STEM subjects (science, technology, engineering and mathematics) as well as health were the most popular domains for educational digital games. Boyle et al. (2016) report that research on games in education has a strong international focus: out of 143 evaluated studies, 62 were conducted in North America, 45 in Europe, 26 in Asia, 5 in South America and 5 in Australasia. Interestingly, not a single study reported in the systematic review was conducted in Africa. This also corresponds to similar findings of Hew et al. (2016) who reported that gamification studies are mainly conducted in the USA and Europe.

It is important to clarify the terminology used in this research. The basic differentiation between a digital game and gamification is that the latter is not a completely developed as a fully-fledged game (Deterding et al., 2011). However, some gamification and learning researchers, for example Kapp (2012), use gamification as a term that encompasses complete games and practices of playful design (game elements) for learning. Another term used extensively in the literature is serious games (Arnab, Lim, Carvalho, Bellotti, De Freitas, & Louchart et al., 2015). This category tends to highlight the characteristics of specific game elements such as avatars and fully immersive virtual reality. Moreover, serious games are likely to emphasise learning content, while gamification is a technique for learner engagement and motivation (Hamari, Koivisto, & Sarsa, 2014, pp. 3025–3034). Nevertheless, differentiating between gamification practice and fully-fledged games is complex. However, in this research we refer to gamification and the use of game elements for engagement and motivation. Serious games, simulation and fully immersive games are not our main focus. Compared to research dedicated to fully-fledged games in education, studies on the integration of gamification in the learning process are in their infancy (Hamari et al., 2014, pp. 3025–3034; Hew et al., 2016). Gamification as an academic topic of interest is still relatively novel and lacks established theoretical frameworks and unified discourses (Dicheva et al., 2015; Hamari et al., 2014, pp. 3025–3034).

Dicheva et al. (2015) conducted an empirical study on gamification in education, employing a systematic mapping approach. From the 34 studies analysed, the following game mechanics were found to be most commonly used in education: points, badges, leader boards, levels, virtual currency, progress bars, and avatars. Similarly, Hamari et al. (2014, pp. 3025–3034) identified the ten most common motivational affordances: points, leader boards, achievements/badges, levels, story/theme, clear goals, feedback, rewards, progress, and challenge. Game mechanics such as badges, leader boards and points can significantly affect students' behavioural engagement as can be observed, for example, in the number of messages posted (Coetzee, Fox, Hearst, & Hartmann, 2014; Denny, 2013), or tags produced (Mekler, Brühlmann, Opwis, & Tuch, 2013). However, contrasting evidence was found by Dominguez et al. (2013): the experimental (gamified) group performed better in practical application but had poorer results in the final written exam, which tested knowledge of concepts explained in the course. Hew et al. (2016) reported that the use of gamification mechanics produced greater contributions in student discussion forums. However, the authors did not identify any significant difference in terms of students' recall of information.

While gamification has become popular as educational tool (Kapp, 2012), an emerging body of research suggests that gamifying learning is not always beneficial and effective (e.g., De-Marcos, Garcia-Lopez, & Garcia-Cabot, 2016; Domínguez et al., 2013; Hamari et al., 2014, pp. 3025–3034; Christy & Fox, 2014). Some studies report mixed results regarding gamification use for learning, such as marginal positive outcomes compared to the necessary investment to develop successful gamification systems (O'Donovan et al., 2013; Mekler et al., 2013). Hanus and Fox (2015) conclude that the use of badges, leader boards, and competition mechanisms did not improve educational outcomes. The authors state that "gamification in the classroom may be a double-edged sword" (2015:160). That is, for students who are interested in the subject and motivated to learn, gamification can diminish intrinsic motivation. For uninterested and -motivated students, the incentives brought about by gamification can increase intrinsic motivation.

2.2. Digital play in South Africa

As stated previously, while play and games are universal, studying them in South Africa requires a highly context-sensitive approach (Walton & Pallitt, 2012). According to the authors, while access to digital gaming infrastructure is very unequal, play is mediatised in both less and more privileged contexts. Arcade-type mobile phone games are more prevalent in under-resourced areas, and console games with elaborate narratives are more diffused in suburban and more affluent

environments. Moreover, daily playing practices in South Africa involve "multi-literacies"; that is, the use of various semiotic modes such as multilingual communication, gestures, and dance (Walton & Pallitt, 2012).

Amory (2010) conducted a study with 12 teenage orphans from a disadvantaged area in South Africa, who participated in the study by playing a complex video game on health-related concepts. The researcher found that the digital game mediated learning and that participants could gain new knowledge. Amory argues, consequently, that video games should be used as tools that mediate learning by collaboration, discussion and questioning in a setting of social constructivist learning. O'Donovan et al, (2013) presented a case study on how a course on Computer Science in a South African university was gamified to improve content understanding, engagement, lecture attendance as well as problem solving skills. Various techniques were introduced throughout the course: a reward structure with badges and points, progress bars and leader boards, and a storyline with visuals. All the evaluation measures (final marks, attendance, lecturer evaluation questionnaire) were reported as positive and successful. However, the authors cautioned on the costs involved to introduce successful gamification interventions for education.

Ultimately, there is a paucity of scientific literature on play, games and gamification in South Africa. Yet, various research approaches and empirical studies do exist, mainly focusing on children in disadvantaged and under-resourced areas of the country, primarily addressing concepts of literacy (Amory, 2010; Walton & Pallitt, 2012). Conversely, gamification is mainly addressed at the higher education level through gamifying course learning materials in order to engage and motivate students (O'Donovan et al., 2013; Titus & Ng'ambi, 2014).

2.3. Tourism education

Tourism is often introduced as a subject in formal education curricula because of the increasing and significant economic contribution of the tourism industry to the private and public sectors (Adukaite, van Zyl, & Cantoni, 2016). Recently, enrolments in tourism and hospitality programs at global higher education institutions have rapidly increased (Airey, Tribe, Benckendorff, & Xiao, 2015; Dredge, Benckendorff, Day, Gross, Walo, Weeks et al., 2013). It is argued, however, that tourism as a subject suffers from relatively poor performance. This is because it largely attracts weaker students and consequently produces graduates who struggle to find suitable employment (Dredge et al., 2013). In some countries, a shift from more research oriented education toward more business and vocationally oriented curricula is observed. This has led to a debate among scholars as to what extent tourism education should take the instrumental standpoint in preparing students for employment compared to having a knowledgeable citizenry (Tribe, 2000; Cuffy, Tribe, & Airey, 2012; Caton, 2015; Airey et al., 2015). According to Cuffy et al. (2012), most research on tourism education and training is conducted in the field of higher education. Not many researchers take the 'lifelong' perspective, which implies that learning occurs in all types of environments; that is, in structured educational institutions as well as in informal settings. Another crucial aspect evident in the literature is that effective tourism education at different levels should be relevant to its context. That is, the cultural, economic, political and social environment should be prudently and sensibly considered (Lewis, 2005; Smith & Cooper, 2000). This is especially relevant in emerging economies in Asia and Africa, where tourism education is becoming increasingly popular (Cuffy et al., 2012; Hsu, 2015; Mayaka & Akama, 2015). Hsu (2015) reported limited educational resources, qualifications of faculty, and outdated educational materials as the main obstacles for tourism education. Similar results were reported by Harrison (2015) about tourism education in the South Pacific: he emphasised the lack of touristic exposure of tourism learners, and the challenge of striking the right balance between vocational and academic aspects within tourism education.

Some researchers have suggested that technology enhanced learning may overcome some of the challenges faced by tourism education (Adukaite, van Zyl, & Cantoni, 2016; Benckendorff et al., 2015; Cantoni, Kalbaska, & Inversini, 2009; Mayaka & Akama, 2015). Gamification, serious games, and simulations have received increasing attention in several education fields as well as in tourism (Adukaite & Cantoni, 2016; Benckendorff et al., 2015). It is here argued that gamification and game elements can facilitate experiential learning environments with the potential to increase student engagement and motivation (Benckendorff et al., 2015)

2.4. Tourism education in South African high schools

The setting for this study is South Africa, a developing/emerging country with a growing tourism industry. Tourism in South Africa is recognised as a key economic sector with potential for continuous growth, which demands a skilled and professional workforce. This implies that the local workforce should be aware of the nature and role of tourism, and should be able to evaluate its potential in a critical manner (Adukaite, van Zyl, & Cantoni, 2016). Various strategies could be introduced to raise tourism awareness (Van Niekerk & Saayman, 2013); one of them is the introduction of tourism as a school subject. At secondary level, tourism has been introduced at schools throughout South Africa since 2000. Since then, the tourism subject has seen significant growth in terms of the number of schools where it is taught: from 120 schools in 2000 to almost 3′000 schools in 2014 (Grussendorf, Booyse, & Burroughs, 2014). To date, tourism is one of the most popular electives in high schools: up to 20% of all high school students select the subject (Allais, 2014; Adukaite, van Zyl, & Cantoni, 2016).

Tourism teachers are requested to have access to internet resources to keep up with dynamic industry developments. The National Department of Basic Education also recommends access to audio-visual resources and computers (Department of Basic Education, 2011). Generally, tourism teachers have autonomy in selecting teaching approaches. The topics and themes are stipulated by the national curriculum, but teachers have the freedom to decide which instructional methodologies to adopt. However, tourism education is generally constrained by a lack of qualified teachers, limited exposure to tourism, and the lack of interest and motivation to study the subject as both students and teachers perceive it as 'easy' (Adukaite, van Zyl, & Cantoni, 2016; Chili, 2013). The introduction and adoption of information and communication technology (ICT) has been identified as a potential enabler of tourism education (Adukaite, van Zyl, & Cantoni, 2016). To address the challenge of student apathy regarding the subject, one potential strategy would be the use of digitally gamified learning. A specific gamified application, described in the following section, was utilised within this study to assess tourism teachers' attitudes toward gamification and learning.

2.5. A digital quiz on world heritage and sustainable tourism

A gamified application called WHACY (www.whacy.org) was used as an experimental tool for this research. The campaign raises awareness and fosters informal learning about the universal value of 39 World Heritage Sites located in the Southern African Development Community (SADC). The campaign further promotes sustainable tourism, primarily among 16 to 19-year-old students in SADC. The campaign employed an online and offline gamified learning platform, which is based on an algorithm that randomly retrieves questions from a previously populated database, and presents a unique collection of multiple choice quizzes to the user. The platform was supported by a dedicated website, a Facebook page, a wiki and other offline materials. In one year of operation (2014–2015), the campaign reached an audience of more than 100′000.

The purpose of this study is to explore the acceptance of the WHACY application in formal learning settings by tourism teachers. Tourism teachers were selected because topics of World Heritage Sites and sustainable tourism are covered in the tourism curriculum; thus, teachers of the subject have background knowledge about the content used within the platform. For this research, the content of the existing platform was aligned with the content of the national tourism curriculum. Finally, an exemplary quiz about heritage sites and sustainable tourism was created (www.whacygame.org/test). The quiz contained gamification features such as a reward system with a scoring mechanism, immediate feedback, and a final certificate of completion. Each question was illustrated with related background pictures, and in certain instances, with videos.

3. Conceptual framework

Many conceptual frameworks in technology adoption originated with the theory of reasoned action (TRA), which derives from social psychology and describes human social behaviour (Fishbein & Ajzen, 1975). The core assumption of TRA is that behavioural intention is informed by a person's attitudes and subjective norms, and that eventually, intentions lead to actual behaviour. In 1989, Fred Davis introduced the technology acceptance model (TAM), which became a well-recognised framework in the technology adoption field. TAM explains behavioural intention in terms of perceived usefulness ("the degree to which a person believes that using a particular system would enhance his or her job performance") and ease of use ("the degree to which a person believes that using a particular system would be free from effort") (Davis, 1989, p. 230). The TAM model has received major criticism, especially regarding its incapability to address contextual, organisational, individual, technological, and task characteristics (Legris, Ingham, & Collerette, 2003). Furthermore, TAM primarily originated in the business environment. Therefore, scholars argue that TAM variables do not adequately reflect the motivations of educators in accepting technology for teaching (Teo et al., 2016; Tate, Evermann, & Gable, 2015).

The literature review on teachers' acceptance of technology, with specific focus on digital games and gamified applications, has demonstrated that various determinants affect the adoption process. These include (i) factors at the individual teacher level like attitudes, experience, and skills (technological know-how) (Agbatogun, 2010; Bourgonjon et al., 2013; De Grove et al., 2012; Hamari & Nousiainen, 2015; Li & Huang, 2016); (ii) system related matters like playfulness, appropriate challenge, relatedness to the curriculum, and offered learning opportunities (Bourgonjon et al., 2013; De Grove et al., 2012; Jagger, Siala, & Sloan et al., 2015; Ketelhut & Schifter, 2011; Padilla-Melendez et al., 2013; Da Rocha Seixas et al., 2016); and (iii) context related aspects like organisational culture, support, and student preparedness (De Grove et al., 2012; De Smet et al., 2011; Hamari & Nousiainen, 2015; Lai & Chen, 2011; Pynoo et al., 2011).

3.1. Hypothetical model

Considering the abovementioned conceptual framework, the researchers developed a hypothetical model (Fig. 1). The goal of this model is to determine the extent to which six selected variables influence South African tourism teachers' behavioural intention to advocate for the integration of a gamified learning application into tourism instruction. These variables have been selected based on broader theoretical developments and empirical literature in the field, and will be discussed in the sections that follow. The hypotheses stemming from conceptual and empirical research are presented below.

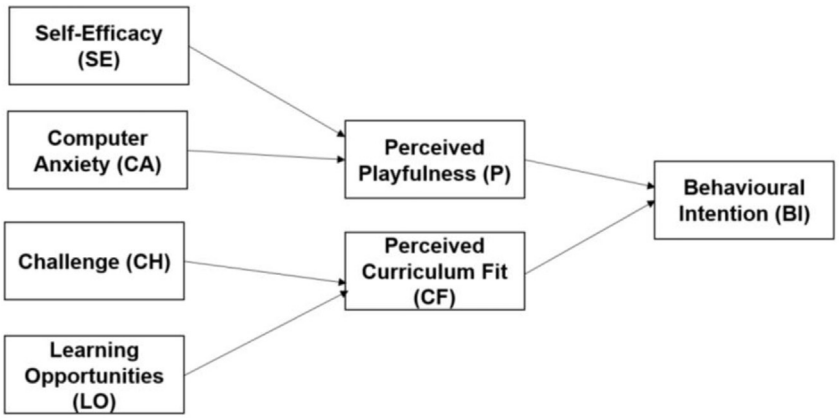

Fig. 1. Hypothetical model.

3.1.1. Dependant variable: behavioural intention

In this research, gamified learning acceptance is operationalised as tourism teachers' behavioural intention to advocate for the use of a gamified application within the tourism curriculum. It is argued that in evaluating the technology, teachers not only consider their own experience but also the experience of the actual end users. The authors are proposing a model of technology advocacy, looking at subjects that influence technology decisions but are not necessarily the direct users themselves. The study selected behavioural intention as a consequential variable because intention contains the decision of actual behaviour, according to TAM (Davis, 1989), which originates from the theory of reasoned action. Fishbein and Ajzen (1975) claim that human behaviour is predicted by a person's intention. Our study focused on intention and not actual use, because only a few teachers have had experience with gamified learning in their professional practice. The model suggests that the dependant variable can be influenced through variables of perceived playfulness and perceived curriculum fit.

3.1.2. Perceived playfulness

Perceived playfulness is an intrinsic motivation related to the usage of a system (Venkatesh & Bala, 2008; Wang & Wang, 2008). It is influenced by personal experience with the setting (Moon & Kim, 2001) and encompasses physiological interest and stimulation (Csikszentmihalyi, 1990). Thus, when users are in a 'playful state', they feel that interaction with an application is intrinsically motivating, their attention is focused and they feel curious (Moon & Kim, 2001). Intrinsic motivation, which refers to satisfaction and enjoyment in performing certain behaviour, plays a significant role in behavioural intention to play digital games (Wang & Wang, 2008). Research has identified that playfulness is among the key drivers to use and adopt blended learning approaches (Padilla-Melendez et al., 2013). Huang, Jang, Machtmes, and Deggs (2012) found that playfulness positively influences English learning on mobile devices. Wang, Wu, and Wang (2009) identified positive links between users' perceived playfulness and behavioural intention to use eLearning platforms and digital games for learning (Jagger, Siala, & Sloan, 2015). Playfulness is considered as one of the critical determinants that could impact learning engagement when introducing technology related instructional methods (Huang et al., 2012). The playfulness of the digital quiz about heritage and tourism used within this study is facilitated through gamification features such as a reward system with a scoring mechanism, immediate feedback, a final certificate of completion, and aesthetics – these are common gamification features in the education field (Kapp, 2012). Thus, it is hypothesised that when engaging with a gamified application, perceived playfulness will influence tourism teachers' intentions to advocate and recommend the tested or similar systems to others. Similarly, perceived playfulness will influence the intention to use these systems. The following hypothesis can thus be derived:

H1. Perceived playfulness (P) positively relates to behavioural intention (BI).

3.1.3. Perceived curriculum fit

Secondary school teachers generally teach pre-planned content within a defined period. This can negatively influence the acceptance of new teaching practices in the formal educational environment (Becker, 2007; De Grove et al., 2012). However, if the new practice – for example, a gamified application – strongly relates to the curriculum and can facilitate the achievement of curriculum outcomes, it can positively influence adoption (Da Rocha Seixas et al., 2016; De Grove et al., 2012; Ketelhut & Schifter, 2011). De Grove et al. (2012) validated the construct of 'curriculum relatedness' and analysed teachers' intention to adopt digital games in the classroom. Their study revealed that curriculum relatedness and previous experience were the

most important determinants in adopting digital games. Consequently, the digital application used in this study incorporates content from the official South African tourism curriculum, specifically related to World Heritage Sites and sustainable tourism. Within the context of this study construct was renamed 'perceived curriculum fit' to clarify that it resembles the task-technology fit concept from the TAM literature (Legris et al., 2003; Teo et al., 2016) and is not an objective quality of the system but rather a perception. We thus hypothesise that:

H2. Perceived Curriculum FIT (CF) positively relates to behavioural intention (BI).

The selected antecedents of the model fall under two categories: (i) individual differences of the teachers, such as self-efficacy (SE) and computer anxiety (CA), as well as (ii) perceptions whether the system address students' needs and is beneficial to them such as challenge (CH) and learning opportunities (LO).

3.1.4. Self-efficacy

There are various individual differences related to ICT usage, including individual personality traits, demographics as well as factors such as training and experience. The notion of self-efficacy originates from social cognitive theory (Bandura, 1977), and refers to a person's belief in their ability to perform a behaviour successfully. Self-efficacy is an important determinant of motivation and action (Bandura, 1986). Because of its significance in predicting human behaviour, self-efficacy has been studied extensively in the education field (Agbatogun, 2010 Lai & Chen, 2011; Van Zyl, 2013). There is strong evidence that having positive judgement about one's own ability influences the acceptance of technological tools in education (Compeau & Higgins, 1995; Teo, 2011). Teachers with high self-efficacy in using gamified applications should be able to assess their relevance for the broader curriculum in terms of content and existing instructional methodologies. Conversely, lack of self-efficacy will result in lower levels of satisfaction and enjoyment while engaging with a system. Moreover, prior studies suggest that self-efficacy is an important antecedent to playfulness (Chung & Tan, 2004; Wang & Wang, 2008). We derived the following hypotheses to this end:

H3. Self-efficacy (SE) positively relates to perceived playfulness (P).

3.1.5. Computer anxiety

Computer anxiety is the fear or apprehension of using computer related technologies (Leso & Peck, 1992). This is a common inhibitor of ICT integration into the educational setting (Azarfam & Jabbari, 2012), especially in developing country contexts (Agbatogun, 2010). Furthermore, scholars have found that technology experience and skills are inversely related to technology anxiety (Ekizoglu & Ozcinar, 2010; Shah, Hassan, & Embi, 2012). Technology anxiety or technostress have been found to be a significant influence on in-service teachers' intentions to use technology use as well as assessing application's relevance to curriculum (Joo, Lim, & Kim, 2016). Many different obstacles inhibit teachers to use technology more actively, such as inadequate infrastructure, lack of training, and lack of support – collectively, these may induce tension or anxiety. This can result in physical or psychological stress, and tends to prevent the user entering a playful state while using a system and the interaction with the application will not be intrinsically motivating (Joo et al., 2016). Thus, the phenomenon defined as technology anxiety or technostress (Brod, 1984) continues to receive attention in the educational environment as various new technologies are introduced for teaching and learning purposes, such as digital books, mobile technology, digital games, cloud computing and others (Joo et al., 2016). Based on this, we deduced the following hypotheses:

H4. Computer anxiety (CA) negatively relates to perceived playfulness (P).

3.1.6. Challenge

Research has identified various characteristics of gamified applications that can augment the learning process. This includes aspects such as immediate feedback and playful challenges (Kapp, 2012). Challenge is a common gaming feature, which is the extent to which a user's playing skills match the challenges presented by the digital game or gamified application (De-Marcos et al., 2016; Hamari et al., 2016). Therefore, appropriate challenges in a digital game will keep the player engaged and motivated throughout the game (Hamari et al., 2016). Thus, if an application is too challenging, users may become frustrated quickly. Similarly, if an application is not deemed challenging enough, users may become disinterested. Within this study, respondents were asked to evaluate if the gamified application provides a suitable level of challenge in terms of the computer skills and knowledge levels of their students. Teachers often decide on behalf of their learners when choosing instructional strategies. South African secondary school tourism teachers have quite a high degree of autonomy in selecting teaching approaches, thus, they were considered being able to make this judgement related to application's characteristics and their suitability to the students. Thus, we hypothesised the relationship between challenge and perceived curriculum fit.

H5. Challenge (CH) positively relates to perceived curriculum fit (CF).

3.1.7. Learning opportunities

In the field of digital game acceptance in education, Bourgonjon, Valcke, Soetaert, and Schellens (2010) introduced the construct of 'perceived learning opportunities'. This examines whether educators believe that games offer learning affordances. Simply stated, the construct of learning opportunities reflects the benefits and advantages of digital games (Egenfeldt-Nielsen, 2007; Li & Huang, 2016; Prensky, 2005). The researchers hypothesised that, if teachers perceive a gamified application to offer strong learning opportunities, they will consider its acceptance for teaching (Bourgonjon et al., 2013). It is assumed that today's students demonstrate greater preference towards learning methods that allow for interaction, control and experimentation (see Romero, Usart, & Ott, 2015), therefore, it can be expected that perceived learning opportunities are positively associated with perceived curriculum fit. This is because the achievement of curriculum outcomes relates to knowledge transfer (De Grove et al., 2012). The digital quiz about heritage and tourism used within this study was designed mainly to foster awareness and enhance knowledge about World Heritage Sites in Southern Africa. By employing gamified features in a formal setting, it is expected that students will be motivated to learn about their own heritage, which is explicitly highlighted as one of the goals of the National South African Tourism Curriculum (Department of Basic Education, 2011).

H6. Learning opportunities (LO) positively relate to perceived curriculum fit (CF).

4. Research methodology

4.1. Instrument and measures

An online questionnaire was utilised for collecting data and consisted of three parts: (i) demographic information (gender, age, ethnicity, home language, and province); (ii) teacher related variables (teaching experience, grades and subjects taught); and (iii) constructs of the hypothetical model. To ensure validity of the constructs, validated scales from previous research were applied and adapted to the context of the current study:

- *Behavioural intention* (Venkatesh, Morris, Davis, & Davis, 2003; Venkatesh & Bala, 2008).
- *Perceived playfulness* (Venkatesh & Bala, 2008; Wang & Wang, 2008; Padilla-Melendez et al., 2013).
- *Perceived curriculum fit* (De Grove et al., 2012).
- *Self-efficacy* (Lai & Chen, 2011; Hamari & Nousiainen, 2015).
- *Computer anxiety* (Heinssen, Glass, & Knight, 1987; Wang & Wang, 2008).
- *Challenge* (Chung & Tan, 2004; Wang & Wang, 2008).
- *Learning opportunities* (Bourgonjon et al., 2010, 2013; De Grove et al., 2012).

The measures were reviewed by three experts in information systems and educational technology and adjusted accordingly. The research model contained seven constructs with a total of 30 items which were measured using Likert scales (1–5), with anchors ranging from *strongly agree* to *strongly disagree*.

4.2. Sample and data collection

The sample of the study was a group of in-service tourism teachers in South Africa. The study adopted a convenience sampling (i.e. non-randomised) technique to collect data. The geographic focus of the study was three South African provinces: Western Cape, Gauteng, and Eastern Cape. Tourism is widely offered as a high school subject in these regions (Grussendorf et al., 2014). Moreover, the three provinces are all popular tourist destinations in the country (South African Tourism, 2015).

Research permission was obtained from the respective regional Departments of Education. Lists of schools offering tourism in the respective provinces were obtained from the National Department of Education and a mailing list was subsequently compiled ($n = 529$ valid email addresses in 3 provinces). Principals of the respective schools were contacted and invited to distribute the surveys to their tourism teaching staff. Telephone calls ($n = 80$) were also conducted to invite tourism teachers to participate in the survey. Additionally, 16 schools were visited in person in the Western ($n = 10$) and Eastern Cape Provinces ($n = 6$) to distribute information about the study. Finally, an invitation to partake in the survey was distributed through tourism subject coordinators and their mailing lists. In total, 218 teachers completed the survey, of which 209 were retained after data cleaning.

83% ($n = 174$) of the respondents were female and 17% ($n = 35$) were male. Most respondents (80%) were between 35 and 54 years old. They were mainly Afrikaans (37%), English (24%) and isiXhosa (26%) native speakers, which correspond well to the main languages of the respective provinces: Western Cape (34%), Eastern Cape (32%), and Gauteng (30%). 94% of respondents were from public schools and the remaining 6% from private schools.

5. Results: descriptive statistics

The descriptive demographic data was analysed in SPSS 22. All respondents taught tourism as a subject. Only 11% of the sample taught one subject, i.e. tourism, while the majority (81%) of teachers taught two subjects, and the remaining 8% taught more than two subjects. Tourism was commonly taught by teachers also teaching geography (24%), life orientation (23%), commerce subjects (business studies, economics and management science, accounting – 17%), languages (13%), consumer studies and hospitality (12%), history (6%) and IT related subjects (4%). The remaining 1% taught other subjects such as music, physical sciences, and mathematics. On average, teachers had 16 years of teaching experience (M:16; SD:7.9).

Respondents were asked to self-declare their level of technology training: 13% reported having extensive, 35% moderate, 32% occasional, and 20% no technology training. This implies that most respondents were somehow exposed to digital technology. 66% of the sample stated that they used technology for teaching purposes. However, data revealed that respondents hardly had any experience with digital games/quizzes: only 9% previously used digital games/quizzes for teaching purposes, which echoes similar findings in other contexts in Europe and the United States (Bourgonjon et al., 2013; Kenny & McDaniel, 2011).

Moreover, the relationship between three items of the behavioural intention (BI) construct and level of self-reported technology training (extensive, moderate, occasional and no training) were tested (Table 1). According to the Chi-Square values (χ^2 $(df, n = 209)$), there is a strong association between training and agreement levels with all three behavioural intention items. According to Kendal's tau b correlation statistic (r_τ) between two ordinal variables, a positive correlation value was identified, indicating that higher training levels correspond to more agreement with BI items.

All respondents indicated that they tested the quiz before completing the survey: 84% of them finished the quiz, while the remaining 16% indicated that they played at least for 2 min before quitting. The main reasons for quitting were lack of time (12%), low quality internet connection (3%), perceived as not interesting (3%), and one person had difficulties understanding how it worked. Thus, all responses (n = 209) were analysed, because 2 min was considered sufficient to understand basic quiz functions and characteristics.

Generally, almost all respondents (96%) perceived the gamified application as a potential teaching aid for the tourism subject, mainly for assessment purposes (93%) due to its multiple-choice format. Interestingly, the gamified application was perceived as crossing formal and informal learning environments: 95% of respondents reported that the tool might be used both in the classroom and outside of it. Moreover, descriptive statistics demonstrated that the majority (91%) of respondents did not have any experience with using games or gamified systems in their teaching practices; this may have influenced their responses.

5.1. Instrument validity and reliability

Confirmatory factor analysis (CFA) was conducted with the Lavaan for R (Rosseel, 2012) open source package using the estimation method of weighted least squares (WLS) (asymptotically distribution free: ADF) to assess the internal consistency and factor structure stability. WLS was preferred since all the items were measured using ordinal variables via a 5-point Likert scale. Table 3 lists the set of items utilised to measure the constructs. There are several indicators to assess if the set of questions measuring an underlying construct are internally consistent. These are standardised factor loadings, average variance extracted (AVE), which demonstrate the average percentage of variation explained among the items of a construct, and composite reliability (CR), which is a measure of reliability and internal consistency of the measured variables representing a latent construct. The standardised factor loading estimates should be greater than 0.5 (ideally > 0.7), AVE should be greater than 0.5, and CR should be greater than 0.7 for good internal consistency (Fornell & Larcker, 1981).

The third column in Table 3 shows the factor loadings for each item measuring a construct where the full set of items were included in CFA. It is evident that some of the items have factor loading estimates lower than 0.5; AVE for the construct is less than 0.5 and CR less than 0.7 indicating that the internal consistency of the constructs is weak. As a result, the items with factor loadings lower than 0.5 were excluded and the CFA was re-estimated. After the refinement, the construct validity and reliability measures for behavioural intention (BI), perceived playfulness (P), perceived curriculum fit (CF) and self-efficacy

Table 1
Training level and behavioural intention items.

Item	Chi-Square	Kendal's tau b correlation
BI1: Assuming I had access to the tool, I intend to use it for tourism teaching activities.	χ^2 $(9, n = 209) = 174.074$ $(p < 0.001)$	$r_\tau = 0.549$ $(p < 0.05)$
BI2: I would suggest to my school's headmaster to evaluate the possibility of using this tool for tourism teaching activities.	χ^2 $(12, n = 209) = 104.663$ $(p < 0.001)$	$r_\tau = 0.384$ $(p < 0.10)$
BI3: If I had to vote, I would vote in favour of using this type of tool in the classroom.	χ^2 $(9, n = 209) = 129.316$ $(p < 0.001)$	$r_\tau = 0.444$ $(p < 0.10)$

(SE) constructs are above the accepted thresholds of 0.5 and 0.7 respectively. However, the learning opportunities (LO) construct has an AVE just below 0.5 with factor loadings greater than 0.5 and CR greater than 0.7. As a result, the internal consistency of LO is weaker than other constructs. The challenge (CH) construct has an AVE of 0.422, which is below 0.5 and a CR of 0.686 which is just below 0.7. However, since the factor loadings are greater than 0.5, it was again deemed acceptable to consider challenge (CH) as a weakly consistent construct.

To ensure discriminant validity, we ascertained that the square root of the AVE for each construct was higher than the correlations of the construct with other constructs, this way indicating that latent construct explains variance in its items better than in another construct (Hair, Anderson, Tatham, & Black, 1998). For constructs BI, SE, CF, CH, and CA the discriminant validity is obtained. However, between P and LO, the construct validity is weak (Table 2).

The following model-fit indices (Byrne, 2001) were also calculated: the root mean square error of approximation (RMSEA), which should be below 0.05 while the 90% confidence interval must be narrow; the goodness-of-fit index (GFI), comparative fit index (CFI), and the adjusted goodness of fit index (AGFI) should be all above 0.9 for a good model fit. In the modified model (Table 3, 4th column) with two weakly consistent constructs, the RMSEA is 0.046 with a 90% confidence interval of 0.034–0.057. This is a satisfactory measure to accept that the modified CFA model is a good approximation for measuring the seven constructs involved in the analysis. Moreover, the goodness of fit statistics: GFI (=0.983), CFI (=0.994), AGFI (0.974) all exceed 0.95 indicating that the modified CFA model can be used in further estimations.

The construct scales indicated a high level of internal reliability, as Chronbach's alpha coefficients exceeded the threshold of 0.7 (Hair et al., 1998): behavioural intention ($\alpha = 0.934$), perceived playfulness ($\alpha = 0.810$), perceived curriculum fit ($\alpha = 0.909$), challenge ($\alpha = 0.850$), learning opportunities ($\alpha = 0.853$), self-efficacy ($\alpha = 0.909$), and computer anxiety ($\alpha = 0.957$). This indicates that the instruments can be considered reliable and valid. In the next step, structural equation modelling (Lavaan for R) was performed, which is an effective approach to test the interconnectedness between constructs (Kline, 2005).

5.2. Path analysis of research model

In examining tourism teachers' acceptance of a gamified application, seven constructs were considered: behavioural intention (BI), perceived playfulness (P), perceived curriculum fit (CF), learning opportunities (LO), challenge (CH), self-efficacy (SE), and computer anxiety (CA). The goal was to find the interrelations between these constructs in line with the hypothetical model depicted in Fig. 1. The constructs are measured as given in the CFA model discussed in the previous section.

According to this model (Fig. 2), the exogenous constructs SE and CA both have an indirect effect on BI via P. Similarly, CH and LO have indirect effects on BI via CF. Since all the constructs are measured using 5-point Likert scale indicators, WLS (ADF) method is used to predict the parameters. The standardised and un-standardised parameter estimates, standard errors and p-values for each of the hypothetical model relationships are given in the third column of Table 4. When examining the parameter estimates, it can be observed that all paths are statistically significant with high p-values. The only exception is the path from LO to CF which has a marginally significant coefficient of 0.243 with a $0.05 < p < 0.10$.

Considering the fit and error measures, hypothetical model is at the acceptable level. The normed chi-square value is less than 2, RMSEA is below the accepted norm 0.05 and the confidence interval is also at the acceptable level. Finally, all the fit indices (GFI, CFI, AGFI) are above 0.95. These measures indicate an appropriate model.

The results of the paths between the constructs show the following key findings: the constructs of playfulness, curriculum fit both have a positive, direct impact on the construct of behavioural intention. The exogenous constructs of self-efficacy, computer anxiety, challenge, and learning opportunities have an indirect effect on behavioural intentions. These effects happen via playfulness or perceived curriculum fit. The indirect standardised effect of self-efficacy via playfulness is 0.225 (=0.538*0.418), computer anxiety via playfulness is −0.229 (=0.240 + 0.538*(-0.871), which demonstrates negative total association. Furthermore, challenge via curriculum fit is 0.290 (=0.599*0.484) and learning opportunities via curriculum fit is

Table 2
Discriminant validity measure between constructs.

Construct	AVE Before Modification	AVE After Modification	√AVE Before Modification	√AVE After Modification	Highest Correlation
BI: Behavioural Intentions	0.621	0.612	0.788	0.782	> 0.455 (BI ~ CH)
P: Playfulness	0.388	0.556	0.623	0.746	< 0.791 (P ~ LO)
SE: Self-Efficacy	0.594	0.923	0.771	0.961	> 0.470 (SE ~ CH)
CF: Curriculum Fit	0.399	0.566	0.632	0.752	> 0.591 (CR ~ CH)
LO: Learning Opportunities	0.339	0.467	0.582	0.683	< 0.791 (LO ~ P)
CH: Challenge	0.424	0.422	0.651	0.650	> 0.618 (CH ~ P)
CA: Computer Anxiety	0.718	0.655	0.847	0.809	> 0.452 (CA ~ SE)

Table 3
Confirmatory factor analysis (items in *italics* were excluded for model re-estimation).

Construct and items		Factor Loadings	Factor Loadings	Variances	Variances
		Before	After	Before	After
BI: Behavioural Intentions	**AVE**	**0.621**	**0.612**	**CR 0.829**	**0.823**
BI1. Assuming I had access to the tool, I intend to use it for tourism teaching activities		0.684	0.645	0.532	0.584
BI2. I would suggest to my school's headmaster to evaluate the possibility of using this tool for tourism teaching activities		0.778	0.783	0.394	0.387
BI3. If I had to vote, I would vote in favour of using this type of tool in the classroom		0.888	0.899	0.212	0.191
P: Playfulness	**AVE**	**0.388**	**0.556**	**CR 0.692**	**0.776**
P1. Using the tool was enjoyable		0.853	0.933	0.273	0.130
P2. Using the tool stimulated my curiosity		0.445	0.443	0.802	0.804
P3. When using the tool I did not realise how time passed		0.333		0.889	
P4. I had fun using the tool		0.717	0.775	0.487	0.400
SE: Self-Efficacy	**AVE**	**0.594**	**0.923**	**CR 0.838**	**0.973**
SE1. I felt confident playing an online quiz even if there was no one around to show me how to play it		0.964	0.966	0.071	0.066
SE2. I felt confident playing an online quiz even if I have never played it before		0.960	0.961	0.078	0.077
SE3. I felt confident playing an online quiz even if I had only the online rules as a reference		0.951	0.955	0.095	0.089
SE4. I would felt more confident playing an online quiz if someone showed me how to do it first		−0.087		0.993	
SE5. I would know how to handle the usage of this tool in tourism teaching classes		0.456		0.792	
CF: Perceived Curriculum Fit	**AVE**	**0.399**	**0.566**	**CR 0.652**	**0.722**
CF1. The tool would fit the current tourism curriculum		0.652	0.745	0.575	0.446
CF2. The tool could compliment the fulfilment of tourism curriculum requirements		0.408		0.834	
CF3. The contents of the tool correspond well with the tourism curriculum part on World HS		0.778	0.759	0.394	0.423
LO: Learning Opportunities	**AVE**	**0.339**	**0.467**	**CR 0.789**	**0.811**
LO1. Foster awareness about World Heritage Sites		0.515	0.580	0.735	0.663
LO2. Enhance knowledge of World Heritage Sites		0.774	0.789	0.400	0.378
LO3. Motivate students to learn more about heritage		0.740	0.741	0.453	0.451
LO4. Increase sense of pride of own heritage		0.375		0.859	
LO5. Increase sense of responsibility for heritage protection		0.410		0.832	
LO6. Better understand Southern African touristic potential		0.298		0.911	
LO7. Better visualize heritage places		0.576	0.573	0.668	0.672
LO8. Increase interest in tourism subject		0.754	0.705	0.432	0.503
CH: Challenge	**AVE**	**0.424**	**0.422**	**CR 0.688**	**0.686**
CH1. When playing the online quiz, the students will experience suitable level of challenge		0.633	0.694	0.600	0.519
CH2. It would provide students with challenges that are closely matched to their technology skill level		0.643	0.612	0.587	0.625
CH3. It would provide students with challenges that are closely matched to their knowledge level		0.677	0.639	0.541	0.591
CA: Computer Anxiety	**AVE**	**0.718**	**0.655**	**CR 0.909**	**0.884**
CA1. Computers do not scare me at all		0.704	0.752	0.505	0.435
CA2. Working with computers makes me nervous		0.935	0.806	0.126	0.351
CA3. Computers make me feel uncomfortable		0.778	0.856	0.395	0.267
CA4. Computers are somewhat intimidating to me		0.946	0.821	0.104	0.326
	Chi	859.772 (384)	297.222 (207)		
	RMSEA	0.077 (0.070 −0.084)	0.046 (0.034 −0.057)		
	GFI	0.958	0.983		
	CFI	0.971	0.994		
	AGFI	0.942	0.974		

0.118 (=0.243*0.484). It is evident that the highest indirect impact is from the challenge construct. The estimated disturbance variances reflect the percentage of the variance for an endogenous variable that is not explained by its direct causes. The standardised disturbance variance estimate for the BI construct 0.413 (Table 4 Disturbance Variances). As a result, we can

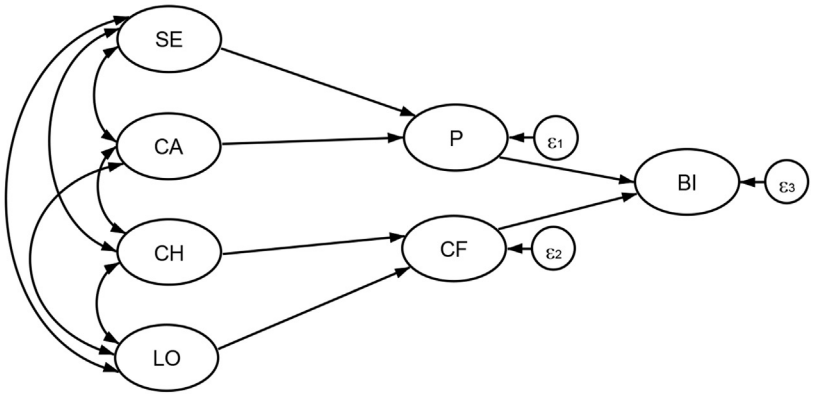

Fig. 2. SEM model.

conclude that the model is able to explain 58.7% (100%–41.3%) of the variance in tourism teachers' behavioural intention to advocate and accepts a gamified application for tourism education. Table 5 provides an overview of the confirmed hypotheses.

6. Discussion and conclusions

Scholars argue that individuals play an essential role in the decision to adopt ICT; thus, the teacher's role is critical in examining ICT use in education (Sumak, Hericko, & Pusnik, 2011; Teo et al., 2016). While, in many cases the actual decision-maker is a school administrator and the end-users are students, the teachers are essential advocates and facilitators in the technology adoption process. Teachers must make the adoption decision to some extent on the students' behalves, and teachers' buy-in is required in the technology adoption process in an educative environment. Therefore, this study introduced a two-tiered model, with two types of constructs: teachers' personal characteristics (self-efficacy and computer anxiety) and their perceived playfulness when interacting with the gamified tool as well as teachers' perceptions and expectations whether students would benefit from the tool and whether those benefits match the official curriculum requirements (learning opportunities, challenge and perceived curriculum fit).

This study investigated the extent to which the determined factors influence the advocacy and acceptance of a gamified application by South African tourism teachers. Using structural equation modelling, the study found that among the six variables, the constructs of playfulness, curriculum fit both have a positive, direct impact on the construct of behavioural intention. The exogenous constructs of self-efficacy, computer anxiety, challenge, and learning opportunities have an indirect effect on behavioural intentions. These effects happen via playfulness or curriculum fit. The highest indirect impact was from the challenge construct.

It is argued that emotions play a role in the acceptance of a technology; scholars have proposed several variables such as perceived playfulness, perceived enjoyment, and flow to assess this (Venkatesh & Bala, 2008). This study assessed teachers' perceived playfulness of a specific gamified application and observed a positive direct effect on behavioural intention to use it. Because the application was perceived as enjoyable, fun and stimulating, teachers tend to consider advocating for its adoption for tourism education. The findings support those of Wang and Wang (2008) and Moon and Kim (2001), where a significant direct relationship was found between playfulness and behavioural intention to use information technology and digital games. Similarly, in a study on secondary school teachers' adoption of teaching blogs (Lai & Chen, 2011), 'perceived enjoyment' was identified as a key determinant.

Considering constructs of individual differences, Wang and Wang (2008) found that computer self-efficacy and computer anxiety had no significant influence on the playfulness of digital games, but rather directly influenced the behavioural intention to play digital games. In this study, self-efficacy has an indirect effect on behavioural intention through perceived playfulness. This suggests that teachers who felt confident in their own abilities playing the quiz without prior demonstration or training tended to have higher degree of satisfaction and enjoyment while engaging with the system which lead to high behavioural intention to accept the application. Moreover, computer anxiety influenced behavioural intention indirectly through perceived playfulness. Teachers who were less anxious and who coped better with stress related to technology usage also perceived the application as more playful and eventually presented higher levels of intention to advocate and use the gamified application.

Table 4
Hypothetical model parameter estimates.

Model			
		Estimates [st.error] (p-value)	Standardised Estimates
P	SE	0.487 [0.076] (0.000)	0.538
	CA	0.298 [0.113] (0.008)	0.240
CF	CH	0.599 [0.159] (0.000)	0.605
	LO	0.243 [0.141] (0.084)	0.207
BI	P	0.315 [0.087] (0.000)	0.418
	CF	0.484 [0.138] (0.000)	0.499
Covariances			
SE	LO	0.486 [0.058] (0.000)	0.601
	CH	0.531 [0.050] (0.000)	0.616
	CA	−0.811 [0.028] (0.000)	−0.871
LO	CH	0.433 [0.057] (0.000)	0.603
	CA	−0.196 [0.060] (0.000)	−0.253
CH	CA	−0.310 [0.059] (0.000)	−0.375
Disturbance	Variances		
	BI	0.179 [0.074]	0.413
	P	0.412 [0.088]	0.539
	CF	0.218 [0.078]	0.475
Chisq/df		328.943/216 = 1.523	
RMSEA		0.05	
90% conf interval		(0.039–0.061)	
GFI		0.982	
CFI		0.993	
AGFI		0.972	

Furthermore, a gamified application's congruency to the educational curriculum is essential in the adoption decision process (Da Rocha Seixas et al., 2016; Ketelhut & Schifter, 2011; De Grove et al., 2012). This corresponds to the findings of this study, as perceived curriculum fit of the tested application positively influences the behavioural intention to adopt it. Bourgonjon et al. (2013) illustrated that teachers do not perceive commercial video games as having the capacity to improve their job performance; however, they did perceive that games provided opportunities for learning. Thus, it was also hypothesised that the construct of learning opportunities offered by the application will positively affect perceived curriculum fit (De Grove et al., 2012). Even though the use of digital games in South African education is still in its infancy and

Table 5
Hypotheses results.

Hypotheses	Result
Perceived playfulness (P) positively relates to behavioural intention (BI)	Confirmed
Perceived curriculum fit (CF) positively relates to behavioural intention (BI)	Confirmed
Self-efficacy (SE) positively relates to perceived playfulness (P)	Confirmed
Computer anxiety (CA) negatively relates to perceived playfulness (P)	Confirmed
Challenge (CH) positively relates to perceived curriculum fit (CF)	Confirmed
Learning opportunities (LO) positively relate to perceived curriculum fit (CF)	Confirmed

supposedly, most educators do not yet possess the beliefs and attitudes toward this medium of instruction; in this study, the construct of perceived curriculum fit has direct significant influence on teachers' behavioural intention.

Moreover, learning opportunities have significant relationship with perceived curriculum fit and indirect effect on behavioural intention. This can be interpreted that South African tourism educators believe that gamified applications offer learning affordances for their students, which match the curriculum requirements of the subject of Tourism.

This research established that the variable of 'challenge' positively affected perceived curriculum fit. This means that the challenge offered by the application is appropriate for tourism students' computer and knowledge skills, and relates well to the formal tourism curriculum. The challenge reconciles learning content and the digital quiz's ability to facilitate an enjoyable and engaging experience.

The structural model explained 58.7% of the variance in tourism teachers' behavioural intention to advocate and accepts a gamified application for tourism education. Although the results are statistically significant and the effect of independent variables on the dependent variables is high, it is worth reflecting more on various external factors related to the study context that come into play and can affect acceptance intention. Thus, potential barriers for integrating the gamified application into education were also identified. The main barrier was acknowledged as the "lack of time". 78% of respondents listed it as the primary obstacle. In the comment section of the survey, respondents explained that the tourism programme is already crammed, and that they were under pressure to prepare their students for final examinations. This prevents them from introducing new methodologies or tools. Slightly less than half of respondents (47%) put forward the barrier of "lack of technological access in the school". Similarly, 38% of respondents underlined the low quality or lack of internet connection in their school for using digital applications. Frequent electricity cuts were also mentioned as a barrier to bring students to the computer lab. This relates to another expressed challenge of logistical coordination with computer labs. Rarely do tourism teachers have operational technology in the classroom. Students must thus be brought to a central computer lab. However, it is often challenging to coordinate the student timetable with IT related subjects, which are not prioritised (Adukaite, van Zyl, & Cantoni, 2016). Moreover, in township areas, classes are big (up to 50 students), resulting in a high student-computer ratio. Another barrier identified was the lack of professional training in integrating technology for education (38%). In the comment section, teachers expressed the need for training on incorporating the gamified application. Another barrier frequently mentioned in the comment section was "language". Even though tourism is mainly taught in English, it is often not students' first (or even second) language. According to the respondents, having content translated in local languages would enhance the learning experience. However, further research needs to be conducted. For example, study subjects could be probed in more detail to examine whether teachers of a certain age and with specific teaching experience have more positive views.

6.1. Implications

The results of this research make a novel contribution to theory and practice. The present study aimed to identify significant factors in educators' behavioural intention to advocate for gamified learning adoption. The study contributes to the literature in various ways. Firstly, much of the research in the field of gamification and learning has been conducted in more economically advanced and developed regions, and not in emerging economies (Boyle et al., 2016; Dicheva et al., 2015; Hew et al., 2016). In developing economies, gamified learning could serve as a previously unharnessed strategy to address the lack of student engagement within formal education (Da Rocha Seixas et al., 2016). This is especially the case in secondary education, where research on the improvement of tourism instruction is sparse (see Cuffy et al., 2012), specifically pertaining to the benefits of digital technologies (Adukaite, van Zyl, & Cantoni, 2016). Furthermore, this study should stimulate debate around digital gaming in formal educational environments with limited technological infrastructure, but with great interest in digital play (Titus & Ng'ambi, 2014).

Moreover, some practical implications were identified. The results are specific to tourism teachers from three provinces in South Africa ($n = 209$). However, it may prove useful to other educators in developing countries, especially in dealing with the lack of student engagement with tourism education (Boyle et al., 2016). To harness the positive impact of gamification for learning, educators should be provided with opportunities for interaction with gamified applications. These interactions should help educators acknowledge the role and value of 'playfulness' and the potential learning opportunities it can provide. Curriculum fit and playfulness with a proper level of challenge were found to be key drivers for adoption. Thus, gamified

applications should provide adequate and curriculum-related content, presented in a playful and challenging manner. These have potential for subject knowledge advancement and can address student apathy and lack of motivation. Moreover, translation of application content should be considered as an important indicator for successful acceptance. Self-efficacy and computer anxiety also influence behavioural intention due to an identified lack of preparation, where specialised training becomes an important consideration (Joo et al., 2016). Thus, it could be reasoned that training, demonstrations, and hands-on experiences could play an important role, especially for pre-service teachers (Teo et al., 2016).

6.2. Limitations and future research

This research, as with any other empirical study, has limitations. Firstly, the sample was drawn from only three South African provinces, and the questionnaire was completed online. Thus, results cannot be generalised nationally. Studies with larger samples covering other provinces and including rural schools would be required. Furthermore, other variables could increase the explanatory power of the gamified learning advocacy and adoption model, such as personal innovativeness of the teachers or variables at the school level, such as available technical support or influence of social norms. The descriptive statistics demonstrated that very few teachers have experience with using gamified systems for teaching purposes. Generally, the use of digital games in South African education is still in its early stages; many educators do not yet possess the information and expertise around this medium of instruction. This study requested respondents to test a specific application before completing the survey. Most respondents tested the entire application, which took approximately 15–20 min. However, it is debatable if the allotted time was enough to inform beliefs about gamified applications and their potential for tourism education. Thus, a more longitudinal approach and a combination of qualitative and quantitative insights would be beneficial in establishing the potential of gamified systems for teaching. The use of experimental design could prove to be a more appropriate strategy to achieve the objectives of the research more comprehensively.

Appendix AItem statistics

Construct	Item	mean	median	Range	s.d.	CV
BI						
	BI1	2.35	2	1–4	0.94	39.9%
	BI2	2.22	2	1–5	1.00	45.3%
	BI3	2.16	2	1–4	0.98	45.6%
P						
	P1	1.62	2	1–3	0.52	31.9%
	P2	2.15	2	1–5	0.82	38.2%
	P3	2.40	2	1–5	0.94	39.0%
	P4	1.68	2	1–4	0.62	36.8%
SE						
	SE1	1.82	2	1–4	0.86	47.3%
	SE2	1.89	2	1–4	0.87	46.0%
	SE3	1.88	2	1–4	0.90	48.0%
	SE4	3.00	3	1–5	1.21	40.3%
	SE5	2.28	2	1–4	0.83	36.5%
CA						
	CA1	4.06	4	2–5	0.90	22.3%
	CA2	3.71	4	2–5	0.99	26.7%
	CA3	3.70	4	1–5	1.09	29.5%
	CA4	3.75	4	1–5	1.05	27.9%
CF						
	CF1	1.92	2	1–4	0.84	43.9%
	CF2	2.70	3	1–5	1.03	38.1%
	CF3	2.11	2	1–4	0.80	37.8%
LO						
	LO1	1.44	1	1–3	0.51	35.3%
	LO2	1.88	2	1–4	0.52	27.6%
	LO3	1.95	2	1–4	0.73	37.2%
	LO4	2.67	3	1–5	1.01	37.7%
	LO5	3.11	3	1–5	0.91	29.3%
	LO6	2.44	2	1–5	0.93	38.2%
	LO7	1.70	2	1–4	0.63	37.0%
	LO8	1.94	2	1–4	0.60	31.0%
CH						
	Ch1	1.65	2	1–4	0.73	44.1%
	Ch2	2.07	2	1–5	0.81	39.3%
	Ch3	2.21	2	1–5	0.84	38.0%

APPENDIX B

	BI1	BI2	BI3	P1	P2	P3	P4	SE1	SE2	SE3	SE4	SE5	CR1	CR2	CR3	LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	Ch1	Ch2	Ch3	CA1	CA2	CA3	CA4
BI1	1.000																													
BI2	0.295	1.000																												
BI3	0.445	0.758	1.000																											
P1	0.221	0.260	0.328	1.000																										
P2	0.291	0.231	0.108	0.079	1.000																									
P3	0.164	0.120	0.113	0.281	0.303	1.000																								
P4	0.087	0.367	0.294	0.623	0.297	−0.022	1.000																							
SE1	0.358	0.232	0.278	0.556	0.155	0.169	0.319	1.000																						
SE2	0.388	0.273	0.398	0.472	0.189	0.138	0.303	0.925	1.000																					
SE3	0.281	0.251	0.262	0.469	0.194	0.102	0.329	0.915	0.910	1.000																				
SE4	0.043	−0.033	0.037	0.071	0.021	0.021	0.010	0.135	0.139	0.181	1.000																			
SE5	0.515	0.374	0.334	0.026	0.311	0.370	−0.069	0.324	0.363	0.363	0.134	1.000																		
CR1	0.144	0.081	0.045	0.448	0.071	0.131	0.250	0.390	0.241	0.219	−0.021	−0.132	1.000																	
CR2	0.164	0.149	0.186	−0.077	0.268	0.043	0.048	0.074	0.104	0.168	−0.054	0.327	0.128	1.000																
CR3	0.429	0.336	0.281	0.225	0.205	0.215	0.171	0.264	0.170	0.218	0.078	0.403	0.556	0.312	1.000															
LO1	−0.007	0.007	0.050	0.600	−0.077	0.133	0.360	0.294	0.330	0.272	0.213	−0.062	0.397	−0.178	−0.013	1.000														
LO2	0.258	0.212	0.228	0.515	0.254	0.239	0.486	0.325	0.361	0.320	−0.013	0.235	0.208	0.361	0.298	0.433	1.000													
LO3	0.218	0.252	0.350	0.469	0.227	0.310	0.367	0.304	0.293	0.299	0.103	0.177	0.240	0.163	0.241	0.345	0.567	1.000												
LO4	0.109	−0.105	0.093	0.064	0.202	0.212	−0.066	−0.040	0.010	−0.034	0.010	0.101	−0.030	0.324	0.091	−0.046	0.297	0.194	1.000											
LO5	−0.009	−0.039	0.002	0.188	0.201	0.125	0.098	0.144	0.104	0.111	0.104	0.055	0.095	0.170	−0.023	0.186	0.032	0.265	0.579	1.000										
LO6	0.321	0.148	0.163	0.172	0.005	0.037	0.117	0.107	0.089	0.011	0.032	0.151	−0.083	0.103	0.073	0.035	0.247	0.166	0.151	0.193	1.000									
LO7	0.090	0.154	0.036	0.468	0.248	0.185	0.221	0.240	0.111	0.240	0.075	0.183	0.248	0.201	0.170	0.469	0.534	0.417	0.161	0.214	0.074	1.000								
LO8	0.415	0.190	0.354	0.259	0.475	0.275	0.260	0.236	0.277	0.192	0.087	0.288	0.113	0.287	0.394	0.240	0.551	0.589	0.327	0.280	0.271	0.361	1.000							
Ch1	0.230	0.116	0.278	0.523	0.059	−0.099	0.418	0.408	0.382	0.425	0.086	−0.135	0.465	0.034	0.138	0.500	0.245	0.143	−0.023	0.136	0.091	0.226	0.019	1.000						
Ch2	0.218	0.239	0.204	0.114	0.239	0.120	0.181	0.215	0.210	0.216	0.142	0.265	0.237	0.131	0.289	0.108	0.286	0.237	0.158	0.177	0.231	0.154	0.310	0.139	1.000					
Ch3	0.317	0.193	0.285	0.235	0.280	0.178	0.211	0.265	0.251	0.204	−0.018	0.245	0.232	0.063	0.308	0.004	0.189	0.165	0.245	0.248	0.177	0.165	0.294	0.322	0.599	1.000				
CA1	0.310	0.288	0.284	0.189	0.067	0.089	0.253	0.544	0.522	0.587	0.142	0.249	−0.020	0.057	0.208	−0.065	0.129	0.271	−0.058	0.083	0.062	0.058	0.166	0.155	0.122	0.252	1.000			
CA2	0.222	0.138	0.171	0.434	0.083	0.132	0.311	0.282	0.279	0.299	0.254	0.129	0.150	0.040	0.133	0.230	0.258	0.190	0.077	0.159	0.084	0.191	0.220	0.149	0.159	0.083	0.282	1.000		
CA3	0.278	0.147	0.176	0.348	0.020	0.070	0.235	0.436	0.398	0.463	0.221	0.162	0.158	0.057	0.236	0.157	0.197	0.225	−0.034	0.097	0.045	0.013	0.193	0.201	0.180	0.151	0.365	0.701	1.000	
CA4	0.219	0.137	0.159	0.371	0.051	0.101	0.245	0.259	0.280	0.333	0.251	0.123	0.088	0.036	0.190	0.157	0.167	0.201	0.043	0.136	0.111	0.132	0.149	0.151	0.164	0.120	0.340	0.894	0.734	1.000

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