

Gamified Pedagogy: Examining how a Phonetics App Coupled with Effective Pedagogy can Support Learning

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Abstract

Research has demonstrated that educational game-based apps may provide an approach to instruction in education that allows for greater learning outcomes. The focal context of this article centres around the discussion of how gamified pedagogy supports learning. The first part of this article will delve into the components of gaming, including the application of gamification to education and the methods by which digital game-based components such as scores and rewards are used to engage and motivate learners. The second part will focus on existing research on gaming pedagogy and the gaming elements of a phonetics app developed by the Resource Centre for Ubiquitous Learning and Integrated Pedagogy (ULIP) at Hong Kong Baptist University. The gamified pedagogical element of the app is designed to offer levels of challenge that motivate the players by making learning more exciting and rewarding. The game-based elements of the app not only support active student engagement but are specifically designed to offer challenges and goals for players. Moreover, the need to capture and maintain the players' attention through visual experiences and audio designs is also an important element in the design of the app. When learners are engaged in a game-based app of this nature, they are not only reinforcing their cognitive skills, but they are also constantly drawing connections between images, text and sounds, thereby allowing students to learn and practise basic skills in order to master complex tasks.

1 Introduction

Research has shown that technology-based games and simulations are conducive to learning (Erhel & Jamet, 2013; Kiili, 2005; Rosario & Widmeyer, 2009). The appeal and motivational pull of gaming among learners has led to the increasing use and successful application of next generation digital game-based learning environments. Many learners are interested in gaming, so it is essential and relevant for educators and instructional designers to understand key elements of digital game-based applications from a pedagogical perspective (Hsu & Wang, 2010). Given the recent advancements in technology, the unpredictable nature of technological change and the increasingly ubiquitous nature of mobile computing devices (for example, smartphones and tablet computers), these

learners are likely to be concurrently fluent and flexible technology users, who expect teaching styles and content delivery to meet their learning needs and adapt to changes in their environment (Chang, Wang, Lin, & Yang, 2009). Game elements are defined as “a set of building blocks or features shared by games” (Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011). Prior studies have made important contributions to gaming literature in validating methodologies for developing games that solicit the players' engagement behaviors, in supporting the learning activities to achieve the *desired learning* outcomes (Mitgutsch & Alvarado, 2012; Von Ahn & Dabbish, 2008). Amory, Naicker, Vincent and Adams (1999) identified various digital game-based elements to engage learners such as abstract thinking, visual logic and problem solving. Gathering evidence on the results of their study, they proposed a model for constructing adventure-based learning games linking pedagogy with gaming features and a variety of tasks to reinforce problem solving skills and mastery of concepts. A review of research in gamification has indicated the significance of utilizing gamified learning for augmenting the overall learning experience and maximizing learning (Deterding, 2012; Kapp, 2012). Hence, games that are pedagogically driven have the possibility to demonstrate learning opportunities, utilizing solutions that allow for technology enabled contextualised learning. Additionally, digital game-based learning may offer learners a credible means of practising and applying skills that they have acquired, in addition to displaying content in a visually compelling manner that positively influences their learning (Van Eck, 2006).

Gamification, which encompasses digital game-based elements in non-game situations, has proven effective in supporting learning with a significant impact on motivation and on levels of interaction (Deterding, 2012; Kapp, 2012). The concept behind using gamification from a pedagogical standpoint, is that it piques the learners' interest, keeps them engaged and enhances their learning environment (Deterding, 2012). Prior studies have explained that technology-based games are particularly relevant in learning situations, when they show elements of intrinsically motivated behavior (Garris, Ahlers, & Driskell, 2002; Malone, 1981; Shroff, Vogel, Coombes, & Lee, 2007) and flow (Hamari et al., 2016), which are inherent in game-play and significant to learning and for learner engagement (Klopfer, Sheldon, Perry, & Chen, 2012; Squire & Jenkins, 2003). Furthermore, active engagement has been recognised as a key factor in learning and this active engagement is also the core design goal of gamification. When a learner is engaged and is able to stimulate enjoyment and interest in a task, the learner is more likely to persist at that task. Moreover, prior research has indicated that game-based experiences assist in providing opportunities for students to acquire *higher-order thinking skills and competencies* (Kapp, 2012).

The objective of this article is to examine how key elements of a gamified phonetics app coupled with effective pedagogy support learning, thereby allowing for greater learning outcomes. Identifying these key elements and understanding how they motivate learners will help educators improve pedagogical strategies and correspondingly, help learners learn through activities that interest and engage them. Past studies have demonstrated that digital game-based activities which focus on educational content serve as effective instructional tools. Hence, the objective of this article is not only to add to the methods by which we discuss the concept of “gamification”, but also to extend our conversation beyond the more obscure concept of “gamified pedagogy”. Gamification, when combined with well thought out pedagogy, may afford learners a powerful and compelling way to learn introductory phonetics. In summary, games facilitate learning by utilizing play strategies to promote engagement, interest, and enjoyment. This may be especially effective in teaching phonetics to students with little or no prior background of phonetics.

2 Game-play digital phonetic aid for language learning and teaching

Students majoring in language frequently complain with respect to learning linguistics, and typically regard introductory linguistics courses as potentially challenging, tedious and sometimes boring. However, Battenburg and Lant (2003) contend that most of the criticisms may be because students are disposed towards or inclined to view linguistics as “an abstract and desiccated ritual,” as opposed to “a social, intellectual activity which is engaging and rewarding.” The term phonetics is

used to describe the objective methods for describing and analyzing the sounds within human speech. The instructor's role, in the process of learning phonetics and pronunciation, is notably important if students are to attain higher levels of performance.

Phonetics is typically used as a pedagogical tool in advanced university foreign language courses. The International Phonetic Alphabet (IPA) is one method of describing those sounds and is generally a well-accepted and recognized tool for teaching speech. The IPA is a system for representing phonetic sounds with symbols and is a useful tool not only for the study of phonetics, but also for language teaching and speech pathology. However, a major challenge is that students require some explicit guidance and practice of being able to consciously manipulate those sounds effectively. Regardless of language focus, students must be able to effectively learn and demonstrate familiarity with the symbols of the IPA. For example, a teacher of English as a second language can only assist his/her students if he/she can go beyond the production of English speech sounds to understand what her students are actually enunciating regardless of their background languages. Similar demands would be made of speech pathologists, and other language-related professions. However, learning this most fundamental skill is also one of the most challenging tasks facing the students of linguistics.

Given the diversity of students in the modern classroom, the teaching of phonetics requires individual attention since students of different language backgrounds are likely to be affected differently. However, this type of interaction is not practicable in *large class sizes*, which significantly reduces active engagement and decreased feedback. Moreover, traditional classroom teaching suffers from (i) the uniformity of learning pace which bores some and scares others; and (ii) the difficulty of providing clear visuals to accompany audio demonstrations. In addition, many institutions may not be able to hire adequate numbers of teachers sufficiently trained in phonetics. Language teaching in particular often relies on teachers who know about the target language and little about other languages spoken by their students. These situations necessitate attention on the development of an effective tool that allow students to explore speech sounds in relation to all other speech sounds used in human languages. The tool must allow for students to set their own pace, and to visualize the movements of the articulators. One major challenge is to develop a game-based learning tool that it is game-driven and meets the learning needs of students by leveraging user interface designs and development methodologies and subsequently supports and encourages learning of the content/concepts in engaging and meaningful ways (Devlin-Scherer & Sardone, 2013; Garris et al., 2002; Lepper, Sethi, Dialdin, & Drake, 1997). This is achieved by 1) designing gaming elements constructed to test various skill sets (Mitgutsch & Alvarado, 2012); 2) providing goals and rewards (e.g. point systems and/or the awarding of badges) to drive desired outcomes among users (Malone, 1981); 3) providing levels to indicate the proficiency of the user in the overall gaming experience over time; and 4) providing immediate feedback to keep students aware of their progress and/or failures in real-time.

Through game-play, the our tool aims to be beneficial for learning, both motivationally and cognitively (Chen & Law, 2015; Erhel & Jamet, 2013; Garris et al., 2002; Gee, 2008; Hamari et al., 2016; Schwabe & Göth, 2005). Games have the potential to engage learners with varying learning styles, together with promoting interest in a topic in which it may be difficult to find any interest (Watson, Mong, & Harris, 2011), to facilitate active participation, and finally, provide students attainable yet challenging goals (Callaghan, McCusker, Losada, Harkin, & Wilson, 2013). However, learners require some degree of support in linking game experiences with the implicit knowledge that they skillfully apply in a course (Barzilai & Blau, 2014). Game-based learning facilitates learning through the use of games and/or simulations. Games are a series of interactions that follow a predictable pattern, and more importantly, provide challenges and goals to players, which keep them actively engaged and motivated (Callaghan et al., 2013; Kapp, 2012).

In brief, digital game-based learning elements are designed not only to provide entertainment, but they also possess the principal objective of enabling and supporting learning using interactive and multimodal technologies (Cohen, 2011). Digital games present "challenges to players that require them to think, to strategise, to solve problems, and to acquire a range of cognitive skills" (Gee, 2008. p. 20).

3 Gamification

Until now, limited academic attention has been centred upon what is defined as the concept of “gamification”. Gamification is a purposely-broad term, which includes the process of using gaming elements to engage players in non-gaming contexts, with the objective of improving learning and player engagement (Deterding, 2012; Nicholson, 2012). Hence, any task, process, activity, context or application can theoretically be gamified. Although extensive current examples of “gamification” are digital, the term should not be limited to digital technologies. As a consequence of the need to narrow down the scope of this article to a manageable level, we have chosen to focus only on digital game-based learning, defined in the context of academia. A review of research on gamification emphasizes the significance of utilizing game mechanics to positively support intrinsic motivational behavior, achievement, and engagement (Deterding, 2012; Kapp, 2012). Significant learning opportunities are presented through games by encompassing strategies that support contextualised learning experiences. Moreover, games present a method by which players are able to practise, reinforce and apply what they have learned in the game experience to the real world (Van Eck, 2006).

However, gamification is not only about designing and constructing games, but is about incentivising the right behaviour and aligning it with learning outcomes by using gaming attributes, where learners are engaged in both a rich and challenging learning environment (Arnold, 2014). Cohen (2011) notes, “games associate learning with fun and allow for trial and error (basically the freedom to make mistakes)” (p.17). By taking on a gamified way of thinking, students are subsequently able to learn through trial and error, engagement, and interaction with content (Liu, Alexandrova, & Nakajima, 2011).

Karl Kapp (2012) expounded the definition of the term gamification by describing it as “a careful and considered application of game thinking to solving problems and encouraging learning using all the elements of games that are appropriate” (p.12). Game elements are represented by the rules and competition towards a goal (Deterding et al., 2011, para. 6). These elements are also contingent on the players and the desired end goal. Kapp (2012) proposed that the key elements of a well-designed game should offer a representation of reality, whether imaginary, fictitious or pretended. According to Jonassen (1994), “purposeful knowledge construction may be facilitated by learning environments which provide multiple representations of reality” (p. 6) and, hence, game-based learning has the potential to mimic various representations of reality for solving complex problems. It is imperative a game has objectives to add direction and focus, together with measurable outcomes and rules that essentially define the game. These goals pertain to how the game is played, the social interactions connecting players and what the learner is required to know and internalize subsequent to interacting with the game. Previous studies have identified the following four key notions of gamification that have been affirmed as effective in learning applications: 1) latitude for failing, 2) immediate feedback, 3) player advancement, and; 4) player objectives and decisions. Moreover, Arnold (2014), Deterding (2012) and Nicholson (Nicholson, 2012) delineate between structural and content gamification that support these four dynamics.

3.1 *Structural and content gamification*

Structural gamification is defined as the “application of game elements to propel a learner through content with no alteration or changes to the content” (Kapp, Blair & Mesch, 2014, p. 55). It is essential to emphasize that the learning content by itself does not emerge as game-like — instead, the design and construction around the content must be able to integrate gaming features into the design. A principal focus of this form of gamification is to engage and support learners to explore the content and, through that method, allow them to engage in the learning process through reinforcements and practice. Some of the common features in this form of gamification include badges, points, levels, achievements, leaderboards, various other methods of keeping track of the learning process, as well as social aspects, whereby learners are able to appropriate their attainments and achievements with others (Kapp, Blair, & Mesch, 2014). Awarding the player points-based scoring

would assist the player in progressing to the next level – this illustrates the use of structural gamification. However, paying close attention on only the structural dimension is considered a superficial use of gamification as a learning design strategy (Kapp, 2012; Nicholson, 2012). Furthermore, prior research highlighting structural gamification has neglected to explore the advancement of particular game-based features used for gamification, and propose that gamification on its own may be a solution to enhanced learning performance (Landers, 2014). The method by which gamified elements are incorporated into the app may have different outcomes, contingent upon the intended learning context. Moreover, subsequently focusing on learner motivation and attitudes is a significant missing element in the literature available on gamification. Enhancing learner outcomes through gamification implies an understanding of reasoning for using gamification and how it impacts the learning process including learner behavior, attitudes, application and progress (Landers, 2014).

Gamification not only shapes behavior, but also increases motivation and creative thinking, including the development of higher cognitive skills, supporting collaboration and increasing user engagement (Browne, Anand, & Gosse, 2014; Hamari, Koivisto, & Sarsa, 2014; Walsh, 2014). The utilization of structural gamification presents various ways to assist learners to gain the knowledge, understanding and skills they require, while at the same time, providing them with flexibility and control over when they learn, how they learn and the pace at which they learn during their learning trajectory. Kapp, Blair, and Mesch (2014) noted the importance of communicating with, and setting clearly defined goals for the user, augmenting additional goals and rewards, and setting transparent rules and criteria, all help to promote effective structural gamification.

Conversely, content gamification uses game-like features to positively effect intrinsic motivation by employing game mechanics and game design approaches to motivate players to accomplish their tasks and objectives (Kapp et al., 2014). Supplementing story elements including missions, quests and objectives is a way to illustrate some of the features of content gamification. Stott and Neustaedter (2013) identified the following rationales for using content gamification: 1) latitude for failing, 2) instantaneous feedback, and 3) progression. All three of these gamification features in their study indicated a positive impact on motivation, behaviour change and student achievement, but conditions of each course was crucial in this success. The results of their study concluded that content gamification was validated as effective by taking into consideration the context of course content during development (Stott & Neustaedter, 2013).

3.2 Gamification of instruction

The extraction of design features from games and firmly implanting them into learning systems as a method of gamifying instruction, presents an opportunity for increasing learner engagement and retention and sustaining motivation (Van Eck, 2006). By embedding goals, rules, interaction, penalties, rewards and feedback into the game, players are able to attain their own levels of mastery and subsequently fail with minimal consequences, resulting in learning environments that foster higher levels of motivation, retention and engagement (Garris et al., 2002). Thus, the main objective of gamification is to enhance instruction. Moreover, if the content is not in itself compelling and of high value, then adding gamification will produce few or no results (Kapp et al., 2014).

Perhaps the most misconstrued element of gamification, to some varying degree, is what Kapp (2012) labels as reward structures, such as the use of awards, levels or bonus elements. Kapp (2012) contends these elements should be carefully implemented as essential and requisite elements of the game and should not to be merely perceived as gamification add-ons. Kapp (2012) further emphasizes the importance of having clear and discernible levels of increasing complexity in a game that is both compelling and engrossing; the different levels of attainment keep a game manageable, thereby enabling the player to build up his/her skills that are necessary to be successful in the game. Kapp's (2012) elements suggest that developers need to determine precisely how a game is able to capture a learner's immersion, and thereafter, charting the level of interest as the player progresses through the game. Aesthetic elements are also significant in creating an immersive learning approach that that impacts the gaming experience by subsequently immersing and engaging the

learner. Moreover, failure in a game allows the player to reassess his/her approach to the game (Kapp, 2012). When the player repeatedly loses in the game, it makes winning more entertaining and exciting. A preliminary investigation of the growing body of research in gamification indicates that specific features keep recurring and finally, become established components of all games. Features such as points, levelling up, leaderboards, and awards are all part of the approach referenced invariably by Nicholson (2012) and Kapp (2012).

3.3 Feedback in gamification

A principal design element of gamification is to “provide feedback so that players can achieve a sense of mastery” (Richards, Thompson, & Graham, 2014). Gaining mastery over a task, and learning by failure, is often characterized in gamification through the use of leaderboard ranking, attaining the highest level, rewards, etc. (Richards et al., 2014). By ensuring feedback cycles are immediate and ensuring the stakes are low, players continue to persevere until they are successful and subsequently do not risk much in doing so. Furthermore, the feedback loop in gamification is substantially reduced, by presenting learners with methods to assess their own performance and improve their capabilities, and as a result, this creates conditions in which earnest attempts to learn are rewarded. Hence, students learn to see failure as an ally to self-mastery.

Feedback is an important aspect of gamification and refers to any information that makes learners evaluate their own performance. Feedback is key as it enables the player to learn from mistakes and to subsequently set objectives for future practice. In playing a game-based app, for example, feedback is typically instantaneous, targeted and intended to allow the player to make changes to their approach for more fitting results. Jung et al. (2010) found that giving feedback in the form of points, together with clear objectives (i.e. levels and leaderboards) in an idea generation task generated significant performance gains. Hence this player feedback can be in the form of achievements, avatars, collections, levels, badges or quests and create a sense of progression. The main objective of this feedback provided is to maintain player's attention and provide objective feedback of task performance at the end of each activity to enhance motivation and awareness of progress. Hence, feedback serves the purpose beyond notifying the player about changes to the game state. Moreover, feedback mechanisms can subsequently be strengthened by making use of game design elements and by providing immediate feedback to players through self-paced exercises, visual cues, frequent question-and-answer activities or a progress bar that informs players of how close they are to completing a set of tasks by *showing* percentages of completion along the way.

3.4 Motivation for game play

Behavior is primarily motivated by intrinsic factors that are not always embedded in all games, and not all pedagogical issues are capable of being explained using games. Nonetheless, it is claimed that well-designed games that achieve specific learning goals, are a source for highly varied, interesting and challenging tasks should not go unnoticed in the instructional design process. Several attributes of motivation can be deduced when considering online games. These attributes include curiosity, fantasy, control, skill development, challenging elements and effective stimuli of game play (Deterding, 2012; Kapp, 2012). Research has demonstrated that pedagogically-driven games improve motivation, engagement and long term retention (Huizenga, Admiraal, Akkerman, & Dam, 2009; Papastergiou, 2009). When students actively participate in the learning process, the educational experience becomes more engaging and motivational for the learner. Recent studies have also established that simulations improved the process of learning and learning outcomes, particularly when simulations represented complex real-world processes (Hamari et al., 2016; Hsieh, Lin, & Hou, 2016; Tsai, Huang, Hou, Hsu, & Chiou, 2016). Increased levels of motivation are achievable, along with more time spent interacting with the game by redesigning those environments in which, for example, dimensions of fantasy and control are present, in an intrinsically appealing way ((Venkatesh, 2000; Shroff, Vogel, & Coombes, 2008). Kirriemuir & McFarlane (2004) ascertained

a common premise in the development of games for education: a belief that “learning through doing” in games such as simulations, presents a novel and engaging learning tool. The use of a game-based app not only allows for interactions among learners, but also provides active learning that may simulate real-world situations and environments by creating a setting within which learners engage with the experience of learning through doing (Kirriemuir & McFarlane, 2004). Hence, a better understanding of the nature of motivation and the ability to gauge students’ intrinsic motivation while interacting with games, promises to contribute to the design of more effective game-design and thus, ultimately to higher educational performance (Schwabe & Göth, 2005; Shroff et al., 2008).

The typical practice of gamification as pedagogy includes the integration of scoring features such as badges, levels or leaderboards and making them applicable to an educational context (Deterding, 2012) and keeping learners motivated and engaged to continue progressing through the game (Deterding et al., 2011; Von Ahn & Dabbish, 2008). Gamification as pedagogy has the possibility of increasing learner engagement, especially if it simultaneously furnishes feedback with immediacy and accuracy on the learners’ level of competency (Richards et al., 2014).

4 Mechanics of gaming and learning: a gamified phonetic learning app

Game mechanics are the rules or methods designed for interaction and used for gamifying an application. They delineate the game in the context of a rule system, determining how players behave within a set of rules and “how players are able to interact with the game-world and how that game-world reacts to the choices players make” (Rouse III, 2010). An example of game mechanics elements are achievements, points, badges, levels and leaderboards. Moreover, in gamification, players are required to know where they are positioned at all times and what they are expected to do after a particular move, in order to progress to the next level. Creating effective game dynamics and accompanying them with apt game mechanics may be a formidable task. To illustrate, the acquisition of demonstrative knowledge entails a great deal of association and repetition. Moreover, levels, badges, avatars and leaderboards are fittingly incorporated into appropriate game mechanics – this reinforces game dynamics by giving an impression of seriousness in players and by transforming the same sort of repetitive tasks into more engaging and appealing tasks. Hence, the implementation of levels, badges, avatars and leaderboards has shown to support self-directed learning (Fuchs, 2014). By implementing these types of game elements, learners are able to decide which activities and/or tasks to perform and subsequently concentrate their efforts in performing these tasks, thereby supporting informed choices and fostering learner autonomy. Moreover, learners have control over how they learn and the way in which they approach the learning process and subsequently take control of their own learning (Kapp et al., 2014; Nicholson, 2012).

We now move on to present an overview of our “Interactive Phonetics – An Audio-Visual IPA Reference” app. Speech pathologists and linguistic students must have a firm grasp of the physiology and anatomy associated with speaking. In learning phonetics, it is essential for students to understand the articulatory mechanisms underlying the production of speech sounds. This basic understanding of articulatory mechanisms is the foundation upon which the *International Phonetic Alphabet* is developed for precise transcription of speech sounds. To effectively learn, grasp and use the IPA for transcriptions of speech sounds is the most fundamental and yet one of the most demanding tasks facing students of linguistics and other language-related professions. The “Interactive Phonetics - An Audio-Visual IPA Reference” app designed and developed by the Resource Centre for Ubiquitous Learning & Integrated Pedagogy (ULIP) at the Hong Kong Baptist University is inherently a game-based mobile app, which provides comprehensive coverage in its description of the articulatory properties of nearly all of the speech sounds recognised by the International Phonetic Association. The visual presentation of articulations in this app adopts sagittal cross-sections of the laryngeal, oral and nasal cavities, together with the movements of active articulators such the tongue and lips, accompanied by a synchronised audio transmission of each speech sound aligned with the movement of the articulators. Visualisation through the aid of animation, perception through the

audio transmission and understanding through careful descriptions, all serve to combine into a powerful learning tool, which aids in the provision of a stimulating learning experience. The app is implemented for both iOS and Android, and students are able to access this app by simply loading it on their smartphones, just as they do with all their other smartphone applications.

Screen layouts of the app interface design are depicted in Figure 1. Key features include an intuitive touch interface with clear graphics, high quality audio transmission and textual descriptions of speech sounds, accompanied by cross-section animations, and illustrating the articulations of the consonants, vowels and tonal symbols suitable for understanding sounds of known human languages. Further, a completely original and aptly challenging *game* concept, augmented with detailed game statistics, makes learning exciting and rewarding.

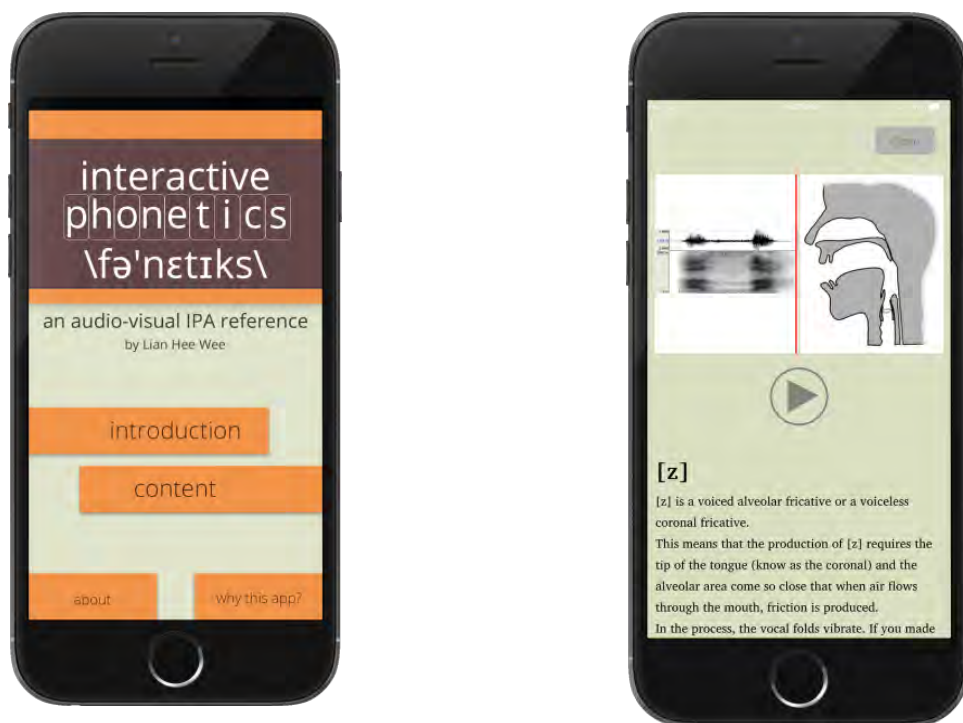


Fig. 1. Interactive Phonetics app with audio transmission and textual descriptions of speech sounds, coverage of consonants, vowels, tonal symbols and cross-section animations

The gaming element in the app combines both logic and creativity, producing greater learning outcomes than traditional rote learning or text-based pedagogy. Students take pulse of their learning through a challenging game component crafted to test various skill sets in phonetics. Penalties, coupled with rewards and achievements make for an engaging learning experience through appropriate use of drill-and-practice approaches. This enables eventual mastery of human speech sounds and the methods to describe or transcribe them with effective accuracy. In so doing, the gaming element contributes to learning outcomes simultaneously at the levels of conceptual knowledge and application skill.

Fundamentally, the app was designed based upon the concept of mastery, meaning that in order to exhibit knowledge and understanding of a given speech sound, a two-way association between the corresponding phonetic symbol and its articulatory properties must be correctly identified. The gaming elements (see Figure 2) consist of the following: 1) matching symbol with audio pronunciation, 2) matching symbol with descriptive label and 3) matching descriptive label with audio pronunciation.

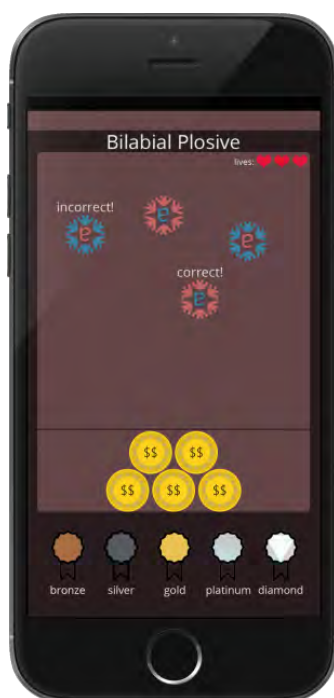


Fig. 2. Interactive Phonetics app illustrating gaming elements (i.e. the use of drill-and-practice approaches for learning speech sounds and visual recognition of phonetic alphabets)

Figure 2 depicts screen layouts of the mobile app running on an iPhone. The user-interface design and each of the twelve crossword puzzle games are consistent in colour scheme, font and layout. These assist players by providing consistency in locating specific features embedded in the app and by displaying the required textual content, without a barrage of other distracting items. In addition, the players are actively involved with game play and can successfully navigate through required finger gestures across the device. Hence, the need to gather and maintain the players' attention through visual experiences and audio designs is also an important element in the design of this specific app. The uptake of the phonetics app by students is impacted by their confidence in using the app and their awareness of how the app is able to assist their overall learning experience. The users' experiences within the app transcends multiple dimensions. In certain cases, this is contingent upon the app's design and how various features of the app draw in each user. Specifically, one way to address the challenge of assessing student learning effectiveness is through data collection and analysis of responses to questionnaires, feedback gathered through structured interviews as well as comments from users through the App Store and Google Play.

While designing the app, game theory recommended taking into consideration the reward features necessary in order to retain the players' interest (Keyes, Shroff, & Chow, 2016). The design mechanisms that go into a game, and provide reward through variability in level difficulty and scoring, are developed based upon the players' cognitive abilities. Malala, Major, Maunez-Cuadra, and McCauley-Bell (2007) demonstrate that "one way to generate interest on the part of students is to institute a rewards system that promises immediate gratification to performance" (p. 4) though an increase in points and by raising the level of difficulty of the game. For each game in the phonetics app, the players are required to progress through the following four levels: Iron > Bronze > Silver > Gold > Platinum. Players are only able to progress to the next level if they collect five coins (that is to say, for each correct answer, one coin is awarded). For each game, the players have three lives represented by a "heart" symbol. For every incorrect answer, one heart disappears. So if the players

select three incorrect answers, then all three hearts will disappear and the game ends. The difficulty of each "level" does not actually increase, but rather each level symbolises a different challenge. Points are awarded for the completion of certain tasks and badges are presented contingent upon how many points are accumulated. The scores are shown on a leaderboard, which allow the players to be able to track their performance. The rationale for this form of gamification is that the player is challenged to beat his/her own new best scores and are therefore, motivated to replay the game. Liu et al. refer to this as the "gamification loop" (Liu et al., 2011).

It is evident from the above that the use of rewards increases motivation and the drive to succeed in a game (Keyes et al., 2016). Correspondingly, the rewards or scoring of points indicate a rise in achievements attained by each player, because each player's encounter will be different when immersed in the same game (Crawford, 1984). The reward features inherent in the design of this app not only provide instructive information immediately to the players regarding a correct answer, but also allow the players to appropriately acknowledge a correct response. Adding a gaming element to the app also helps the players monitor their learning progress, and gain confidence in preparing for more summative assessments. In summary, an essential component in game design is not only to create a delicate balance by which the players advance progressively in the game, but also to ensure that they continuously acquire the cognitive processes required to do so (Keyes et al., 2016). It is here that the scoring mechanism within the phonetics game provides a means for the players to monitor progress. In addition, the design components that go into the phonetics game offer assessment and feedback (i.e. affirmation of performance that communicates information to players about their progress toward their goals) through scoring and are developed based upon the players' distinctive cognitive skills and abilities.

5 Conclusion

The integration of gamification as pedagogy into the educational domain allows instructional designers to assess the effect of games on the learning behaviours of students. Hence, the use of gamification as pedagogy provides numerous benefits for education. One of the most significant benefits is that it provides learners with a sense of control over how their learning takes place. Another key aspect is that it keeps learners motivated by giving them a goal to reach and thereby, attain a level of mastery in the use of the app. For the phonetics app to be pedagogically significant, it needs to satisfy several conditions: 1) the app should focus on specific pedagogical problems that are demonstrably difficult to address in the classroom; 2) the overall design of the app must be transparent and fun to use, and aesthetically pleasing in order for the app to compete in the mobile ecosystem of other apps, all vying for the attention of users; and 3) the reasoning/logic behind the significance of the app's content and how it will be used and/or assessed in the course, must be easily comprehensible to the learner. Typically, the phonetics app affords learners a chance to play at their own level and at their own pace. When learners are engaged in a game-based app of this nature, they are not only developing and reinforcing their cognitive skills, but they are also making constant connections between text, images and sound.

The primary advantage of using a mobile game-based application such as the "Interactive Phonetics - An Audio-Visual IPA Reference" is the ease of repeated opportunities available to learners to engage in a task or learning activity. The valued added-ness of a mobile game-based version of phonetics, and other learning tools, includes opportunities for relatively short but frequent repetitions of learning activities on a device that students usually have with them at all times during a day. By adding appropriate audio and gaming components, mobile apps create an especially rich, engaging and immersive learning environment, and offer that environment at any time and place based on students' preferences. The reuse and multiplicity of learning pathways through the app are also a pedagogically important aspect (Keyes et al., 2016). As an extension into other disciplines, learning activities, and pedagogical needs, mobile apps may increasingly provide rich, ubiquitous and immersive experiences, both useful and practical for building a solid learning foundation for many subjects.

References

- Amory, A., Naicker, K., Vincent, J., & Adams, C. (1999). The use of computer games as an educational tool: identification of appropriate game types and game elements. *British Journal of Educational Technology*, 30(4), 311–321.
- Arnold, B. J. (2014). Gamification in education. *ASBBS Proceedings*, 21(1), 32.
- Barzilai, S., & Blau, I. (2014). Scaffolding game-based learning: Impact on learning achievements, perceived learning, and game experiences. *Computers & Education*, 70, 65–79.
- Browne, K., Anand, C., & Gosse, E. (2014). Gamification and serious game approaches for adult literacy tablet software. *Entertainment Computing*, 5(3), 135–146.
- Callaghan, M. J., McCusker, K., Losada, J. L., Harkin, J., & Wilson, S. (2013). Using game-based learning in virtual worlds to teach electronic and electrical engineering. *IEEE Transactions on Industrial Informatics*, 9(1), 575–584.
- Chang, W.-C., Wang, T.-H., Lin, F. H., & Yang, H.-C. (2009). Game-based learning with ubiquitous technologies. *IEEE Internet Computing*, 13(4), 26–33.
- Chen, C.-H., & Law, V. (2015). Scaffolding individual and collaborative game-based learning in learning performance and intrinsic motivation. *Computers in Human Behavior*.
- Cohen, A. M. (2011). The gamification of education. *The Futurist*, 45(5), 16.
- Crawford, C. (1984). The art of computer game design.
- Deterding, S. (2012). Gamification: designing for motivation. *interactions*, 19(4), 14–17.
- Deterding, S., Sicart, M., Nacke, L., O'Hara, K., & Dixon, D. (2011). *Gamification. using game-design elements in non-gaming contexts*. Paper presented at the CHI'11 Extended Abstracts on Human Factors in Computing Systems.
- Devlin-Scherer, R., & Sardone, N. B. (2013). Collaboration as a form of professional development: Improving learning for faculty and students. *College Teaching*, 61(1), 30–37.
- Erhel, S., & Jamet, E. (2013). Digital game-based learning: Impact of instructions and feedback on motivation and learning effectiveness. *Computers & Education*, 67, 156–167.
- Fuchs, M. (2014). Gamification as twenty-first-century ideology. *Journal of Gaming & Virtual Worlds*, 6(2), 143–157.
- Garris, R., Ahlers, R., & Driskell, J. E. (2002). Games, motivation, and learning: A research and practice model. *Simulation & Gaming*, 33(4), 441–467.
- Gee, J. P. (2008). Learning and games. *The ecology of games: Connecting youth, games, and learning*, 3, 21–40.
- Hamari, J., Koivisto, J., & Sarsa, H. (2014). *Does gamification work?--a literature review of empirical studies on gamification*. Paper presented at the 2014 47th Hawaii International Conference on System Sciences.
- Hamari, J., Shernoff, D. J., Rowe, E., Coller, B., Asbell-Clarke, J., & Edwards, T. (2016). Challenging games help students learn: An empirical study on engagement, flow and immersion in game-based learning. *Computers in Human Behavior*, 54, 170–179.
- Hsieh, Y.-H., Lin, Y.-C., & Hou, H.-T. (2016). Exploring the role of flow experience, learning performance and potential behavior clusters in elementary students' game-based learning. *Interactive Learning Environments*, 24(1), 178–193.
- Hsu, H.-Y., & Wang, S.-K. (2010). Using gaming literacies to cultivate new literacies. *Simulation & Gaming*, 41(3), 400–417.
- Huizenga, J., Admiraal, W., Akkerman, S., & Dam, G. t. (2009). Mobile game-based learning in secondary education: engagement, motivation and learning in a mobile city game. *Journal of Computer Assisted Learning*, 25(4), 332–344.
- Jonassen, D. H. (1994). Thinking technology: Toward a constructivist design model. *Educational technology*, 34(4), 34–37.
- Jung, J., Schneider, C., & Valacich, J. (2010). Enhancing the motivational affordance of information systems: The effects of real-time performance feedback and goal setting in group collaboration environments. *Management science*, 56(4), 724–742.
- Kapp, K. M. (2012). *The gamification of learning and instruction: game-based methods and strategies for training and education*: John Wiley & Sons.
- Kapp, K. M., Blair, L., & Mesch, R. (2014). *The gamification of learning and instruction fieldbook: Ideas into practice*: John Wiley & Sons.
- Keyes, C., Shroff, R. H., & Chow, E. (2016). Pedagogical Foundations of a Mobile Application for Language Acquisition. *Ubiquitous Learning: An International Journal*, 9(2), 1–11.

- Kiili, K. (2005). Digital game-based learning: Towards an experiential gaming model. *The Internet and higher education*, 8(1), 13–24.
- Kirriemuir, J., & McFarlane, A. (2004). Literature review in games and learning. *Futurelab*, 8.
- Klopfer, E., Sheldon, J., Perry, J., & Chen, V. H. (2012). Ubiquitous games for learning (UbiqGames): Weatherlings, a worked example. *Journal of Computer Assisted Learning*, 28(5), 465–476.
- Landers, R. N. (2014). Developing a Theory of Gamified Learning Linking Serious Games and Gamification of Learning. *Simulation & Gaming*, 45(6), 752–768.
- Lepper, M. R., Sethi, S., Dialdin, D., & Drake, M. (1997). Intrinsic and extrinsic motivation: A developmental perspective. *Developmental psychopathology: Perspectives on adjustment, risk, and disorder*, 23–50.
- Liu, Y., Alexandrova, T., & Nakajima, T. (2011). *Gamifying intelligent environments*. Paper presented at the Proceedings of the 2011 international ACM workshop on Ubiquitous meta user interfaces.
- Malala, J., Major, A., Maunez-Cuadra, J., & McCauley-Bell, P. (2007). The Use of Rewards in Instructional Digital Games: An Application of Positive Reinforcement. *Online Submission*.
- Malone, T. W. (1981). Toward a theory of intrinsically motivating instruction. *Cognitive science*, 5(4), 333–369.
- Mitgutsch, K., & Alvarado, N. (2012). *Purposeful by design?: a serious game design assessment framework*. Paper presented at the Proceedings of the International Conference on the foundations of digital games.
- Nicholson, S. (2012). A user-centered theoretical framework for meaningful gamification. *Games+ Learning+ Society*, 8(1), 223–230.
- Papastergiou, M. (2009). Digital game-based learning in high school computer science education: Impact on educational effectiveness and student motivation. *Computers & Education*, 52(1), 1–12.
- Richards, C., Thompson, C. W., & Graham, N. (2014). *Beyond designing for motivation: the importance of context in gamification*. Paper presented at the Proceedings of the first ACM SIGCHI annual symposium on Computer-human interaction in play.
- Rosario, R. A. M., & Widmeyer, G. R. (2009). An exploratory review of design principles in constructivist gaming learning environments. *Journal of Information Systems Education*, 20(3), 289.
- Rouse III, R. (2010). *Game design: Theory and practice*: Jones & Bartlett Learning.
- Schwabe, G., & Göth, C. (2005). Mobile learning with a mobile game: design and motivational effects. *Journal of Computer Assisted Learning*, 21(3), 204–216.
- Shroff, R. H., Vogel, D. R., & Coombes, J. (2008). Assessing individual-level factors supporting student intrinsic motivation in online discussions: A qualitative study. *Journal of Information Systems Education*, 19(1), 111.
- Shroff, R. H., Vogel, D. R., Coombes, J., & Lee, F. (2007). Student e-learning intrinsic motivation: A qualitative analysis. *Communications of the Association for Information Systems*, 19(1), 12.
- Squire, K., & Jenkins, H. (2003). Harnessing the power of games in education. *Insight*, 3(1), 5–33.
- Stott, A., & Neustaedter, C. (2013). Analysis of gamification in education. *Surrey, BC, Canada*, 8.
- Tsai, M.-J., Huang, L.-J., Hou, H.-T., Hsu, C.-Y., & Chiou, G.-L. (2016). Visual behavior, flow and achievement in game-based learning. *Computers & Education*, 98, 115–129.
- Van Eck, R. (2006). Digital game-based learning: It's not just the digital natives who are restless. *EDUCAUSE review*, 41(2), 16.
- Venkatesh, V. (2000). Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information systems research*, 11(4), 342–365.
- Von Ahn, L., & Dabbish, L. (2008). Designing games with a purpose. *Communications of the ACM*, 51(8), 58–67.
- Walsh, A. (2014). The potential for using gamification in academic libraries in order to increase student engagement and achievement. *Nordic Journal of Information Literacy in Higher Education*, 6(1), 39–51.
- Watson, W. R., Mong, C. J., & Harris, C. A. (2011). A case study of the in-class use of a video game for teaching high school history. *Computers & Education*, 56(2), 466–474.

Appendix

Download Statistics

App statistics are regularly tracked to collect data to better understand the *geographic distribution* (see Figure A1) of users and monitoring of user downloads. For example, the interactive phonetics app was downloaded more than 7,000 times (see Figure A2) within the first three months of being available on Google Play. This indicates that our students/users are compelled to download the app because it offers rich and relevant content,

combined with unique gaming elements, which other apps that are currently available on the market may not offer.

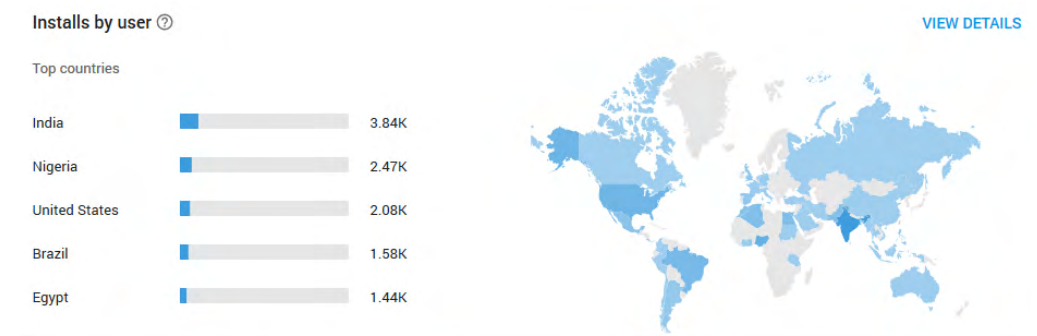


Fig. A1. Android version for Interactive Phonetics app showing total installs by user (top countries)

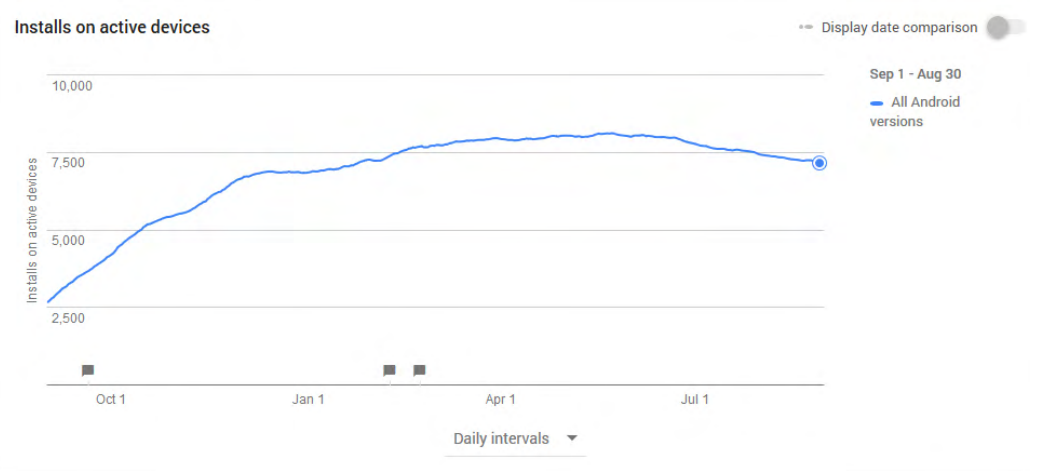


Fig. A2. Android version for Interactive Phonetics app showing the number of active devices on which the app is currently installed

We continue to explore various tracking and analytic data to be collected for interpreting user data. Data collection involved measurement, analysis, reporting and representation of the data with the objective of impacting the primary goal of increased user engagement and enhancement.