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A description of gamification in teaching second language pharmacy technician students

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Abstract

Introduction: Students whose first language is not the language of instruction struggle to master health science terminology in their first few years in higher education. In addition, the funding available to higher education institutions is diminishing. Educators have had to become creative in their teaching techniques to assist learners with low proficiency in the language of instruction.

Description of innovation: A cost effective board game was developed to assist learners in a pharmacy technician programme to master pharmacy practice terminology.

Evaluation: The game kept students engaged and motivated and several observations were made with respect to further game development.

Recommendations: A five step process was developed to guide further development of low cost games for use in the classroom that can be used regardless of the learning objective. The five steps are: Plan, Prepare, Pilot, Play, and Perform.

Keywords: Game Development, Low Language Proficiency, Acquiring Terminology

Introduction

> *I never teach my pupils. I only attempt to provide the conditions in which they can learn.* Albert Einstein

Creating these conditions in an under-resourced environment is not easy. The primary teaching medium in most South African universities and vocational colleges is English, yet only 9.6% of South Africans identified English as their home language in the 2012 census. English ranked fourth behind isXhosa, isiZulu and Afrikaans as the most spoken home language (Statistics South Africa, 2012). This presents a particular challenge in higher education in South Africa, as many students arrive from the basic education system, where they have been taught in their home language, and are placed into an environment which is predominantly English. They are required not only to adapt to the challenges of tertiary education, but are required to master the English language with little remedial assistance (Nel, Troskie-de Bruin & Bitzer, 2009). Educators need to be increasingly more creative with their teaching pedagogies to keep students actively engaged in the learning process. Active learning refers to a range of teaching strategies which are used to bring the learner into the classroom as an active participant rather than a passive observer. Using games as an active learning strategy has been well documented (de Freitas, 2006; Kapp, 2012; Aburahma & Mohamed, 2015). Gamification is an alternative framework for learning using game design in a non-game context, in which studies have shown that students' intrinsic motivation and participation in learning has improved (Vlachopoulos & Makri, 2017). Games have been used in pharmacy schools to teach pharmaceutical scientific concepts but not to specifically address the concerns of understanding or re-enforcing basic pharmacy practice terminology (Rose, 2011; Lee, White & Malone, 2018).

English comprehension is a particular challenge in limited English proficient (LEP) students, with limited vocabulary being the precursor to this. The student cannot fully participate in reading, writing and engagement with the course material while they are grappling with the English language. In addition, Health Science disciplines bring with them an extended vocabulary that is new to all students further delaying the learning of the LEP student (Diab *et al*., 2015).

Furthermore, developing countries, such as South Africa, are resource-constrained in terms of the development of online active learning strategies. Unreliable access to Wi-Fi, technological resources and lack of technological support mean that despite the availability of open source

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teaching resources, they often cannot be utilised to their full extent (Teferra & Altbachl, 2004; Wangenge-Ouma, 2012).

Gamification is a way to assist students in mastering basic pharmaceutical concepts in an active way when resources in the teaching environment are constrained. A low-cost board game was developed to assist students in learning pharmacy practice terminology in an informal, yet engaging way. The article aims to describe the development and implementation of the game, followed by observations made during implementation and the resulting evolution of the game. Guidelines for development of board games to be used in higher education context is then discussed.

Gamification in higher education

Games are an alternative way of engaging students in the learning process. There are three areas in which games can motivate learners: cognitively, emotionally and socially (Lee & Hammer, 2011). Cognitively, games involve the player reaching an objective or set of objectives within the boundaries of game rules. Learners are able to test the rules in creative ways in reaching the objectives. They may not be successful during their turn, but can improve on the next attempt, students therefore do not see themselves as failing, but rather as learning through making mistakes (McGonigal, 2011). The objectives of the game are met within a specified time period and the players feel as though they have accomplished something. This is in contrast to a traditional learning environment where students are provided with a set of objectives at the beginning of an academic semester and then navigate, sometimes aimlessly, towards the objective at the end of the semester, which is usually to pass the module examination (Vleeshouwer, 2015). Emotionally, games evoke a range of positive feelings from curiosity to excitement and self-satisfaction (Hamari, Koivisto & Sarsa, 2014). To achieve this the game must provide enough of a challenge to keep students engaged and learning, but not be so difficult as to result in anxiety, frustration or a sense of failure (Lee & Hammer, 2011). Well-designed games can contribute to developing attributes such as persistence and resilience in learners (McGonigal, 2011). Socially, games create a more relaxed environment where students may not feel judged by their peers. With every student required to participate, a game, in an informal environment, can entice a quieter personality to come to the fore as they take their turn, whether in a team or as an individual (Lee & Hammer, 2011; Vleeshouwer, 2015).

Publications that deal with game design elements, refer to online platforms and incentive shopping or membership models. They list elements such as point scoring, levelling up, leader boards, badges and challenges as being essential to the success of the game and keeping players interested in the game (Urh *et al*., 2015; Vleeshouwer, 2015). Lee and Hammer (2011) even compare schooling systems to a long term game of earning merit points to achieve badges and then levelling up from one grade to the next. Applying these design elements to board games is also possible. Players should be able to see progress by moving forward on a board (points or levelling up), they would be able to see the leader by the placement of the token on the board (leader board) and the winner at the end of the game should earn the 'title' (badge) of being the winner. Challenges can be placed along the way in a board game depending on the nature and objectives of the game.

Context of need for game development

Students whose first language is not the language of learning is not unique to South Africa. Globalisation with respect to education has expanded rapidly over the past 20 years. Students find themselves on study visas in foreign countries where the language of learning (L2) is not the same as their home language (L1). They often have a limited proficiency of L2, which in many cases is English. This brings a number of challenges to both the learner and the educator. Gopang, Bughio and Pathan (2018) showed that learning English at a tertiary level caused anxiety amongst second language learners. Another study of Chinese learners in the United Kingdom, showed that learning in a language in which the student has limited proficiency significantly disadvantaged them during their formative years of tertiary education (Trenkic & Warmington, 2018). Although international students wishing to complete a qualification in a foreign country whose language is different from their own, are required to write a language proficiency test, the test is not always a good indicator of the students' success in their first two years of study (Trenkic & Warmington, 2018). Language proficiency includes both comprehension and reading skills. Comprehending the content knowledge as well as acquiring vocabulary through reading are essential to mastering a language (Cook, 2001; Ellis, 2005; Diab *et al*., 2015). With learning in a second language and adjusting to a tertiary education environment, many students struggle to settle in and show low performance scores (Salamonson *et al*., 2008; Zhou *et al*., 2008; Nel *et al*., 2009; Chetty & Pather, 2015).

Learners who apply for tertiary education are also often directly out of school. The implication is that these learners are younger in age and in maturity, and therefore their ability to cope outside of their home environment and in the context of a higher education institution is more challenging than for an older, more mature student. Morrison, Merrick, Higgs and Le Métais (2005) found that older students performed better academically than younger students. The academic entry requirement to gain access into a certificate or diploma programme, like the pharmacy technician course, is also one of the lowest requirements of any programme offered, further adding to the learner's challenges at a tertiary institution since they need not be academically strong. Although there are many factors that contribute to these students not performing well, learning in a second language is the factor that this paper focuses on.

Hakuta, Butler and Witt (2000) suggest that it takes between four and seven years to achieve academic language proficiency, yet most undergraduate professional programmes are only of four-years duration. The pharmacy technician programme in South Africa, for example, is only of two-years duration. Students who are directly out of school, not academically strong and have moved away from home, sometimes to another country, and into the tertiary education environment, have to contend with low language proficiency in the language of instruction. In addition, health science programmes like the pharmacy technician programme, add new terms to a language in which these students are already struggling. They therefore enter university with a language disadvantage and yet are still expected to perform academically within a Health Science field.

A recent systematic review of six studies showed a positive correlation between playing English learning games and improved English vocabulary (Svensson, 2018). An earlier review also showed a positive experience in learners who played games while learning a new language (Hamari *et al*., 2014). In addition, improving vocabulary in a particular subject area was shown to mitigate the anxiety in learning a subject in a second language (Ardasheva *et al*., 2018).

The aim of the innovative game described in this paper was to improve the vocabulary of pharmacy technician students so that when reading new content, they would not have to grapple with understanding the vocabulary first before comprehending the content of the text.

Game development in low resourced environments

The globalisation of higher education has presented both opportunities and challenges for learners. The cost of higher education and sustainability of higher education institutions is also of concern (Aleixo, Leal & Azeiteiro, 2018). In developing countries, in particular, the call for free education has added to the burden of alternative funding sources such as research grants, donations and contracts (Higher Education South Africa, 2014; Abugre, 2018).

As a result of the lack of funding available to higher education institutions, many of the basics are being neglected. Administrative posts are frozen and failing infrastructure is left in disrepair. Traditional lecture venues are not maintained adequately, computers are not serviced frequently and luxuries such as Wi-Fi are overlooked (Abugre, 2018; Aleixo *et al*., 2018). Therefore, while there is a need to embrace the power of what Information and Communication technologies (ICT) offer higher education in improving teaching and learning and expanding access to tertiary education, the lack of infrastructure and technical assistance available to assist academics already struggling under the demands of large workloads is lost (Mabelebele, 2015). Thus, although academics may be willing to embrace new technologies it becomes more of a frustration than a help. The current generation of student would possibly prefer to be taught *via* applications on their smartphones, however, this is not always possible and academics have had to become creative in their teaching strategies to keep students actively engaged and motivated. The game described in this paper is a basic low cost board game that was developed with these challenges in mind.

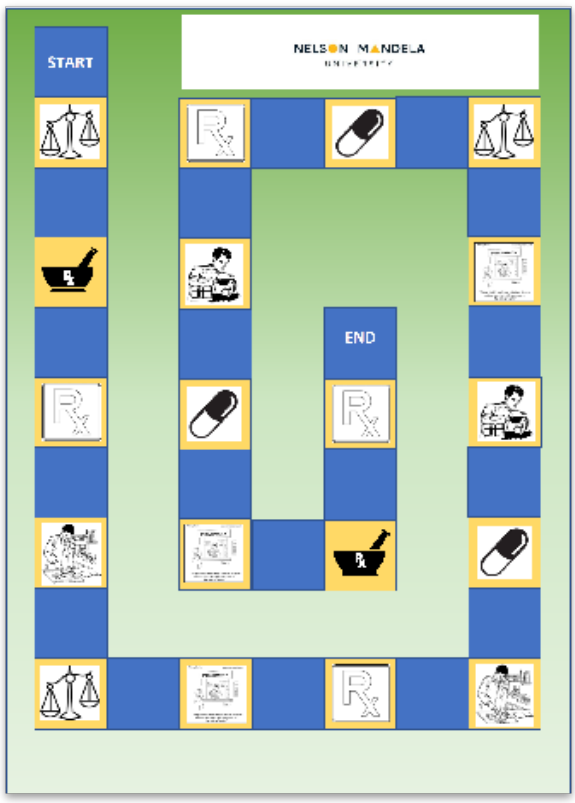
Description of innovation

A board game was developed to assist students in improving their vocabulary in the discipline of pharmacy practice. The game needed to have all of the elements of good game design, but be useful enough for students to learn pharmacy practice terms. The game was based on an existing board game and amended for the needs of learning (Woodlands Games Limited, 2018).

Game development

The game development included a board, tokens and timers and cards containing terms. The board was designed in Microsoft Word using alternating blocks of yellow and blue. To make it more interesting open source clipart was placed on each of the yellow blocks. In total there were 39 blocks on the board including a 'Start' and 'End' block. This ensured that each group had to proceed through a minimum of 10 cards or 40 terms. The board was colour printed in A3 format and laminated (Fig 1).

Figure 1: Game board for learning terminology in pharmacy practice



The tokens used were micro suction capped toys, but any similar object could have been used (*e.g.*, buttons, stones). The timer was a two-minute sand timer, giving teams 30 seconds to define and guess each of the four terms.

To make the cards, 200 terms from textbooks, legislation and class notes were extracted and arranged alphabetically in a Microsoft Excel spreadsheet. These terms were in the language of instruction, namely, English. Each term was allocated a difficulty and a category. Duplicate or similar terms were also identified (*e.g.,* 'lot' and 'batch' number). To keep the game fun and interesting, non-pharmacy terms such as peanut butter; cola and Justin Bieber were randomly allocated.

Each term was then allocated a card number, taking difficulty and categories into consideration, and sorted in Microsoft Excel. The terms were then transferred to Microsoft Powerpoint for formatting into cards. Each card contained four terms of differing difficulty. Sorting the terms into categories, ensured diversity between the terms on each card. Therefore, since there were 200 terms to start with, 50 cards were produced. Half of which were printed with a blue background and the remaining half on a yellow background. The correct definition, in English, was placed on the reverse side of the card (Figure 2).

Game play

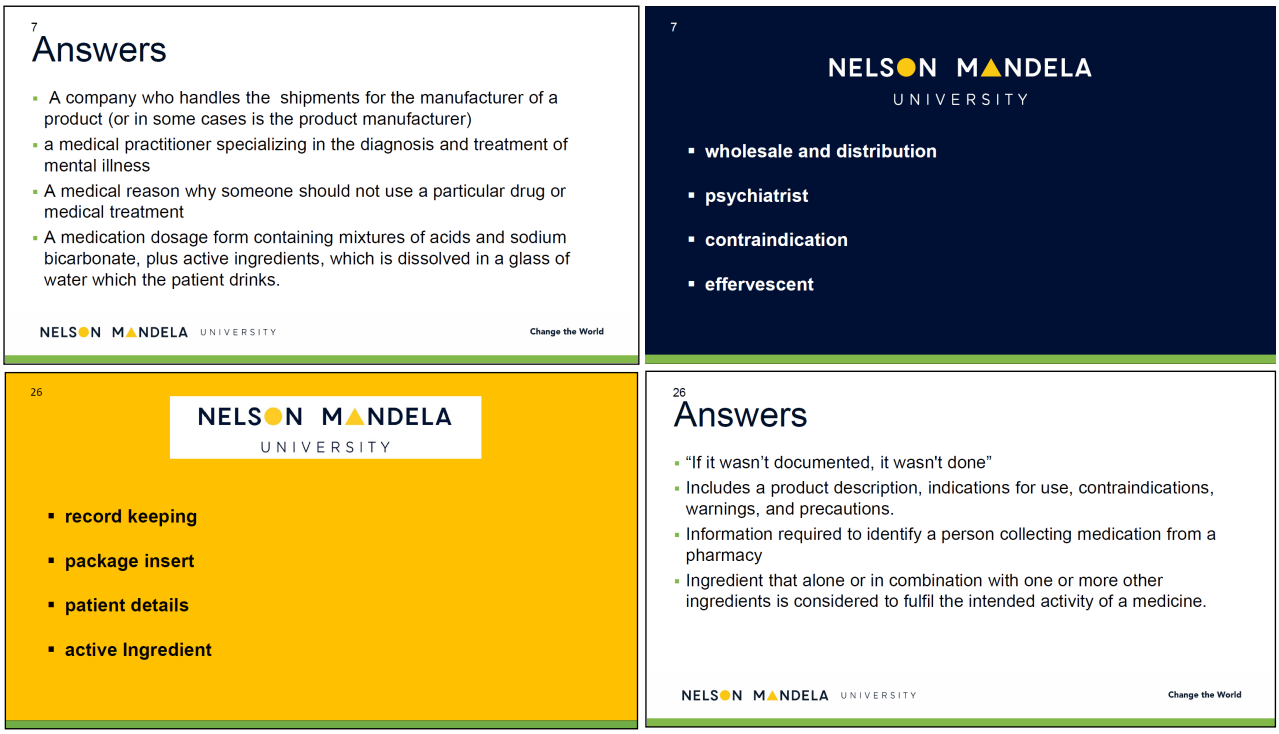
The game was designed to play with a minimum of two teams with two players in each team. For each turn, one player in the team is the 'Describer' and the other player is the 'Guesser'. At the teams next turn, they switch roles. At the start of the turn, the timer is turned over. The 'Describer removes a card from the container with the corresponding colour to where the token is on the board. They begin describing the term but may not use the term itself or any derivative of the term in their description. The opposing team keeps watch over the timer and announces the end of the turn when the timer runs out. The number of correct answers per card within time limit determines the number of squares that the team's token can be moved forward on the game board. During the turn, the 'Describer' could turn the card over and use the definition provided on the back of the card to assist in the description. At the end of the turn, the groups used the definition on the back of the card to discuss their understanding of the term and why they possibly had the term incorrect. The game continued until the last block on the board was reached. The winning team was the first team to reach the end and was rewarded with a small token.

Evaluation

During the implementation of the game in the classroom setting, a number of observations were made.

At the outset of the implementation of the game there was an element of apprehension in some of the students of trying something new. This was offset by the curiosity of what this new technique would bring to the classroom. Once the students had divided themselves into teams, the

Figure 2: Example of game cards for learning terminology in pharmacy practice



rules were explained and game play started. From the beginning to the end of the game there was activity, noise, a willingness to participate and a general enthusiasm amongst the students. This is consistent with findings by studies which indicated that learners remained actively engaged for an extended period of time and had positive emotions when playing games compared with traditional lecturing (Grimley *et al*., 2011; Lee & Hammer, 2011 Hamari *et al*., 2014).

Many of the students come from backgrounds where board games were not part of their upbringing. They were unfamiliar with the platform or concept of what constitutes a board game. On observation, it was noted that some learners were not playing the game correctly. When questioned, the learners identified that they were aware of the objectives of the game but they were confused as to how to play the game. After an individual consultation and a practise round with the presenter present, the students overcame their confusion and were able to continue with the game unaided. This is not much different from the so called 'digital divide' where learners from different genders, races and socio-economic statuses experience game play differently (Andrews, 2008). It is expected that because of our differences, we will experience and use games differently.

For this particular game which focused on building pharmacy practice terminology, it was noted that some students switched to explaining terms in their home language. At first this seemed to be defeating the point of the game, but after consulting with the literature, it was decided that this should be encouraged. Language is learnt first by learning vocabulary and then comprehension. If a learner could first understand the terminology, they could then learn to comprehend what they were reading in the course material. The literature has varying opinions of the use of home language (L1) in learning the target language (L2). In some cases, the literature suggests that learners use their knowledge of L1 language to develop L2 (Cook, 2001). They tend to think in L1 while formulating a response in L2 (Ellis, 2005). Some arguments are against the use of L1 in learning L2 and believe that the reduced exposure of L2 has a negative impact on the students learning the target language (Turnbull & Arnett, 2002). In a large classroom context the use of L1 or L2 is difficult to control and therefore for the purposes of this game, explaining the term in a student's home language was encouraged, however, the 'guesser' still had to use the correct English term to score the point and move forward (Nation, 2003). This could only be implemented if all four players in a game group spoke the same language. If there was a player whose language differed from other players, the game was played in English. The most commonly spoken L1 language in this class group was isiXhosa.

Another observation was that students were not explaining the concepts or terms on the cards using the scientific or academic definitions. They would describe an actual word rather than the concept behind the term. For example, the term 'workflow' was defined as 'planned and repeatable pattern of activity enabled by the systematic organisation of resources into processes that transform materials, provide services, or process information'. Students would split the term into two parts and define the word 'work' for example by saying: "something you do to earn money", followed by the word "flow" as "something a river does when making its way into the sea". The explanation has nothing to do with the concept and therefore defeated the object of the game. The rule was then added that students need to use the academic or scientific definition when explaining a term.

During game play, some teams introduced a variation to the rules. They determined that if the playing team were unable to guess the correct term, that the opportunity to guess to be passed to the opposing team, thus giving the opposing team an opportunity to score a bonus point or move forward in the case of this game. This is a variation that can be compared with point scoring in game design and was added to the rules of the game.

The cost of the game was US$4.50 per set and 15 sets were made. A comparable board game costs between UD$10 and UD$40 when purchasing from an online store. Thus the game is cost-effective and most of the resources used to develop and make the game were accessible through the University.

Recommendations

From this experience, a model for developing cost effective board games for educational purposes is suggested (Figure 3).

1. **PLAN:** Determine what the learning objectives should be. The primary aim of the board game should be determined prior to designing the game. The end point should be known so that the thread of the game throughout is working towards the final learning outcome.

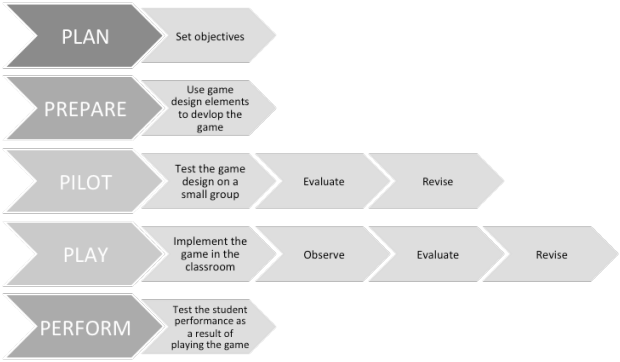
2. **PREPARE**: The design of the game can be new or adapted from an existing game. Regardless of what the game ends up looking like, it should contain game design elements, including but not limited to: point scoring; levelling up; leader boards; challenges and; badges (Urh *et al*., 2015). These elements are easily identifiable in online or video games, but may be more of a challenge in incorporating all elements into a board game.

3. **PILOT:** Pilot the game with a small group of learners. Revise the game with feedback from these learners. A small group session can be held after the game has been completed to gain insight into the practical working of the game and whether or not students think it will be accepted by their peers. They may also recommend improvements or changes to the game.

4. **PLAY:** Implement the game in the classroom setting by allowing a practise round before the competitive round starts, to ensure everyone understands the objectives of the game and how game play is meant to proceed. In addition, during the explanation of the rules, a short video could be viewed showing a group of students playing the game with a narrated explanation. Make observations and get feedback from learners. The presenter of the game should keep a note book with them and write down any observations made while learners are playing. These can be used to revise the game for the next time it is to be used. In addition, run a few small group sessions to gain insight into the learner's experiences of the game. Use the information from the observations and small group sessions to revise and refine the game.

5. **PERFORM:** Test the performance of students as an indicator of the effectiveness of the game in meeting its objectives. The next step for the game discussed in this article is to do a pre- and post-test and analyse the results. This will determine if the game has met its learning objectives.

Figure 3: Model for the development and implementation of educational board games



This article has demonstrated that using games in non-game contexts can be beneficial to learners and can be developed in a cost-effective manner. The motivation to develop the game discussed in this paper was to assist learners who struggle to master terminology of a subject, in health science qualifications, in particular when their home language is different to the language of instruction. This paper describes a creative low-cost board game which can motivate students to master the terminology in a subject area. On implementation of the game in a learning environment, a number of observations were made. As a result of the observations, a five step process in developing educational board games for the classroom was derived. The five step process is generic to any subject area and can be implemented regardless of the nature of the learning objective of the game.

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