

## **A low mobile data usage gamification scavenger hunt prototype for engineering students at an African university of technology**

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### ***Abstract***

*Sun Tzu's first rule of war, from the famous The Art of War, states: "Know your enemy." Not quite an enemy, but the target audience of the university is young students who would rather be spending their time doing something they enjoy than hitting the books. Free time is spent playing computer games instead of studying, reasons being that the rewards are intrinsic and immediate whereas the motivation for learning is not yet clearly felt. Gamification is the logical solution. Literature shows that gamification could be doomed to fail due to poor understanding of gamification design. The purpose of this paper is to design and investigate a prototype low data approach to a gamification scavenger hunt for engineering students. The prototype is piloted and evaluated using a small sample group. Results are discussed, and possible adjustments and recommendations made before it is rolled out to a large class environment.*

**Keywords:** gamification; scavenger hunt; e-Learning, engineering education

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## **1. Description of Teaching and Learning Context**

Literature shows a significant growth in gamification with a common definition “the use of game design elements in non-game contexts” (Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011; Limniou & Mansfield, 2018). Reasons for gamification in education, a non-game context, is based on Sun Tzu's first rule of war, from the famous *The Art of War*, namely; “Know Your Enemy” (Clavell & Tzu, 2013). Not quite an enemy, but the target audience of the university lecturer is students who would rather be spending their time doing something they enjoy than hitting the books. Many students use their free time gaming instead of studying, because the reward is intrinsic and immediate whereas the motivation for learning is not yet clearly felt (Erenli, 2012). One way of gamifying a lesson is a scavenger hunt through e-learning. e-Learning is defined as instruction delivered on a digital device that is intended to support learning (Sleator, 2010). However, the digital device needed utilises mobile data and in South Africa the cost of data is high.

## **2. Literature Review**

In nature learning happens playfully. Education copies these playful elements but abruptly halts it after elementary school (Erenli, 2012). But university students still spend their free time playing games with immediate reward versus delayed reward in class. In this digital and interconnected environment, they expect immediate results for efforts (Serrano Lara & Fajardo, 2017). Gamification addresses this positively (Albero & Ilbanes, 2018; Martinetti, Parada Puig, Oude Alink, Thalen, & Van Dongen, 2017). Designing and developing a gamification learning experience is difficult. A good understanding of game mechanics, that includes the type of game and the tool used for game play and player profiles is essential. Literature also indicates the importance of a test prototype (Morschheuser, Hamari, Werder, & Abe, 2017). Player profiles is also key and can be categorized into strivers, scholars, slayers and socialites (Bartel, Hagel, & Wolff, 2017; Robson, Plangger, Kietzmann, McCarthy, & Pitt, 2016). A scavenger hunt actively engages learning by solving questions, riddles or quizzes on a digital device that also has a GPS device. Locations can be given by GPS coordinates or QR codes (Erenli, 2012; Robson, Plangger, Kietzmann, McCarthy, & Pitt, 2016).

## **3. Findings**

The e-Learning prototype scavenger hunt sees the instructions for the game delivered as questions that must be answered on Blackboard which is the LMS used by the university. Figure 1 shows how three different question types were used to ask engineering specific questions.

Give the truth table for

$Y = (0, 2, 4, 15)$


A	B	C	D	Y
0	0	0	0	[a]
0	0	0	1	[c]
0	0	1	0	[e]
0	0	1	1	[g]
0	1	0	0	[i]
0	1	0	1	[k]
0	1	1	0	[m]
0	1	1	1	[o]
1	0	0	0	[q]
1	0	0	1	[s]
1	0	1	0	[u]
1	0	1	1	[w]
1	1	0	0	[y]
1	1	0	1	[1]
1	1	1	0	[3]
1	1	1	1	[5]

a


What gate is the same as this

(A and B) or (A and C)


A. A




B. B



C. C



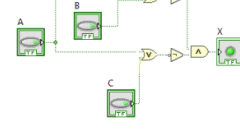
D. D



b

QUESTION 1

Finish the code for:



```

Library ieee;
Use ieee.std_logic_1164.all;
entity andgateluwes is
Port (A,B,C: in bit;
      X: out bit);
end andgateluwes;
architecture logicluwes of andgateluwes is
Begin
  X<=
end logicluwes

```

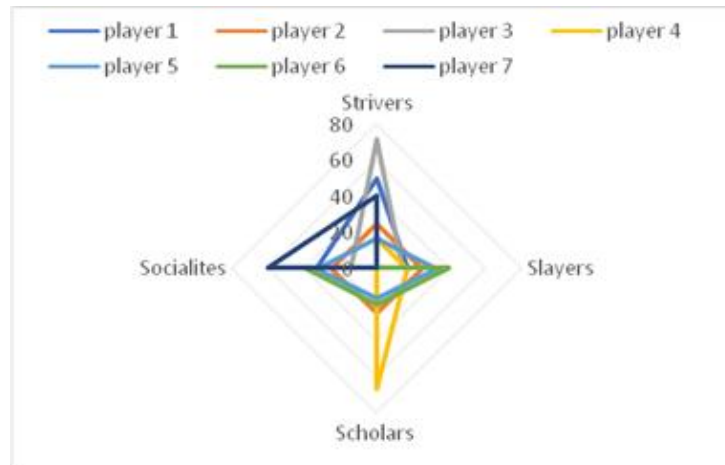
c

Figure 1. An engineering approach to utilizing the LMS test questions for a scavenger hunt; a, b and c show different ways of asking engineering questions – fill in multiple blanks, multiple choice and fill in the blank respectively.

The game sees a team divided into hunters and base station personnel. The base station personnel stay in a computer lab accessing the questions via Blackboard with access to reference material and online search engines. They stay in contact with the hunters via WhatsApp. When a question is solved correctly a map appears where x marks the spot. At the location, they receive a passcode.

After the game an exploratory study is done with descriptive statistics involving quantitative data analysis. An exploratory design usually involves only a single group of respondents (De Vos, Strydom, Fouche, & Delport, 2011; McNeill & Chapman, 2005). Quantitative analysis is important as it brings a methodical approach to the decision-making process, given that qualitative factors such as “gut feel” (Reddy, Higgins, & Wakefield, 2014). Figure 1 show that Blackboard tools have more functionality than just multiple choice.

Figure 2 illustrates the player profiles. Note that the players were very diverse in profile with ages of 19,20,22, 25 and the rest 24. 6 males and 1 female and the cultural diversity included Xhosa, English, Sesotho and Afrikaans. The fun rating as well as the playability was rated at 94%. The dynamics of the game was answered positively with emphasis on fun working in groups as well as the physical aspect thereof. They liked the out of classroom experience. They indicated the need for a prize even if it was just a cold drink on a hot day as well as a leader board with social media connection.



*Figure 2. Results of the personality profiles of sample players.*

Data usage utilizing the WhatsApp approach saw Team 1 using 911.9kb and Team 2 using 1.6 Mb. Teams sent messages, voice notes and pictures. The control was 12Mb use. Data cost in South Africa is about 0,063 Euro per Mb (Dudley, 2018). Thus 0,098 Euro for the team using the highest data verses the 0,75 Euro data control. For context the minimum wage in South Africa is 221,50 Euro per month – (Omarjee, 2019) with an unemployment rate of 26.7% (Masutha, 2018).

#### **4. Implications**

The purpose was a prototype design and evaluation of a low data usage electrical engineering gamification scavenger hunt. Observations show more competitive player profiles grouped themselves as the hunters and scholarly profiles stayed at the base station. This paper shows methods in the design and evaluation of an e-learning gamification scavenger hunt for varied players. If all player personality traits are engaged, the most efficient learning should take place.

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