Edutainment for Effective Teaching and Learning of Digital Natives

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Abstract: This paper studies an effort to enhance the teaching and learning of Digital Natives (ages below 36 years old or born after the year 1980). It explores the concept and current meaning of Edutainment with a focus on a game called QR IT Seek, developed with consideration of the specific characteristics of Digital Native learners who are the future workforce of a nation. The paper endeavors to respond to the demands of the Digital Natives who are distinctly different from the previous generations. The pressure exists for teaching and delivering concepts to the younger generation due to these characteristics. Hence, it is vital for educators of higher learning to develop innovative methods of teaching tertiary education materials and rediscover the concept and application of Edutainment. The need for this study and its findings is enhanced because without attention given to the specific needs of these students at institutions of higher education today, there would be significant impact on the achievement of learning outcomes and result in long term global consequences in this borderless world.

Keywords: edutainment, QR-Code, QR IT Seek competition, Digital Natives, pedagogy.

I. INTRODUCTION

Teaching and learning in higher education faces new challenges in the contemporary education environment. Education has become an integral part of the social and economic development of a country. Thus, the task of shaping this and future generations has become a pivotal role of educators. Several researchers suggest that if we aim to teach something to the next generations, we should think about aligning teaching methods with their needs and wants [1]. Studies have shown that there are identifiable characteristics and special needs of generations that influence how they learn, and suggest that in order to be effective, lecturers must adapt to and address the learning preferences of these students [2].

Entertainment seems to fill its long overdue seat in education [1]. The term 'edutainment' refers to the combination of education with entertainment features that are used in teaching, learning and delivery. Entertainment is meant to be the media while the content is the educational knowledge and or skills to be learned. The American Heritage Dictionary defines edutainment as the act of learning through a medium that both educates and entertains [1]. Edutainment is define as education that has been placed within the framework of entertainment.

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Besides that, edutainment also is describes as a hybrid genre that relies heavily on visual material, narrative and more informal, less didactic styles of address [10].

The purpose of edutainment is to attract and hold the attention of learners by engaging their emotions. Although the term gives reference to technology, many researches in the past have concluded that edutainment can exclude digital technology. Edutainment today takes a wider perspective and a broader meaning, not limited only to games playing [1]. Edutainment was conceptualized as the process of designing and executing a media message to educate and entertain, in order to increase audience knowledge on an educational issue. The message contribution from both the educational content and entertainment element of delivery is coupled with the individual contribution and response, resulting in an edutainment experience [1].

The cognitive, social and emotional needs and behaviors of the new generation vary from those of the previous generation of learners. They are observed to be more attached to technology, more exposed to diverse cultures and the borderless world. For this reason, it is important for the teaching faculty to acknowledge this shift and consider tailoring lessons to suit the learning behaviors of the Digital Natives (*ages below 36 years old or born after the year 1980*). Neglecting these changes could adversely affect the quality of knowledge received and graduates produced.

This research addresses the concept of edutainment, specifically in the form of a game called QR IT Seek. It aims to provide alternatives to teaching using revolutionary and creative forms, rendering variety as an accelerator to learning. A researcher put forward the notion that the teacher uses a 'telling' method, where the focus is on content and transmitting information with an often unreflective outcome. Hence, the quality of receptiveness or effectiveness of the delivery might affect the academic learning experience of the students. Compared to the traditional lecture setting, where the teachers talk and the students listen, interactive lecturing generally sets out to promote two-way teacher and student communication during the lecturing process [3].

II. BACKGROUND

A. Types of Edutainment

1) Youtube / Video / Movie / TV

The trend of education nowadays is for people to learn or gain knowledge via a variety of media, including YouTube, videos, TV shows and other media that can complement the text, lectures, and discussions. Self-learning and exploring through available media in the Internet is very convenient, as users can learn at any time and at anywhere.

Moreover, some such materials are more interactive and easier to understand. The role of media in using entertainment as a source of edutainment has been found to be helpful and able to attract people to explore and self-study with more interesting materials.

In this past year itself, academia and intellectual information or video has flourish on YouTube. In 2006, the Khan Academy, a non-profit educational organization, was created to provide a free, world-class education for anyone and to be used anywhere. The founder of the Khan Academy is Salman Khan, a popular Bollywood movie star. This academy posts videos on subjects for learning and has more than 7000 subscriptions on YouTube, in addition to a lot of other instructional information supplements on their website. They obtain a lot of sponsorship from Google, the Bill and Melinda Gates foundation, NETFLIX and other donors. In 2011, the number of videos doubled, most coming from independent sources or institutions of higher learning outside the USA.

Currently, there are many TVs shows, movies and films being adapted with education. There are some programs that are specifically developed to offer educational benefits to young viewers such as "Dora the explorer" that able to attract kids. There are many skills that are taught to young viewers, such as observation, mathematics, problem solving and others. Some of the films were adapted from novels or classic literature such as "Hikayat Hang Tuah", etc. As a pedagogical tool, films can be utilized in three ways to enhance classroom learning [4]:

- Films adaptations -- a tool for better comprehension;
- Films on education, and
- Education in films.

2) Field Trips / Museum Visit

A field trip or visit to a place outside the regular classroom is a common school activity these days. The most typical trips include visiting museums, historical buildings and other places that are suitable for education purposes. Generally the aims and objectives of the field trips are to [5]:

- Provide students with new experiences outside their everyday activities in school.
- To stimulate students' reasoning skills.
- Allow teachers to explain concepts, skills and knowledge in the real world environment and expand on topics that are difficult to cover during a normal class period (e.g. observe the process of making chocolates in a factory, etc.). For a more meaningful, memorable and effective learning as the students are involved in the real world experience.

3) Computer Games

Most students of the recent generation are prone to play games on their mobile devices. Some students have an adverse interest in formal learning methods such as in the class room. They easily lose focus during the class sessions. The new technology, through educational games, makes learning activities more interesting and effective for them. There are many educational games available in the market, such as [6]:

- **Chemikul**: Is an online Science/Chemistry-based game that will send the students on an atomic mind-bender of confusion and provide endless hours of enjoyment. The goal is to create molecules using all of the atoms floating all over the game screen. Six different atoms have different amounts of 'Valence' (combining power), ranging from 1 to 6 in strength. The student wins the game by using up the Valence of each atom.
- **Game Corp**: Is a highly interactive and entertaining business management simulation game for older kids, high school and college students, and grownups who enjoy online games that involve business themes and thinking strategy. In this game, the students have to set up their own computer game development company through activities which help them practice and test essential real-life business skills, such as money management, project management, decision making and strategy planning, and the ability to successfully motivate employees.

Game-based learning is becoming increasingly popular due to several benefits such as [6][7]:

- Allows participants to experience novelty, curiosity and challenges that may stimulate learning;
- Can be used when examining individual characteristics, such as self-esteem, self-concept, goal-setting and individual differences;
- Fun and stimulating for participants, hence able to provide an innovative way of learning;
- Can provide elements of interactivity that may stimulate learning;
- May help in the development of transferable IT skills;
- Videogames equip children with state-of-the art technology. This may help overcome technophobia (a condition well-known among many adults) and over time, may also help eliminate gender imbalance in IT use (as males tend to be more avid IT users).

4) Treasure Hunt / QR IT Seek

QR IT Seek is becoming an annual event in Asia Pacific University of Technology & Innovation (APU). In this fun and simple competition, students need to use their mobile devices to continue learning outside of lesson time. A series of 20 codes are hidden in random locations around the APU main campus. Students work in small groups of 2 members, equipped with a mobile device (e.g. phone, iPod Touch) that is able to decode the QR codes. An internet connection is not required as the QR codes decode as text files [8]. Each code, when scanned by the mobile device, will turn into a quiz question relating to the study topic. Some of these test existing knowledge while others require further research to obtain the answer [8].

The observation made after successfully implementing the QR IT Seek Competition several times is that such a competition helps the lecturers and students in the following ways [8]:

Lecturer:

- Innovate ways that make the learning process more interesting and effective in educating students;
- Encourage team building amongst the staff.
- Idea generation for other department to conduct more fun and exciting academic-related activities;

- Combine the power of people and technology to improve the way people learn and work;
- Support the learning programs or modules in different way of learning, in terms of structure, assessment and content.

Student:

- Develop a range of necessary skills that can be applied in their career, academia, etc.;
- Use mobile devices for an exciting education-oriented purpose;
- Improve skills in cognitive, affective, psychomotor and social domains;
- Develop collaborative and experiential learning;
- Stimulate problem solving capabilities;
- Keep abreast with the latest technologies;
- Make learning a multi-sensory experience as students learn best when all their senses are engaged - this will make the learning process more exciting and memorable.

B. Types of QR Codes

1) Static QR Codes

Static QR codes are not flexible as they point to a certain fixed address. Reprinting of new QR Codes are required if the owner changes the destination of the QR code links.

2) Dynamic QR Codes

A dynamic QR code provides the ability to change the address to which the QR code redirects. The advantages of using dynamic QR Codes include:

- Allows the owner to change the URL destinations;
- Is more environmentally friendly as no printing of new QR codes is required when owner changes the URL;
- Provides the owner information on how many times the QR code has been scanned;
- Allows multiple URLs - a single QR code could be linked to different URLs, allowing the user to be redirected to the applications or pages in different languages.

III. METHODOLOGY

A. Description of the QR IT Seek Game

In the game, the students had to go around various parts of the campus to locate clues and solve questions related to their field of study (most questions dealt with first year computing syllabi). To enhance the edutainment experience, the QR IT Seek Game presents each question to the participants in three stages, solving each to move on to the next:

- Stage 1: the participants had to first find the clues for the location of the QR codes;
- Stage 2: use the clues to locate the QR codes;
- Stage 3: once the QR code was located, scan the QR codes to get the question.

B. Data Collection

All the answers to the questions had to be recorded in a provided answer booklet, which was submitted and marked at the end of the competition. The participants were given 2 hours to answer all the questions during the competition.

Additionally, data was collected to measure the success of the developed edutainment game via online questionnaires filled by the respondents after they had completed the game and submitted their answer booklet. The questionnaires were embedded into the QR code, hence the respondents had to scan the QR codes and submit the feedback online. Overall, there were 14 questions: 12 were close-ended questions while the other 2 were open-ended questions on opinions and suggestions to improve the edutainment activity.

IV. ANALYSIS

As a case study, the third round of the QR IT Seek competition held in 2015 will be used here for the analysis. It was held at the Asia Pacific University of Technology & Innovation (APU) main campus in Kuala Lumpur, Malaysia. There were 99 groups of APU students registered for this competition, with each group consisting of 2 members.

A. Overall Edutainment Activity Feedback

1) Category of Participants

Figure 1 provides the breakdown analysis of participant categories for the QR IT Seek Competition 2015. Based on online feedback, the majority of the participants were undergraduate degree students from levels (years) 1 and 2, as well diploma level 1 students. This may be due to the lighter course workload for the lower level students as compared to those in the higher levels; as well as the greater interest of the younger students in exploring such game activities.

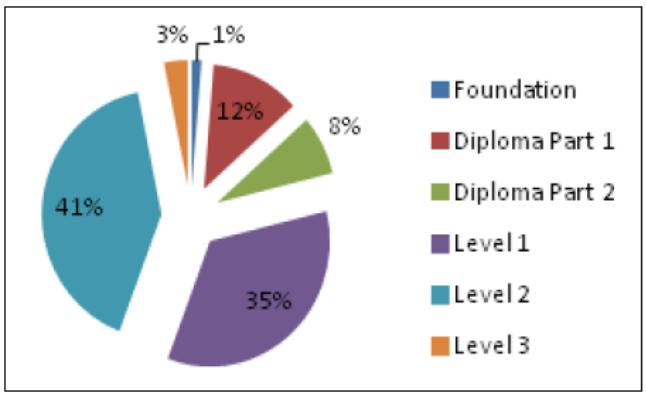

Figure 1. Categories of Respondents

2) Reasons for Participation

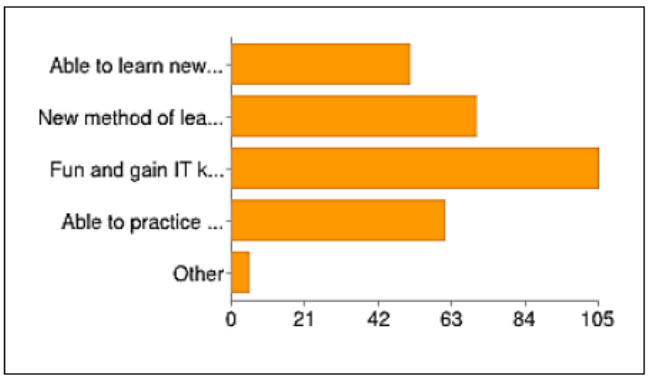

Figure 2. Experiences Gained in Joining the Competition

Figure 2 shows the analysis of the experiences gained by the participants of the QR IT Seek Competition. 32.1% learned a new technology,

44% found the competition to be a new method of learning, while 38.4% responded that they were able to practice understanding of the IT terms learned in class. The majority of the participants found the QR IT Seek Competition to be fun and at the same time provided the opportunity to gain IT knowledge. Some other experiences given included new method to organize a game, good way to learn about technology, tiring, clues and hints given quite hard, difficult to scan the QR Code hence need to improve the quality of the QR Code printing and experience in get to know more friends from different schools.

3) Prior Edutainment Experiences

Figure 3 shows the statistics on the participants' experiences gained by either participating in or heard about similar edutainment activities implemented at other universities. Only 37% responded that they heard or had such experience with edutainment in other universities in Malaysia, while 32% answered that they were unsure and 31% had no prior edutainment experience. This showed that very few universities in Malaysia have embarked on implementing edutainment activities in their educational delivery.

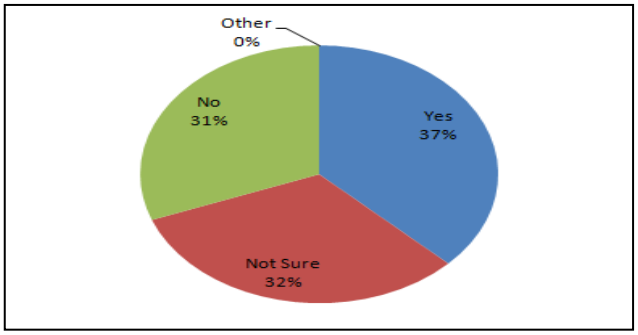

Figure 3. Edutainment Experiences in Other Universities

4) Interest in Edutainment

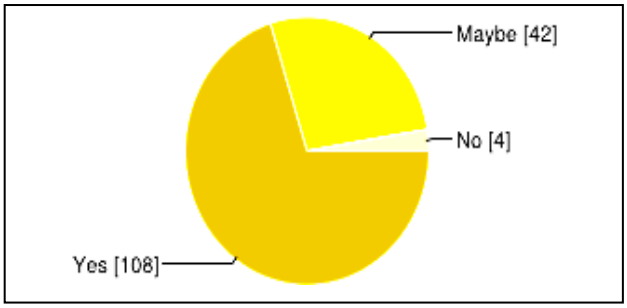

Figure 4. Participants' Interest in Edutainment

Figure 4 provides the statistics on participants' interest in joining the QR IT Seek Competition. 67.9% responded that this kind of edutainment was interesting, while 26.4% were not sure if they were interested with this kind of activity, hence neutral. Only 2.5% disliked the activity. This clearly showed that only a minority of participants found it difficult to accept didactic games as a new method of learning. Didactic games are normally used as a review tool for practicing knowledge and skills, and can sometimes be used to motivate students [9].

5) Difficulty Level

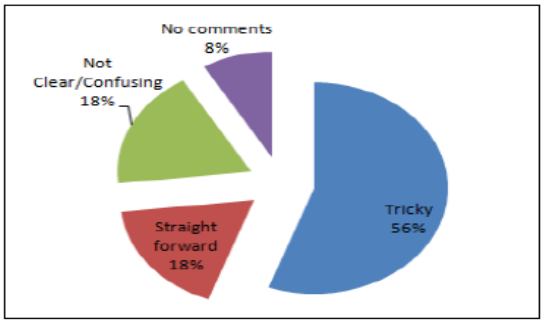

Figure 5. Quiz Questions Feedback

In relation to the difficulty level of the quiz questions, the feedback by the participants is summarized in Figure 5. 56% of respondents felt that the questions were 'tricky', while 18% said that the questions were not clear or confusing. Another 18% of the participants responded that the questions were straightforward, with the remaining 8% choosing not to comment on this aspect. It is felt that the latter may be due to the fact that respondents found that the questions were at the suitable level and hence did not require feedback. The level of difficulty would need to be looked into in future, but 'tricky' is often a necessity for a good game, thus, only minor fine-tuning may be required.

6) Activity Duration

Figure 6 provides the feedback relating to the best duration of time to be allocated for the QR IT Seek Competition. The majority of respondents (56%) voted to allocate 2 hours for QR IT Seek Competition while 26% wanted to have longer hours (within 2 to 3 hours). Only 13% wanted 1 hour edutainment activities, while 5% of respondents recommened that the time allocated for this kind of edutainment should be less than 1 hour. As such, the competition duration was found to be optimal, which reflects the hands-on / practical nature of the activities.

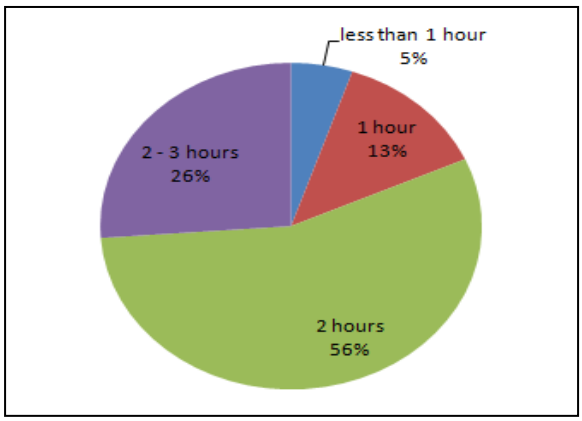

Figure 6. The Best Duration for Edutainment Activities

7) Recommendations

From the questionnaire, some feedbacks for improvement were suggested by the participants. These included:

- To make QR IT Seek an annual event;
- Improve the connection to QR IT WiFi;
- Introduce more tricky and difficult questions;
- Expand the hunting (physical game exploration) area;
- Allow more members per group;
- Identify more challenging spots and clues;

- Accept answers online;
- Improve code readability.

The suggestions received reflect enthusiasm for such future activities. These would be used to enhance and enrich them.

B. Performance in Domain-based Quiz Questions

1) Performance by Category

There were 20 questions prepared for the QR IT Seek Competition from the information technology (IT) and critical thinking domains, based on 3 categories: General IT (10 questions), Programming Concepts (6 questions) and intelligence quotient (IQ) related questions (4 questions). Of the 99 groups, only 26 groups were able to answer at least 10 out of the 20 questions correctly, while the remaining 73 groups answered less than 10 questions correctly. As such, for the purposes of this paper, only the 26 groups with at least 10 correct answers are taken as the sample for further analysis.

From the results tabulated in Table 1, it is observed that 30% of the participants were able to answer the General IT questions correctly, 15% of them answered the Programming Concepts questions correctly, and only 13% of the participants in the 26 groups were able to answer the IQ and brainteaser questions correctly.

Table 1.Categories of Questions

Categories of Questions		No. of Groups that answered correctly	Overall %
General IT	Q1	24	30%
	Q5	9	
	Q12	18	
	Q14	20	
	Q6	10	
	Q11	18	
	Q13	13	
	Q15	7	
	Q9	24	
	Q10	13	
	Total	**156**	
Programming Concepts	Q2	1	15%
	Q3	21	
	Q4	15	
	Q7	24	
	Q16	18	
	Total	**79**	
IQ	Q8	26	13%
	Q18	22	
	Q19	16	
	Q20	3	
	Total	**67**	

Knowledge for the first and second categories above are covered is the contemporary syllabus at the diploma and undergraduate studies level in modules such as Computer Technology (CT), Information System (IS) and Computing & IT in the Work Place (CITW). These or similar modules would have been taken by all the students participating in the competition. However, more than 40% of the participants were unable to answer the questions correctly. This may be due to factors such as:

- Participants failed to obtain the correct clues;
- The questions were 'tricky' (i.e. indirect questions that required critical and out-of-the box thinking);
- Insufficient time;
- Insufficient knowledge;
- Lack of preparation.

The factors above are supported by the analysis of the participants' feedback on the quiz questions, as was discussed in Figure 5. The majority of the participants responded that the questions were tricky, which in turn requires time to think about the answers, hence resulting in the perception of insufficient time to answer all the questions. Many of the erroneous answers were actually due to the lack of knowledge and preparation. Preparation here refers to reading up on IT related information in books, the Internet and other references, before participating in the competition.

Time limitation is not a strong reason for not answering the questions correctly, as based on respondents' feedback shown in Figure 6, the majority of respondents agreed that 2 hours would be the best amount time to be allocated for this kind of edutainment activity. An hour or less would have been too short for the participants to identify the correct answers and the very short period of time would have caused undue stress, hence the participants would not have really enjoyed the activity. Two hours is just nice for this kind of edutainment as longer periods would have tired the participants and possibly led to the initial stages of boredom. From the data gathered and consequent analysis, it is found that the maximum number of questions answered correctly by the participants within 2 hours was only 14 questions. This could be set as the benchmark in similar future activities.

2) Recommended Domains

From the online survey conducted, 35% of respondents recommended that this kind of edutainment be implemented to other subjects/courses/modules in the teaching and learning of IT. Several subjects suggested by the participants for this purpose included Network Security (NWS), Creativity and Innovation (CRI), Switching Technology (SWIT), System and Network Administration (SNA), Information System Security (ISS), Software Engineering (SE), PITS, Artificial Intelligence (AI), Computer System Architecture (CSA), Professional and Enterprise Development (PDT), System Development Methods (SDM), E-commerce, Mobile Technology (MT), Computer Forensics (CF), etc.

This shows that the Digital Natives viewed that their learning would be improved in many subjects through this kind of edutainment that make the class activity more interesting and interactive. However, 29% of respondents did not agree with the implementation of this kind of edutainment in education. This is due to the preference of some students with the conventional classroom learning method that would be more serious and formal. Of the remaining respondents, 35% did not comment, while 1 % answered 'maybe'.

C. School vs University Students' Feedback

In addition to the testing with university students, an edition of the QR IT Seek was also conducted with secondary school students. A total of 14 schools in the state of Selangor, Malaysia participated in the competition, namely, SMK Bandar Sungai Buaya, Asia Pacific Smart School, SMK Dato' Ahmad Razali, SMK TTDI Jaya, SMK Sultan Salahuddin Abdul Aziz Shah, SMK Danau Kota, Chong Hwa Independent High School, SMJK Yu Hua, SMK Bandar Utama Damansara 4, SMK Bandar Baru Bangi, SMK (P) Methodist KL, SMK La Salle PJ, SMK Bandar Sunway, and SMK (L) Methodist. This was a good sampling of secondary schools as it covered government and private schools using different curriculums (Malaysian and international GCSE), taught in various main medium of instruction (English, Malay, Chinese) and of various standing in terms of achievement in major examinations. Most of the students who participated were within the ages of 16 to 17 years old.

In order to compare the learning and acceptance attitudes of these two groups of Digital Natives, specifically the university students and the secondary school students, towards edutainment activities, further feedback was obtained. The criteria and results obtained are tabulated in Table 2 below.

Table 2.School and University Students Feedback

Criteria	Response	School	University
Response to QR Code game organized by APU	Interesting	98%	70%
	Neutral	2%	27%
	Not Interesting	0%	3%
Develop IT Knowledge faster	Strongly Agree	31%	32%
	Agree	63%	59%
	Not Agree	6%	9%
Experience gained from QR Code Game	Learn new technology	11%	34%
	New Method of learning	35%	45%
	Fun and gain IT Knowledge	70%	67%
	Others	7%	3%
Experience using QR codes before joining the game	Yes	59%	65%
	No	41%	35%
Interest in joining edutainment games in future	Yes	89%	70%
	Maybe	11%	27%
	No	0%	3%

Based on the feedback, the majority of the participants (98% of the school students and 70% of the university students) responded that the QR code game was interesting. There was a 28% discrepancy between both groups in regards to school students preferring edutainment as compared to university students. This may be due to the more mature university students being more accustomed to a formal way of study. This conclusion is further supported by the minority of the university students (3%) responding that the edutainment activity was not interesting.

Further, the knowledge that the respondents gained during the QR IT Seek competition was evaluated. 31% of the school students and 32% of the university students strongly agreed that edutainment is able to develop their IT knowledge faster. A high percentage of respondents from the schools (63%) and university (59%) agree that edutainment helps to develop IT knowledge faster, and one of the easy and interesting ways to gain knowledge. A minority of the students disagreed that edutainment unable to help the students to easily gain knowledge where only 6% from school students and 9% from university students.

The analysis conducted also tries to identify the experiences gained by the respondents during the edutainment game. Based on the data collected, it was found that 11% of the school students and 34% of the university students responded that this kind of edutainment exposes them to learn new technologies. The game enables introduction of new technologies that can be implemented for education purposes outside the classroom. This is to show the students that education is not limited to the classroom and that there are many other methods of learning that could be implemented at the schools and university, such as computer games, treasure hunts and education trips. The respondents (35% of the school students and 45% of the university students) claimed that the QR IT Seek Competition had introduced them to new method of learning. Almost the same percentage of participants from the school schools (70%) and university (67%) responded that this edutainment activity was fun and enabled the students to grasp the IT knowledge faster compared to the formal class that sometimes made them very bored. A small percentage of participants also gained other additional experiences, such as meeting new friends via the game. More than 50% of the participants had prior experience using QR codes before joining the game, hence the briefing on the edutainment games was easier and faster. The majority of them were interested to join this kind of edutainment games in future.

From the results above, it is clear that both sets of Digital Natives are keen on the use of edutainment in teaching and learning. The younger group (i.e. school students), however, were slightly more receptive to the activity than the more mature ones.

V. CONCLUSION

Based on the analysis of the feedbacks gathered from the school and university students who participated in QR IT Seek Competition, the researchers of this work found that both categories of students had strong acceptance towards edutainment as an effective method of leaning. Since the scope of this study was focused on IT related knowledge, it may be concluded that IT related subjects are suitable for edutainment. The students gained IT knowledge as well as experience with the current technology (i.e. QR codes and scanner / mobile phone). More edutainment activities can be included in daily teaching to make the teaching environment more fun and challenging, trends expected by the Digital Native nowadays. Activities during tutorials can be enhanced into gaming activities that is

related to the subjects such as reverse engineering or capture the flag that is suitable for security and forensic students at higher education. Capture the flag competition able to enhance the technical skills of using security or forensic tools that only can be gained through experience. Indirectly, edutainment not only delivers knowledge to the students, but also skills that will help make the students more creative and able to think out of the box in solving problems.

The set of questions given to the students during the edutainment activity were divided into 3 categories, namely, general IT, programming concepts and IQ. It was found that most of the participants were able to answer the general IT questions as compared to the programming concept and IQ questions.

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