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QR IT Seek: A Conceptual Model for Teaching and Learning by Digital Natives via Edutainment Game

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Abstract: ***The goal of teaching and learning activities is to for the target recipient to achieve the learning outcomes. As the Digital Natives generation is being brought up in a much more sophisticated technologically advanced world, the aptitude and requirements in their studies have changed. More interactive and fun learning, out of the classroom setting, is desired. This paper proposes a conceptual framework for edutainment and reports on a primary study on a developed QR IT Seek game. The primary study, results and analysis would aid in further improvements and adaptation of such activities to improve the teaching and learning performance of the Digital Natives.***

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

I. INTRODUCTION

The Digital Natives are exposed to a very different environment as compared to those from the earlier generations. They are inundated with technological advancement from a very young age, and are very reliant on technology in their everyday lives. Consequently, this has affected the way they learn and gain knowledge, leading to an increasingly common problem faced in the classroom – the traditional teaching and learning techniques are ineffective for this generation. Effort needs to be taken into creating and adapting teaching and learning strategies to suit the needs of the Digital Natives, in order maximize achievement of the desired learning outcomes. One such technique is via interactive games as a tool to make learning a more fun and immersive experience, as compared to the formal and more passive classroom approach. Edutainment, i.e. educational entertainment, allows the use of any form of entertainment approach towards achieving the educational objectives. Edutainment does not necessarily require the use of modern technology, as even card systems, board games, dice, processes, fun penalties, etc. used in order to make learning interesting, may be considered as edutainment. Ideally, however, the Digital Natives would prefer edutainment that incorporate the use of modern technology.

This paper proposes a conceptual view of the use of edutainment, Specifically, the conceptual framework of an innovative game called QR IT Seek that was developed at the Asia Pacific University of Technology and Innovation (APU), Malaysia. The framework processes and primary study is reported and analyzed in order to improve such delivery in future as a recommended activity in teaching and learning in information technology (IT) and other fields. The study takes into account the learning objectives targeted at the focus group, i.e. the Digital Natives, the generation that is currently at both the university and secondary school levels.

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II. BACKGROUND

Edutainment can be divided into several categories. These are described below [5]:

A. Edutainment on Television.

On television there are educational programs for all age groups: for preschool children (e.g. animated series such as Dora the Explorer), primary and secondary students (e.g. educational TV, values-based stories such as Aqil Story), and adults (e.g. legends and historical documentaries such as Hang Tuah, Bukit Kepong). Table 1 lists some examples of edutainment on television in Malaysia.

B. Computer Edutainment / Edutainment on the Internet.

Nowadays, computers are widely used in education and research. Hence, computers play the important roles of both tools and targets. These different roles of computers are referred to with expressions such as Computer-Based Education (CBE) or Computer-Based Learning (CBL). Online education is another type of teaching and learning systems that Web-based systems are part of. Table 2 shows some examples of educational games that are available.

C. QR codes usage in education.

Quick Response (QR) code is a quick, scan-able barcode-like image that links to a specific digital destination. With safe and specific structures, mobile learning tools can harness the excitement of technology with the purpose of effective instruction. QR codes can be used in education in several ways such as [6]:

- Make Learning stations

Stick the QR codes in different areas of the classroom that will take students to different online activities, videos or content.

- Show Exemplars

Create QR code for linking students to examples of quality work, referencing format, etc.

- Check Answers and Reflect

Enable students to check their answers by scanning the QR code after completing a test or assignment.

- Create Interactive Labs or Dissections
  Codes attached to a skeleton model can take students to important instructions or content.

Table1. Types of Edutainment on Television in Malaysia

Type	Example	Learner	Remarks
Animated Series	Dora The Explorer	Children	An animated series. The show plays out almost like a computer adventure showing a mouse on different scenes where the kids make a decision, learn counting etc.
Historical Movie	Bukit Kepong	Adults	A patriotic film where the police and Malaysian unite to against the communist
Education TV	Various subjects such as science, maths, language, etc	Primary and secondary students	Education TV is owned, produced and operated by the Educational Technology Division of the Ministry of Education, Malaysia and shows various programs for various school subjects
Literature Movie	Hang Tuah	Adults	Stories of Hang Tuah and his four sworn brothers, Hang Jebat, Hang Kasturi, Hang Lekir and Hang Lekiu, who pledged to protect the Sultan of Malacca
Religious Animated Series	Aqil Story	Children	An animated series that teaches the children to be good Muslims

Table 2. Educational online games

Online Resource	Learner	Remarks
http://www.education.com/games/	Children from ages 3 to 8	The Brainzy learning program is designed to help early learners build math and reading skills in a way that's fun and effective
http://www.babloo.com/	Children	Includes mini games, puzzles, quizzes, tales and rhymes, and often have cartoon-like colorful appearance. The main goal of the site is to offer learners "activating tools" for learning, such as playing games, doing crosswords and developing specific skills. These sites often have their own subsections for different age groups
http://www.learn4good.com/games/simulation/doctor-hospital-games-for-kids.htm	Children	Is an educational online activity, especially for children who dream of becoming doctors, nurses or other medical professionals
http://www.learn4good.com/games/online/projectmanagement.htm	All Ages	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
http://www.learn4good.com/games/high-school-students-games/critical-thinking-activity.htm	All Ages	Brain-teasing puzzle game for all ages that helps develop logical and analytical thinking skills. It requires the user to solve puzzles or riddles, earn trophies, challenges and develops problem solving skills.

III. CONCEPTUAL FRAMEWORK FOR QR CODE IT SEEK COMPETITION: DELIVERING FUN LEARNING WHILE GAINING IT KNOWLEDGE

The developed QR IT Seek is an example concept of one of the types of edutainment for higher education. This approach aims to deliver a fun way of learning Information Technology (IT). Pilot studies conducted at APU support that students found the approach to be an effective learning method, both at the tertiary and secondary school levels.

The QR IT Seek is a mobile application that uses QR code technology, which embraces learning through mobile devices and takes learning to a different level. According to another research in [1], mobile learning or m-learning brings forth a new perspective and advantage for teachers to conduct their lesson anytime and anywhere. Further, adopting elements of playful interaction in m-learning applications may create a fun, enjoyable and effective learning experience. Therefore, the study believes that by adding the element of fun, a mobile learning application such QR Code IT Seek would be able to make the learning experience more enjoyable, encouraging and engaging for the student.

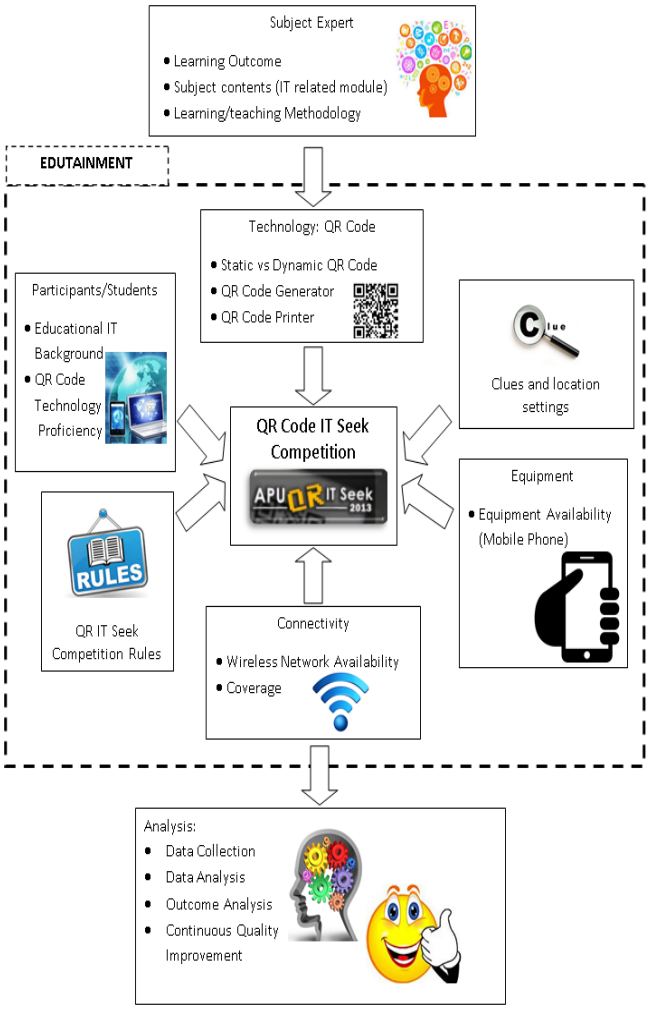

Figure 1: Conceptual Framework of QR Code IT Seek Edutainment Competition.

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The conceptual framework for the edutainment proposed in this study is shown in Figure 1. The framework outlines the concept and idea on how to form a game-based learning application called QR IT Seek This particular application is not limited for use in IT subjects, but may also be extended to a variety of other subjects as well. The requirements for the QR IT Seek edutainment activity are divided into several components and sub-components, as described below.

A. Subject Matter Expert

Lecturers / instructors identify which IT related module(s) is/are suitable or needed for this competition. The selection of module(s) for this competition may be based on the impact, importance and hands-on benefit of the module itself. The subject content needs to clearly identified, so that it would align with the desired learning outcome of the selected module and the edutainment activity. The teaching and learning method to be applied is determined. In this case, as the QR IT Seek Competition edutainment approach has been selected, the necessary tasks in preparing the questions, clues, generating the QR codes, identification of locations, etc. have to be undertaken. The components needed for the QR IT Seek Competition are detailed in the next sub-Section.

B. Edutainment Components

There are six edutainment components for the QR IT Seek Competition, as given below:

i. Technology: QR Code

The QR code was invented by the DENSO Corporation in 1994 for commercial tracking, logistic, inventory control and advertising [2]. In education, QR code technology is considered a "new approach". It was first used by instructors in their slide presentations with the purpose of redirecting to a website where other supplementary materials could be found. There is a growing number of researchers on QR code in education, some funded by prestigious universities. Some see the potential in using QR codes to direct students to RSS feeds or lecture podcasts. As for physical learning spaces, QR codes can be used as effective repositories of data in problem-solving activities, which involve role-play or alternate reality games (ARGs) [3]. In APU, for instance, the QR IT Seek Competition pilot study used QR codes to hide clues in the unfolding game.

In general, a QR code is divided into two (2) types: Static and Dynamic. Table 3 briefly describes the differences between these two [7]-[9].

Table 3: Static vs. Dynamic QR Code

Feature	Static QR Code	Dynamic QR Code
Link	Link will always go to its primary destination only	Also known as a "simple" and a "live QR code" that can allow links to multiple destinations
Destination Address	There is no secondary or short URL involved, so the destination cannot be changed. The address is usually fixed	The primary destination URL can be edited while the QR code pattern itself remains unchanged
URL destination	Changing the destination requires generating an entirely new QR code	The URL can be edited at any time without the pattern changing. There is no need to reprint the code, just edit the primary destination URL
Editable	Cannot be edited	Able to change the target URL of the QR Code after publishing
Trackable	Cannot be tracked	Able to track from where, when and whom the code has been scanned
Fee	More widely available in the free segment as it does not impose any technological requirements	Normally fees are charged due to high demands on the servers through which they are processed

As for the QR code generator, there is a variety of options to generate QR codes based on preference. One of the many code generators online could be used, e.g. Denso Ware Incorporated provides a free online platform (http://www.qr-code-generator.com/) to generate QR codes and users have the option to select either static or dynamic codes.

ii. Equipment

The most important equipment for this edutainment activity is the mobile device. In the case of the QR IT Seek, participants have the option to use any mobile device as long as it is able to read and translate the QR codes. This may be implemented by installing a readily available free QR reader, such as ScanLife or QR Code Reader applications available on App Store and Google Play. The target is to minimize the equipment requirements such that it would be readily available, as in this case where the majority of the students these days (i.e. the Digital Natives) own a compatible mobile phone.

The QR code would need to be visible for it to be scanned by the participants in the activity. The QR codes may be displayed digitally or hardcopies could be put up at the various locations. Just like the traditional bar code, the typical QR Code is usually in black and white, although color versions are available, thus labels can easily be printed using a good quality laser printer (e.g. an Epson LW-600P Portable Label Printer was used in the pilot study).

If the QR code reader on the mobile device is unable to clearly detect the code, it could be due to some similarity between the code and the background color, hence greater contrast may be needed to be able to read and translate the content of the QR code. Hardware (and software) problems of the mobile device camera or application are not discussed here as it is out of the scope of this work and a replacement mobile device would have to be made readily available. Current technology also allows for the designing and sending of the print job to the printer to be done from the mobile device itself, (e.g. smartphone or tablet) via smart printing and connecter, which allows wireless printing from iOS and Android devices using Bluetooth.

iii. Connectivity

In order to run the competition smoothly, all other supporting facilities need to be in place. In the case of the QR IT Seek, the competition requires the participants (students) to look up information from the Internet. Good wireless network connectivity is required.

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This is ensured by special arrangement with the network support unit of the university to dedicate a specified bandwidth for the use of the competition at the chosen location throughout the duration of the competition. Where necessary, connectivity may be supplemented via broadband data plans as well as access point boosters, if the need arises, especially for very wide locations.

iv. Clues and Location Setting

The type of clues and their locations are important aspect of the edutainment, as they ultimately determine the main contribution towards the fun experience. Much thought needs to go into designing the clues, choosing the right wording and targeting the difficulty at the correct level so as to generate interest and excitement, providing sufficient challenge, yet not demotivate the participants with unrealistic expectations of clues that are just too difficult to decipher. Further, as there are learning outcomes to be achieved, the clues need to be designed such that these are incorporated into the activity in as many areas of the tasks as possible. Similarly, the locations of the clues (in this case the QR codes) need to be exciting and challenging. In the pilot study, the printed QR codes of the first stage clues were hidden at random locations around the designated area. Figure 2 shows an example of one of the locations, where a participant is in the midst of scanning the QR code with a mobile phone.

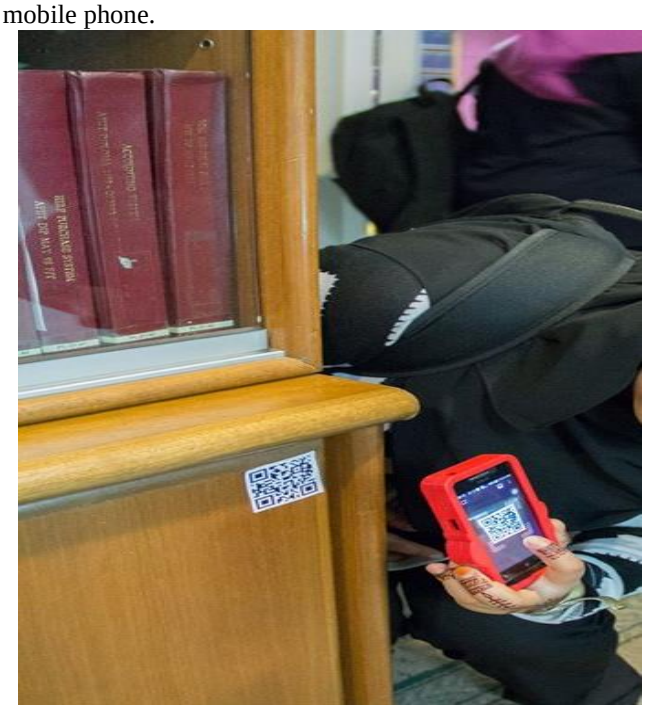

Figure 2. QR Code Clue Placed at a Hidden Location on a cabinet

The choice of the overall designated area is vital as it must be able to cater for the size of the group(s) participating in the activity, as well as provide all the necessary facilities at the required level. Amongst the common support facilities required include broadband bandwidth, uninterrupted communication and power supply, lighting, ensuring sufficient access (e.g. unlocked doors and disabled access, if required), refreshments, restrooms, work / discussion areas, etc.

v. Rules and Information

As per any competition or game, the edutainment requires a set of rules and regulations, in order to ensure that there are clear instructions and guidelines on the do's and don'ts during the activity. In the event of breaking any rules, either as an individual or a group, the participant(s) would incur a penalty of forfeit the competition.

In the case of the QR IT Seek Competition pilot study, the participants were given a brochure that explained the rules that need to be followed, as shown in figure 3. The brochure also provided brief information on how to use the QR codes and where the QR code scanner could be downloaded, for those who were still new to the technology. As it is edutainment, the objectives of the activity are also provided, along with the location (circuit) sketch and other relevant information.

In addition, before the competition starts, all participants are required to attend a briefing. Here, pertinent information relating to the activity, including the learning outcomes, rules and regulations, safety information, contact information, etc. are given. Figure 4 shows a briefing session in progress. This was done at the activity area itself instead of a more formal classroom setting, in order to keep with the activity excitement.

A debriefing session is important at the end of the activity in order to recap the important lessons learned, garner feedback and keep the participants motivated for other such future activities. Where applicable, a formal or informal prize giving ceremony may be held in conjunction with the debriefing session, as shown in figure 5.

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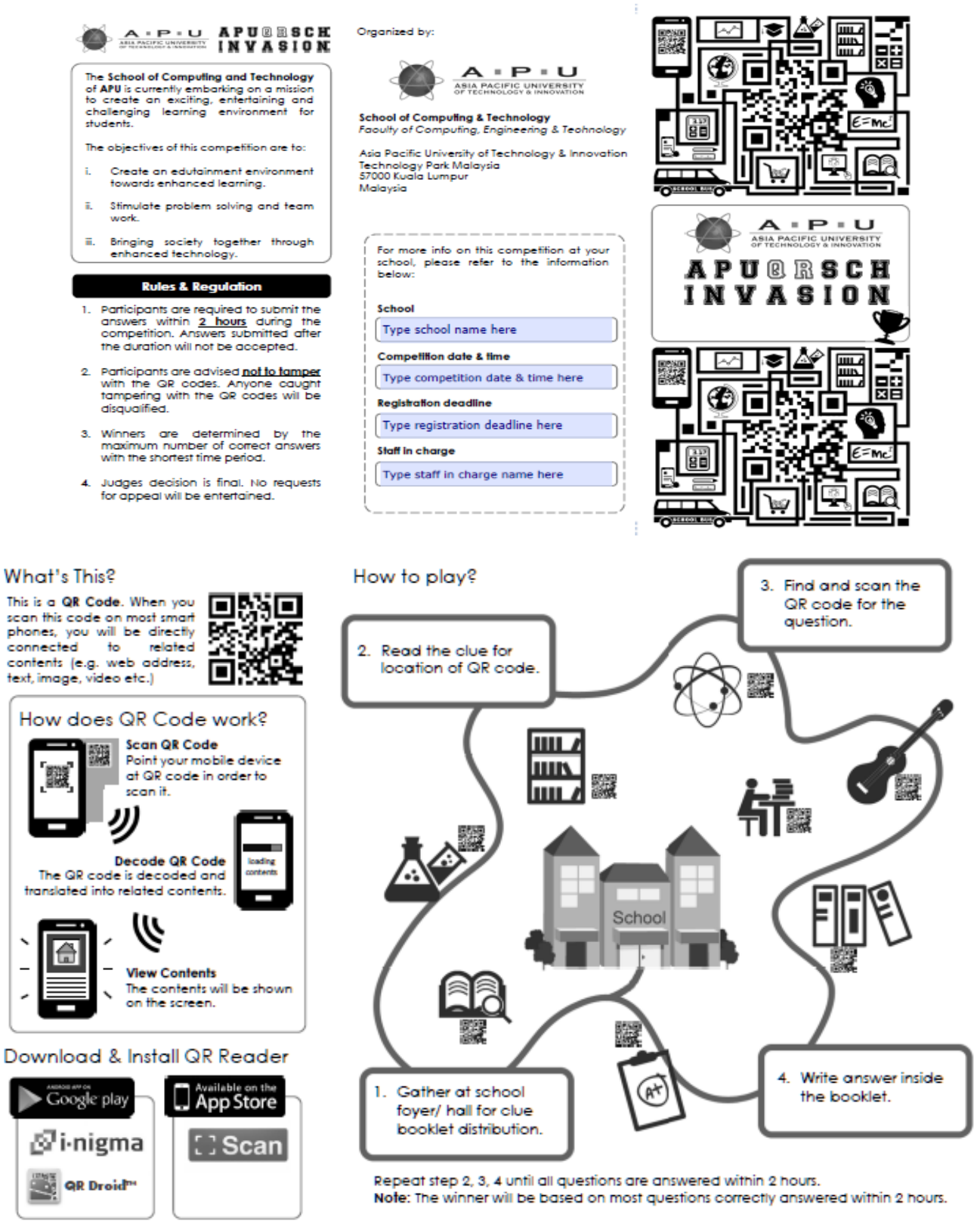

Figure 3. Sample Brochure

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Figure 4. Briefing Session at the Start of the Competition

Figure 5. Prize Giving Ceremony After Debriefing Session at the end of the Competition

vi. Participants

Central to the theme of any edutainment activity are the participants, where all activities, resources, technology, facilities, outcomes, etc. are tailored towards maximizing impact. In the case of the pilot study, the QR IT Seek competition is designed for students who have some fundamental IT background. Hence, the choice to use QR codes in the edutainment was deemed appropriate. This was also supported by the literature, where it was believed that integrating QR code and mobile technology into the learning environment not only motivates learners, but also develops their skills and allows them to collaborate and produce effective output [4]. An additional outcome that was sought in the pilot study was to promote more teamwork and group skills. The participants working together in groups to solve the clues, as shown in figure 6, is evidence of the achievement of such an outcome.

Figure 6. Participants Working Together to Solve a Clue

C. Analysis

The analysis phase is conducted at the end of the edutainment activity. Information for this stage is derived from various sources, including the participants, organizers, subject matter experts, helpers, support staff, statistics from the registration counter, data from achievement of each of the sub-tasks, online feedback, informal feedback, etc. During this stage, all available data is collated, tabulated and analyzed. From these, pertinent trends, shortcomings, successes and recommendations for improvements are determined. These are vital for use in designing future events, whether similar or for other specific or general objectives. As an example, some parts of the questionnaires that could be used to garner feedback is given in Table 4. The QR IT Seek competition was designed to be applicable to students from tertiary (university diploma and degree) and secondary schools. Thus, it would be useful to gain insight to the feedback from both groups. Some examples of the relevant feedback categories to better understand the different categories of Digital Natives are given in the lower part of the table.

Table 4: Summary and Description of Questionnaires

Group	*Question Area*	*Description / Aim*
University Respondents' Feedback	Category of Participants	To identify the participants category (Foundation, Diploma Part 1-2, Degree Level 1-3)
	Reasons for Participation	To identify the experiences gained in joining the competition. The categories of experiences to choose from: Able to learn new technology, New method of learning, Fun and gain IT knowledge, Able to practice understanding of IT, and others.
	Prior Edutainment Experiences	To identify participants' experiences (either joined or heard about) of similar edutainment activities in other universities.
	Interest in Edutainment	To identify participants' interest in edutainment.
	Activity Duration	To identify a suitable duration for edutainment activity.
School vs. University Students' Feedback	Response to QR Code game organized by APU	These questions seek to identify feedback from both university and school students, in order to assess several criteria relating to the effectiveness of the QR code game-based (edutainment) for sectors of Digital Natives.
	Develop IT Knowledge faster	
	Experience gained from QR Code game	
	Experience using QR codes before joining the game	
	Interest in joining edutainment games in future	

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Generally, the results of the analysis of the pilot study supported that both groups of students (Digital Native participants from the university and secondary schools) of the QR IT Seek found that such edutainment activity was effective in providing them better understanding of the IT related concepts and knowledge. They enjoyed the activity and recommended that more such activities be held in future. They also felt that the teaching and learning of more subjects (i.e. modules) would gain from the edutainment approach.

IV. CONCLUSION

This paper presents an edutainment conceptual framework that is aimed to have a positive effect on the teaching and learning perspective on Digital Natives. The entertainment-based educational activity, specifically the pilot study on the QR Code IT Seek competition on university and secondary school students, shows promise for a more effective teaching and learning approach for the younger generation. The proposed framework illustrates the important elements to have a successful edutainment activity and opens up avenues for a larger coverage of fields and subject matter that could benefit from the approach.

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