

## **INSTRUCTIONAL DESIGN TO MEASURE THE EFFICACY OF INTERACTIVE E-BOOKS IN A HIGH SCHOOL SETTING**

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### **ABSTRACT**

This article describes a qualitative research analysis on the implementation of interactive e-books in high school courses using a case study approach. The subjects of the study included seven professors and 16 freshmen who were surveyed and interviewed with a questionnaire designed according to the Kemp Model of Instructional Design. The study revealed that participants use interactive e-books as a technological educational resource. The professors pointed out that the design of the interactive e-books helped students develop essential learning skills: technological ability, reading and writing skills, as well as cognition and metacognition abilities. Furthermore, the students noted that the use of interactive e-books has a positive effect on their grades due to its high audio and visual contents. However, the students indicated that they were allured to chat, to play or to navigate in their mobile device while they were using it. Finally, this study can contribute to the relative knowledge about the use of mobile technology in education, as well as, it aids the professor to make a reflection about the Instructional Design of the educational technological resources used in the classroom to promote better result in the process of learning.

**Keywords:** Instructional Design, mobile learning, interactive e-books, high school.

### **INTRODUCTION**

The new millennium arrived with an astonishing technological revolution. Today, more diverse society is living in a complex and globalized world saturated with media. Over this period, technology has become the fastest generator and transmitter of information, and it is invading the daily lives of the general public. The educational setting is not an exception. Education is considered as one of the major most productive users of technology and where its revolutionary effects are taking place since the second half of the 20th century (Coll, 2008). However, the high expectation of the impact of technology in education were not noticeable because of the existence of relative inefficiency in the application of the old practices in a modern world educational systems (Molenda & Sullivan, 2003).

**The 21st century students of today are not the same students who were in the classrooms during the first decade of the millennium. Present-day-students require more than watching videos and images in the classroom or participating in a math game or taking turns in an interactive board: all of these activities are not attractive to them anymore. They demand a rapid access to new knowledge because they are already capable of participating in a completely different level of learning. So, there is a need to design modern courses with proper educational materials to meet the needs of today's students.**

**With the rise of mobile technology, e-books and interactive e-books were created to deliver instruction and motivate the students to be responsible in their own learning in an attractive way. Interactive e-books according to Bozkurt & Bozkaya (2015) are books in digital format in which the user can interact to the real and virtual environments at the same time. However, Ramos, Herrera and Ramirez (2010) indicated that cognitive skills are only developed when mobile educational resources are used together with activities carefully designed by the professor. Therefore, a responsible use of mobile educational resources coupled with the use of carefully designed activities of the professor can guarantee that the students can acquire higher cognitive skills.**

**The actual generation of students who were born between 1980 and 2000, is referred to as the Millennial (Howe & Strauss, 2000), also called digital natives (Prensky, 2001), in which the present generation of high school students are included. According to Prensky (2001), the arrival and the rapid dissemination of digital technology during the last part of the 20th century marked the difference between the Millennial and the students of the past. Millennial were born with technology and have been living with it as part of their lives. With all of these experiences, this generation of youngsters have different thinking patterns and behaviors compared to the last generations. This young group of people expect that technology should be used in the classroom to provide dynamic visual aids (Keller, 2006).**

**With technology in the educational settings, students can access new environments and they can generate possibilities with these technologies that allow them to conduct their own learning experiences and skills (Dominguez, 2009) such as skills in analysis, reflection, self-learning, written and oral communication, to name a few. Apart from these, the use of technology helps form individuals with global vision and a capacity to adapt and learn in an always changing world (Coll, 2008). The use of available technologies provides students the wider opportunity to learn, in which they offer the students more alternatives to succeed in their field of work.**

**Millennial share the educational spotlight with professors who, Prensky (2001) termed, the Digital Immigrants. This generation were exposed to technological devices during their college years or later during their professional practice. They acquired their knowledge in handling technology and were able to incorporate the experience in their practice, but in the classroom, they still teach in a traditional way. According to Coll (2008), professors who use traditional teaching practices apply technology in their classrooms to reinforce their strategies when transmitting lesson contents, meanwhile, the constructivist professors employ technology to develop activities that motivate the student to explore, to make inquiries, to become self-learner and to work collaboratively with other students. So, even though there are evidence**

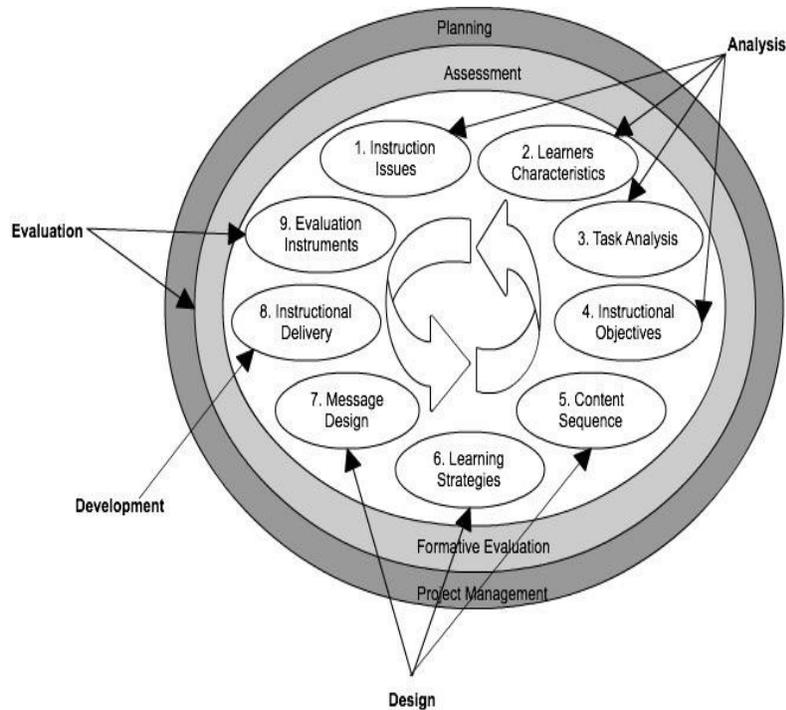
**that students of today have access to technology, especially those who are in the metropolitan areas, they have low learning achievement and slow development of cognitive skills. Therefore, the new role of educators is to facilitate learning and bring about positive changes on the demands of their learners.**

**Due to the growing use of technology and mobile devices today, educators started to explore other educational settings in teaching and learning environments, and one of them is mobile learning (Brown & Mbat, 2015). From printed textbooks, educators and other professionals dedicated to education also are compelled to design resources for mobile devices like e-books and interactive e-books. These resources offer a magnificent learning experience due to their varied and colorful visual contents and the mobility of the devices in which they can be used (Peraza, Estrada, Zaldivar, Mendoza, Olivarría, Peraza, Zaragoza & Cobian, 2013). Visual contents alone do not guarantee significant learning, mobile learning resources should be designed correctly to have its benefits (Herrera & Fennema, 2011). Thus, there is a need to create educational materials to stimulate critical thinking and improve cognitive skills of today's students. This implicates that those who are engaged in the creation of educational materials should know the guidelines that can have a positive impact on the educational process and make the learners become involved and be responsible with their own learning.**

**These guidelines can be summarized as to what Reigeluth (2013) referred to as the Instructional Design (ID). ID is a theory that serves as a guide in the process of learning and in the development of a person through a design process. It provides a guide in the development of educational plans as to how educational practices should be designed for better learning experiences (Caeiro, Llamas & Anido, 2006; Rothwell & Kazanas, 2008). Furthermore, Morrison, Ross, Kemp & Kalman (2010) cited that Instructional Design focuses on the individual learner's performance, in which, the characteristics of the learner is taken into consideration in the selection of teaching strategies, learning methods and the development of necessary learning skills. So, it is crucial for the professor to plan or design the course and the way the educational resources should be used. Thus, Instructional Design is an important tool to help students succeed in learning because it provides the necessary conditions for them to live up their own learning experiences.**

**There are various Instructional Design models that can be used in designing a course. According to Liu (2014), they can be applied in different learning environments, different types of learners, different means of application, different resources design, among others. But, even with these differences, these models have one sole objective, they serve as a guide to complete the design process, step by step, and help the designer to evaluate the validity, reliability and usability of the chosen instructional design. Many of these design models were developed for different types of instructions and for designers with diverse levels of expertise.**

**In this case study, the Kemp Model was applied for its flexibility to ensure the accomplishment of the learning objectives (Morrison, Ross & Kemp, 2004). That is, its flexibility will allow the objectives to be achieved in different ways. Furthermore, the model adapts in technological contexts like online environments. The Kemp Model consists of nine (9) elements. These elements are represented by Figure 1.**



**Figure 1. Kemp Model of Instructional Design  
(Elaborated by the authors. Image was adapted from The Herridge Group, 2004).**

The Kemp Model is different among most of the models because it is focused on the learner. It is represented by a continuous cycle which includes planning, design, development and constant evaluation to ensure effective instruction (Sims & Jones, 2002); therefore, this model is adequate for extended course design and online modules. Also, this model is particularly useful in developing instructional programs that can be combined with the use of technology, pedagogy and program contents for effective and efficient learning (Kranich, 2008).

## PURPOSE OF THE STUDY

A higher education institution in Mexico called Tecnológico de Monterrey had launched an educational program called Modelo Tec21 to meet the needs of its 21st century students. Since the new generation of students have different skills compared to the past generations, Tecnológico de Monterrey seeks to always be at the forefront and create better learning environments for its community (ITESM, 2015). In 2013, the university entered a Bring Your Own Device (BYOD) pilot program and introduced the use of mobile devices to high school freshmen only. BYOD is a policy in which students bring their own electronic device to work on in their classroom. All professors teaching courses on this educational level had organized to design interactive e-books for a mobile device. So, high school professors with or without prior knowledge about the use interactive e-books had taken the role of an instructional designers.

The main purpose of this research is to evaluate the use of the interactive e-books based on Kemp Model of Instructional Design. The study is guided by the main research question: What is the relationship of Instructional Design and the implementation of courses using interactive e-books as a resource? With this came two specific questions: 1) How do teachers implement

interactive e-books as a technological resource? 2) How do teachers evaluate the functionality and the practical purpose of the interactive e-books as technological resources and instructional tool for their courses?

This study can contribute to the relative knowledge about the use of mobile technology in education. Eventually, it will help the educators to make reflections regarding the use of instructional design in the creation of educational materials through the use of technology in mobile learning environments that can guarantee the optimum learning results. Professors, though they are not professional designers, are best suited to design educational materials because they are mentors and in direct contacts with the students. For this reason, the result of this study can serve as a guide for the professor in designing educational materials to facilitate the educational process in a fun and entertaining way.

## **METHOD**

This work is based on a qualitative research with a case study design. The case study allows the researcher to explore individuals or organizations, through complex interventions, relationships, communities or programs and moreover, it is applicable to test a particular theory or model when not much is known about an issue (Yin, 2003). Since not so many studies were done about interactive e-books, a case study approach was applied.

### **Participants**

They consisted of 16 bilingual first semester high school students enrolled in the Life Basics course. Also, there were considered seven teachers who were authors and creators of iBooks and also who taught subjects in the mentioned semester. All participants are part of Tecnológico de Monterrey Campus based on the state of Sonora in northwest Mexico.

### **Data Collection and Analysis**

In this research, three instruments were used for data collection: the survey for students and teachers, the face-to-face interview for teachers with closed and open questionnaire and a field diary. The survey was applied to students in online format to facilitate data processing. As for the teachers, they were first given an online questionnaire and then it was conducted a semi-structured interview face-to-face based on Valenzuela and Flores, (2012) proposal. The interview was made to clarify the comments of the participants or to supplement some response of the questionnaire. As for the face-to-face interview, Gubrium and Holstein (2002) mention that it offers flexibility in the questions and generates greater clarity to the answers. In turn allows the use of visual aids in the presentation of questions and response options. In addition, face-to-face interviews allow the interviewer to observe respondents unobstructed. All instruments were validated by experts before using them in this study.

To proceed with the data collection, first, a checklist was made to evaluate the coincidences of iBooks with the Kemp model. The results served as a guide for the design of the questions for the survey and the questionnaire. At the same time a letter of consent was drawn up for the participants. The second stage was the application of the survey to the students and the questionnaire to the teachers. The teachers' responses were reviewed and the interview was then designed to clarify some points and to obtain more data. Finally, we proceeded with the interview and then with the capture of the information.

After data collection, the first step for the analysis was the determination of organizational criteria, both for the survey and for the interview. In this first stage, the information of the result of the survey and the questionnaire were emptied in a spreadsheet in each case to facilitate the handling of the information. The recordings were transcribed and the interview notes were scanned.

In the second stage, the data were reviewed to ensure they were complete and ready for analysis. In the transcription of recordings, the researcher practiced the principle of confidentiality, following the guide of Valenzuela and Flores (2012), who suggest changing the true name of the participants by codes, nicknames or other names.

The third step was to code and assign categories that emerged according to the elements of the Kemp Model to the data collected. The criteria were by type of data: survey, questionnaire, interview; by groups: students and teachers and by subject. Later, associations between categories were found. The summary of the methodology is depicted in Figure 2.

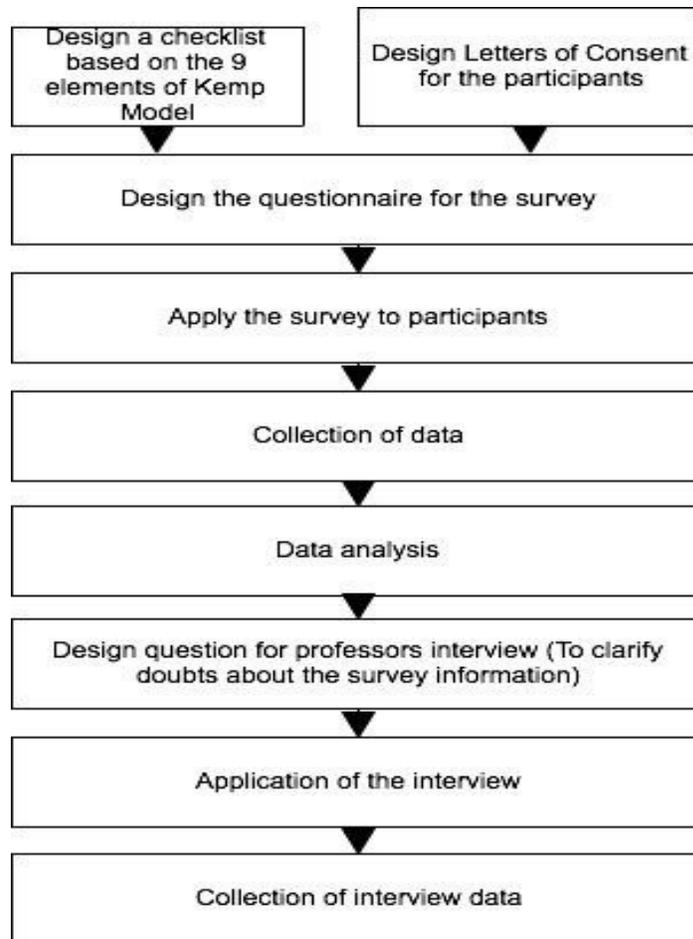


Figure 2. Steps in collection of data (Elaborated by the authors).

## FINDINGS

The purpose of this study was to evaluate the use of the interactive e-books based on Kemp Model of Instructional Design. Results are presented in two categories: (A) Instructional Design, and, (B) Implementation of interactive e-books. The result includes quoted text of the participants: quoted text of professors are with their initial and their area, while student participants are marked with their initials only.

### Category A: Instructional Design

This section contains 10 subcategories based on the Kemp Model. This category was designed to answer the first research question: How do professors implement interactive e-books as a technological resource in the classroom?

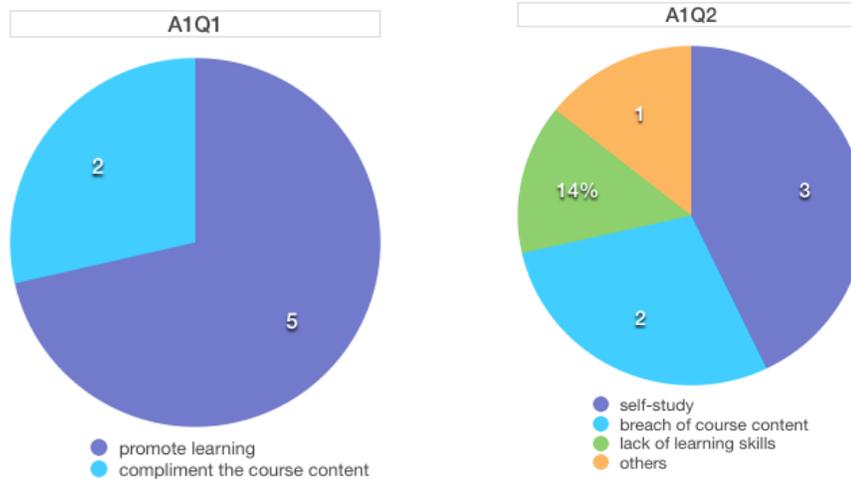


Figure 3. A1Q1 & A1Q2: Purpose of Instructional design (Elaborated by the authors).

In accordance with the result, participants were aware of the importance of instructional design to promote learning and the development of self-study skills on students: "it makes the course more attractive and interactive for the students, which results in their motivation to learn"— (BA, language professor). Moreover, some of the participants thought that Instructional Design help them plan the course "to comply with the course content and to make the class go on as smooth as possible"— (MM, science professor). Most of the professors commented that Instructional Design serve as a guide to plan activities and help improve students' learning.

### Learners' Characteristics

Learners are diverse in many aspects such as cultures, ethnicity, experiences, learning styles and many other dimensions which make up their unique learning style. Effective educators know the needs of the learners and apply variety of teaching strategies to meet their needs. Result showed that interviewed professors focus on learners' needs when designing their courses: "the learners are the users of the course so their needs and requirements should be satisfied"— (MB, language professor); also, "students are the beneficiaries with the design of the course and they should comply with their own expectations" — (MTV, science professor). The 21st century education, according to Shi-Ming (2001), is centered on the students. The way to educate has also changed, a change in which the students learn through discovery and construction of knowledge. All the interviewed participants agreed that the students are the protagonists in the classroom.

In accordance with the Partnership for 21st Century Skills (2011), students should develop essential skills, such as critical thinking, problem solving, communication, collaboration in order to succeed in their field of endeavor. The participants mentioned a list of needs that can be satisfied and a number of skills that can be developed while using Instructional Design: "way of learning: visual, auditive, or kinesthetic"—(MTV, science professor); "academic level"—(MM, science professor); " technological skills"—(MC, science professor); oral and written skills because students nowadays lack these skills"—(BA, language professor);

“cognition, preferences, socioeconomic status, values, communication skills”—(ML, language professor). Most of the participants coincided with Shin & Kang (2015) on the essential skills necessary to be developed for the students to succeed in learning.

With regard to the survey result, students mentioned that it is important to meet their needs in designing the course: “because if it is not interactive, they can lose interest on the course”—(FN); “better materials used in the course means better understanding of it”—(MT). Students emphasized that when their needs are met, they become interested with the course and learn more. When designing course materials, factors should be considered, like the characteristics of the learners and their degree of motivation, which contribute to their interest and be able to achieve success in learning (Morrison, Ross & Kemp, 2004).

### **Task Analysis**

It is not enough to know what students are capable of doing that is why designing objectives become crucial and task analysis aids in formulating learning objectives (Crandall, Klein & Hoffmann, 2006). In the survey students expressed that concentration is decisive in learning: “increased amount of concentration on the lesson and a capacity to summarize what was learned”—(DV); “concentration and faster speed in learning”—(JC); “I want to develop better ways to remember information and write notes”—(ME); some of the students indicated the value of oral/reading skills in learning: “reading comprehension”—(FN); “oral skills”—(IR).

On the other hand, professors mentioned that reading comprehension, oral and written skills are necessary to help the students learn. All participants coincided that technology can boost learning and a touch of emotional stability to affirm better learning performance which is aligned with the proposal of Chen & Summers (2015).

### **Instructional Objectives**

According to the participating professors, they mentioned that their formulated learning objectives can be classified, based on Bloom’s Taxonomy (Krathwohl, 2002), at the lower level of the pyramid, which are analysis, application, comprehension and knowledge: “the student should be able to interpret and analyze results”— (MTV, science professor); “student should be able apply the programs seen in the course”— (EL, science professor). The professors did not mention higher order thinking skills like evaluation and synthesis.

### **Content Sequence**

The result demonstrated that most of the professors organize their course content according to the course program and the needs of the learners. They classify the activities from simplest to increasing complexity, including actual issues in everyday life to attract the interest of the students and incorporate the use of multimedia: “check the knowledge background of the students then organize the contents based on their needs and arrange the activities from the simplest to the most complex; making connections with previous knowledge induce a better skill development”— (ML, language professor). One professor mentioned the incorporation of technology in the course content: “I try to innovate with technology, but I also try to incorporate application to real-life activities”— (MTV, science professor). Some expressed their opinion about content sequencing: “The sequence of the course is determined about how the course program is arranged, or I follow how the contents of the textbook are arranged”— (EL, science professor); “I use different incentives like videos, collaborative activities, challenges, laboratory activities”— (MM, science professor). According to Colenci (2012), new skills are acquired when basics are learned first. So, sequencing the contents is an important factor to help the students develop new skills.

In the case of students, they answered affirmatively that the contents of the interactive e-books are arranged to promote their learning because of its interactivity and visual characteristics: “yes, it is interactive and I can do exercises and practice on them”—(FN); “the interactive e-book focuses in our needs and it contains more materials that we need to learn”—

(IR). Interactivity in educational materials improves the learner's experience when designed and implemented correctly and carefully (Beauchamp & Kennewell, 2010).

### Teaching Strategies

For this subcategory, the professors mentioned the importance of teaching strategies, such as connecting prior knowledge, applying individual and group works, then challenging students to apply what they learned to actual issues. They believed that using these strategies help the students comply with the learning objectives: "I start the lesson with the importance of the topic, giving examples or connecting previous lessons"— (MM, science professor); "my strategies include an introduction, materials needed, exercises, collaborative works to reinforce their learning"— (ML, language professor); "I use tutorial videos"— (MTV, science professor).

Concerning the students, they mentioned that videos, graphics, and lesson presentations help them learn: "videos that accompanies the information helps me learn visually"—(IR); "graphic and videos"—(FN); "I learn by doing concept maps"—(VO). It is apparent that both actors, professors and students, agreed that the use of visual aids helps in the learning process. It can be inferred that educational advancement can be maximized when adequate tools are employed.

### Instructional Message

Participating professors revealed that they introduce the subject matter by motivating the curiosity of the students applying interesting questions or watching videos related to the lesson and using clear and concise instructions: "I apply clear instructions, using appropriate language level to enable my students understand what they are asked to do"— (MTV, science professor); "I give the instructions first, then model them"— (BA, language professor). One professor mentioned the regularity of utilizing the same language in giving instruction especially during tests and quizzes. Effective instructional message can help motivate communication when designed within context and according to the needs of the learners (Bishop, 2015). In order for the learners to understand the task, their needs and level of understanding should be met.

### Instructional Development

The result showed that professors design attractive and fun activities to attract the interest of the learners using vocabulary suitable for their level. At the same time, they try to design activities that cover all learning styles "considering modern topics that are of interest to them, including the development of human values"— (EL, science professor). In the development of instruction, collaborative learning is the predominantly used technique in this school regarding the implementation of classroom activities.

### Evaluation Instruments

For assessment tools, the result showed that professors use activities, quizzes, exams and projects to evaluate the student's learning outcome. According to the participating professors, the success of the lesson is reached when there's a high percentage of passing students, and a high average score. Aside from the aforementioned assessment tools, other professors mentioned that they apply self-evaluation at the end of the course to get a feedback of how student learned.

### Instructional Model Application

Even though participating professors had designed courses during their teaching practices, they expressed that they had not utilized any specific instructional model: "what model? I design my course based on the course program!"— (EL, science professor). All the participating professors conveyed their lack of knowledge about the existence of Instructional Design

models: "I do not know any Instructional Design model!"— (MTV, science professor); "I do not use any model, I design based on the course program"— (MB, language professor).

### **Category B: Implementation of Interactive E-books**

#### **Implementation of Interactive E-books in the Course**

This category answers both research questions. Participating professors helped to answer the questions by considering interactive e-books as a supporting resource, work instrument and a textbook. One professor noted that the interactive e-book is not a simple textbook because it is designed according to the course program: "It is important to point out that the interactive e-books are created and adapted exactly to the topics of the course program"— (MTV, science professor).

On the student standpoint, they acknowledged the contribution of the interactive e-books in their learning due to its mobility, and its high visual contents. However, one of the students mentioned "I still consult physical textbooks, though"—(IR). Besides the benefits the students mentioned about the resource, they revealed some drawbacks: "sometimes I feel distracted and play in my mobile device while I am using the interactive e-book."—(FN); "the application crashes sometimes"—(NS).

## **DISCUSSIONS**

This study adopted a qualitative approach to collect answers from seven professors and 16 first semester students through a questionnaire designed according to the elements of the Kemp Model of Instructional Design. Data were processed in response to the problem statement mentioned earlier. Two goals prompted the collection of data and the subsequent data analysis. These goals were to examine how teachers implement interactive e-books as a technological resource in the classroom, and to determine how teachers evaluate the functionality of the interactive e-books. These objectives were achieved and the findings are presented in this section.

Participating professors commented that the purpose of instructional design consists in helping them to plan activities for the benefit of their students. They were aware that knowing the learning needs of their students would help them in designing the course. It should be worth mentioning that the purpose of Instructional Design is to guide the professors or designers in the course scheme for a better and significant learning (Reigeluth, 2013; Caeiro, Llamas & Anido, 2006; Rothwell & Kazanas, 2008). However, it was found that professors were not familiar with the different models of Instructional Design and some professors had not used any of them when designing a course. This situation did not block them to create learning resources such as interactive e-books. Nonetheless, it should be noted that Herrera & Fennema (2011) mentioned that visual contents alone do not guarantee significant learning, mobile learning resources should be designed correctly to have its benefits. So, the knowledge of Instructional Design Model is crucial at any stage of course planning.

It is also apparent that students are motivated to learn by the use of interactive e-books. The presence of colored interactive graphics and the use of different incentives helped them understand the topics of the course. But again, Beauchamp and Kennewell (2010) reiterated that a careful planning and implementation of multimedia in electronic e-books will have better benefits in learning experiences. So, knowledge of Instructional Design in the planning of a course is crucial to meet the needs of the learners and aid them for better learning experiences.

## CONCLUSION

With mobile devices and applications available, there are many opportunities to create and design educational technology to motivate student learning. These educational resources must be properly designed to reap its benefits. The problem statement of this research is to analyze the design and implementation of high school courses using interactive e-books as a technological resource. This problem is guided by a general question: What is the relationship of Instructional Design and the implementation of courses using interactive e-books as a resource? With this came two specific questions: How do teachers implement interactive e-books as a technological resource? How do teachers evaluate the functionality and the practical purpose of the interactive e-books as technological resources and instructional tool for their courses?

Through this study, it was known how a type of technological resource, such as interactive e-books, can assist in promoting the learning process. However, the knowledge of Instructional Design can help the professors to create better suited materials and maximize students' achievements. The creation of technological resources such as interactive e-books, help to meet the needs of students, not only in what they have to learn but in how they learn. The use of Instructional Design model will guarantee that the course covers the necessary elements for an optimal learning experience. Based on the results, the authors suggests more training courses for professors regarding the use of Instructional Design models.

The importance of a responsible use of technology (i.e. mobile phones, tablets) in the classroom should be emphasized on the student community to succeed in their educational benefits. Professors should be motivated to create their own educational resources because they are the experts in the areas in which they teach. It will also be beneficial if students are implicated in the design of educational resources because they are the main purpose of these materials. It is also necessary to study more in depth the design of technological resources for mobile devices as well as reviewing their impact on mobile learning as their integration is becoming more apparent in education programs.

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