PUPILS' INTERNET USAGE, GAMING EXPERIENCE, LEARNING PROBLEMS, EDUCATIONAL VALUES AND CHANGE IN BEHAVIOUR USING KAHOOT IN BIOLOGY

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UNIVERSITI PENDIDIKAN SULTAN IDRIS

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ABSTRACT

This study was aimed to identify pupils' internet usage, gaming experience, learning problems, educational values and change in behaviour using Kahoot in biology. A mixed method approach with embedded design was used. The study used purposive sampling with ten form 4 biology students, four biology teachers and four parents as participants in the qualitative part of the study while random sampling was used for 250 students who were respondents for the survey. The instruments used to gather qualitative data were interview protocols, field notes and document analysis while questionnaire was used to gather quantitative data. All instruments were checked and validated by five experts with percentage agreements of more than 90%. Reliability was carried out through member checking, peer checking, expert consultation, and pilot study with Cronbach's alpha value of 0.752. There were 18 interviews, ten document analysis, four observations and a survey. Data analysis for interview protocols and field notes were through thematic analysis, document analysis checklist through rubric while questionnaire used mean and standard variation. The findings revealed that 98% of the pupils surf internet using handphones. 79.2% of the pupils have online gaming experience with 30.4% of them gaming for fun. Problems in learning biology are due to the subject itself, students themselves, parents' influence, teacher's characteristics and infrastructures such as classrooms, biology laboratories, library and computer laboratory. Thinking skill is the educational value that emerged in interviews, observations and survey. Playing Kahoot caused positive and negative change in behaviour too. As a conclusion, the study provides positive indication on the usefulness of Kahoot as an effective, interesting and motivating technique in learning biology. The implication of this study is mainly on pupils, teachers, parents and school to further improve so that learning of biology will be more successful, meaningful and fun

PENGGUNAAN INTERNET, PENGALAMAN "*GAMING*" MURID, MASALAH PEMBELAJARAN, NILAI PENDIDIKAN DAN PERUBAHAN TINGKAH LAKU MENGGUNAKAN KAHOOT DALAM BIOLOGI

ABSTRAK

Kajian ini bertujuan untuk mengenal pasti penggunaan internet, pengalaman "*gaming*", masalah pembelajaran, nilai pendidikan dan perubahan tingkah laku murid menggunakan Kahoot dalam biologi. Pendekatan kajian gabungan dengan reka bentuk "*embedded*" digunakan. Kajian ini menggunakan persampelan bertujuan dengan sepuluh orang murid biologi tingkatan 4, empat orang guru biologi dan empat orang ibu bapa sebagai peserta dalam bahagian kualitatif kajian manakala persampelan rawak digunakan untuk 250 orang murid yang merupakan responden dalam tinjauan. Instrumen untuk mengumpulkan data kualitatif adalah protokol temu bual, nota lapangan dan analisis dokumen manakala soal selidik digunakan untuk mengumpul data kuantitatif. Kesemua instrumen telah disemak dan disahkan oleh lima orang pakar dengan peratus persetujuan melebihi 90%. Kebolehpercayaan dijalankan melalui semakan peserta kajian, semakan rakan sejawat, rundingan pakar dan kajian rintis dengan nilai *Cronbach alpha* sebanyak 0.752. Sebanyak 18 temubual, sepuluh analisis dokumen, empat pemerhatian dan satu tinjauan telah dijalankan. Analisis data untuk protokol temubual dan nota lapangan ialah secara analisis bertema, senarai semak analisis dokumen melalui rubrik dan soal selidik pula menggunakan min dan sisihan piawai. Hasil dapatan mendedahkan bahawa 98% murid melayari internet menggunakan telefon bimbit. 79.2% murid mempunyai pengalaman "*gaming*" secara online dengan 30.4% daripada mereka "*gaming*" untuk keseronokan. Masalah pembelajaran dalam biologi berpunca daripada subjek, diri murid, pengaruh ibu bapa, ciri-ciri guru dan infrastruktur seperti bilik darjah, makmal biologi, perpustakaan dan makmal komputer. Kemahiran berfikir ialah nilai pendidikan yang diperolehi dalam temubual, pemerhatian dan tinjauan. Bermain Kahoot juga menyebabkan perubahan tingkah laku positif dan negatif. Sebagai kesimpulan, kajian ini memberi indikasi positif terhadap kebaikan Kahoot sebagai teknik yang efektif, menarik dan mendorong dalam pembelajaran biologi. Implikasi kajian ini terutamanya pada murid, guru, ibu bapa dan sekolah untuk ditambah baik supaya pembelajaran biologi akan lebih berjaya, bermakna dan menyeronokkan.

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DG	Digital Game
DGs	Digital Games
CDC	Curriculum Development Center
ICT	Information and Communication Technology
MoE	Ministry of Education
NEP	National Education Policy
HOTS	Higher Order Thinking Skills
UPSR	*Ujian Penilaian Sekolah Rendah*
SPM	*Sijil Pelajaran Malaysia*
KPM	*Kementerian Pendidikan Malaysia*
IAB	Institute of Aminuddin Baki

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CHAPTER 1

INTRODUCTION

1.1 Overview

We are living in a world where constant technological innovations occur and according to Duncan (2015), the measure of our success is becoming less about what we know. Our success is more about what we do with our knowledge and about learning new skills in order to adapt to a quickly changing world. The use of games in learning and instruction, have been publicized by many researchers. Games are hypothesized to address both the cognitive and affective dimensions of learning (O'Neil, Wainess & Baker, 2005).

Playing games is not only fun, but students can learn more effectively through activities and participation rather than passive instruction since they are usually better motivated and more active in reaching their goals. Games provide visual representation of problems through manipulative operations. Games can increase students' knowledge and in addition, they influence their cognitive and social development (Pinter, 2011). Hense and Mandl (2014) added that players of conventional games are often acquiring a range of skills and contents while playing, and they do so with immense motivational and emotional involvement. Games aim at specific learning goals and consequently for specific learning outcomes as well. Therefore, it seems obvious to conduct the review from this perspective. Many studies on games have focused particularly on cognitive learning outcomes: learning of knowledge and problem-solving skills.

Technology enhancement has been integrated with current games in which a player needs to engage with full emotion, cognition and social skills interaction when playing the games (Yusoff, Kamsin, Shamshirband & Chronopoulos, 2018). Besides using traditional books in conveying learning objectives, educational games can be an alternative approach to generate learner's understanding. Educational games can be effective tools for learning outcome because it can create individual motivation and satisfaction, facilitate a variety learning styles, reinforce the master skills and provide interactive platform (Yusoff et. al., 2018). According to Ismail and Tyler-Jones (2018), with the rise of gamified experiences across the web and mobile applications, technology enhanced learning have been inspired to incorporate games-based elements. To reach this goal, it is important to develop teacher's knowledge and competence in the use of technology so that their students' need can be met.

Creativity and intellectual capacity increase with technology (Chun, Kern & Smith, 2016). For effective learning, technology should be used in education (Kessler, 2018) because motivating students through traditional method is difficult (Premarathne, 2017). The application of mobile learning and the use of game-based instructional strategies have been demonstrated in promoting students' learning performances and motivation (Chang & Hwang, 2019). Martí, Mendez and Alonso (2016) mentioned that games can increase students' inner learning motivation and agreed with active learning based on every student's learning needs.

Prensky (2001) mentioned that games became digitalized because 21st century students are multitasking, prefer more graphical content, want fast information, technology friendly and prefer learning by discovering and gaming. Digitalized games are known as Digital Games (DGs). Michael and Chen (2005) defined a DG as a computer-based game with a primary purpose other than entertainment, ranging from anywhere between advertisements to military training exercises. Many definitions exist that describe a DG (Garris, Ahlers & Driskell, 2002) and (Vogel et al., 2006), but mostly a definition along the following lines is chosen: that it is goal-directed, a competitive activity (against the computer, another player, or oneself) and conducted within a framework of agreed rules (Lindley, 2004). In addition, DGs constantly provide feedback to enable players to monitor their progress towards the goal (Prensky, 2001). According to Fabricatore and Lopez (2009), most DGs require players to engage in activities organized as a sequence of steps involving different thinking skills and knowledge. First, players identify or define a goal to accomplish in the game. Then players plan how to achieve the set goal, relying on problem-solving, decision making and creativity. Next is action where players put into practice the

knowledge and skills acquired in the previous stages. The players assess the final outcome after the action is taken. Holmes and Gee (2016) stated that DGs use competitive exercises in order to motivate the students to learn better either by putting the students against each other or getting them to challenge themselves. DGs can be used creatively to create a learner-centred and learner-guided environment. When the learning approach incorporates educational content or learning designs into digital games, it is known as digital game-based learning (Chang & Hwang, 2019).

1.2 Background of the Study

Biology is taught in Form 4, 5 and 6. The existing activities which are normally conducted in the classroom are teaching using textbooks and reference books, where expansion of ideas and knowledge are limited (Tahar & Zaid, 2018). Deng, Tian, Cornwell, Phillips, Chen and Alsuwaida (2019) mentioned that internet is playing an important role in children's life as they prefer to using and interacting with content and images on screen than papers and books. Ciftci (2018) suggest the usage of educational games through E-learning in the form of media that focuses on education. In E-learning, students learn through audios, videos, images, texts, animation and many more (Nygren, Blignaut, Leendertz & Sutinen, 2019).

Agaoglu and Metin (2015) agrees that the DGs attract players due to their characteristics such as active participation in the process, user customization, socializing in virtual environment, sense of achieving success, entertainment, and rewards. DGs require the usage of whether computer game or handheld-based game,

which are characterized by rules, goals, objectives, outcomes, feedback, conflict, competition, challenge, opposition, interaction, and representation of story (Prenksy, 2001) or more simply, "Purposeful, goal-oriented, rule-based activity that the players perceive as fun" (Klopfer, 2008). They are distinguished by two key elements: (i) an interactive virtual playing environment, and (ii) the struggle of the player against opposition (Fabricatore, 2000).

DGs can develop cognitive, spatial and motor skills and help improve students' ICT skills. They can be used to teach facts (example; knowledge, recall, rote learning or memorization), principles (example; cause and effect relationship) and complex problem solving, to increase creativity or to provide practical examples of concepts and rules that would be difficult to illustrate in the real world. DGs possess intrinsic learning qualities that challenge and foster learners' challenging environments, where they can make mistakes and learn by doing. These types of environments might be particularly suited to students who are pragmatically minded. These students might prefer to go through the process of experimenting, instead of regurgitating information. Such an experience could help them to better understand some concepts that they might otherwise perceive as complicated or boring (Felicia, 2009). Serin (2018) also acknowledged this by stating that DGs have student centered approach. Student centered approach is important as cooperative learning is enhanced, problem solving and decision making skills are developed as well as stimulating reflective and critical thinking skills.

In this research the DG that is integrated is Kahoot. Kahoot is the most popular gamified student response system used in education (Ismail & Mohammad, 2017). According to Tan, Malini and Manjeet Kaur (2018), Kahoot is a digital game-based student response system where interaction between students and teachers occur in classroom settings through competitive knowledge games. Pedagogical practices are supported by Kahoot as technological solutions (Tan, Malini & Manjeet Kaur, 2018). Kahoot is a game-based learning platform where students' knowledge is reviewed, as formative assessment tool or break from traditional classroom activities that uses audience responses, role plays, using of video and audio-visual aids (Wang & Tahir, 2020) while Eltahir, Alsalhi, Qatawneh, AlQudah, Jaradat (2021) claimed Kahoot is a game-based online assessment tool. Zarzycka-Piskorz, (2016) sees Kahoot as a game-based learning or gamification tool as it incorporates playing and learning where game elements and game designs are used in a non-game context. Through the employment of game elements, game-based thinking and elements, effective learning and motivation are promoted by gamification (Kapp, 2014). Similarly, Wang, Zhu and Saetre (2016) agree that through gamification, Kahoot focuses on student motivation and engagement. Students have the opportunity to be fully involved in the learning cycle through game-based learning or gamification (Tan, Malini & Manjeet Kaur, 2018).

Wang and Tahir (2020) further stated that Kahoot improves learning performance and classroom dynamics by increasing engagement, motivation, enjoyment and concentration. Similarly, Al-Hadithy and Ali (2018) acknowledged that integrating Kahoot into the learning environment, increases students' engagement, self-efficacy and independent learning. Dellos (2015) mentioned Kahoot

is a digital game that can engage students in a fun way in the classroom and challenges students in the learning process.

According to Ismail, Anisa, Jamilah, Nik Mohamad Rizal, Mohamad Zarawi and Mohamad Najib (2019), advantages of Kahoot are (i) free platform, (ii) multiple formats, (iii), facilitates participation as game pin generated automatically, (iv)computers, smartphones and tablets user friendly, (v) user-friendly, (vi) generate excitement through music and colourful illustrations and (vii) based on complexity of the question, the response time is flexible and adjustable.

Nah, Zeng, Telaprolu, Ayyappa and Eschenbrenner (2014), stated that Kahoot as a pedagogical tool and gamifying academic, increases and maintain students' engagement allowing them to reach academic achievements. Kahoot! builds teamwork skills as it promotes empathy and develops metacognitive abilities (Licorish, Owen, Daniel & George, 2018). Kahoot allows students to demonstrate their knowledge in a fun and exciting way (Jones, Katyal, Xie, Nicolas, Leung, Noland & Montclare, 2019) as multiple choice assessments are changed into an interactive game (Dellos, 2015).

However, many parents have a negative perspective on online games, thus promoting E-learning in the form of games can be challenging (Lee & Hammer, 2011). Many parents are not familiar with online learning through games as many do not see online games as an educational tool (Anwar, Kristiadi, Novezar, Tanto, Septha, Ardhia & Abraham, 2020) as they feel playing games have a bad impact on children's behaviour (Gok, Inan & Akbayr, 2020). Parents worry that children do not

socialise and prefer playing games (Deng, Tian, Cornwell, Phillips, Chen & Alsuwaida , 2019)

1.3 Statement of the Problem

KPM (2013) stated that for science, Malaysian students "have very limited scientific knowledge that can only be applied to a few familiar situations. They can present scientific explanation that follows explicitly from the given evidence but will struggle to draw conclusions or make interpretations from simple investigations." This was a wake-up call for the Malaysian government to do something with regards to improving the quality of science and mathematics teaching in the country.

Students have difficulty understanding science because it involves investigation on complex phenomena, abstracts and cannot be studied directly. Cimer (2012) agreed that this was one of the causes in the declining of student's interest on science subjects. Many students have a negative attitude towards science subjects (Nordin & Ling, 2011). At the same time the low achievement of students in science in the country is worrying. The government's intention for Malaysian students at the upper secondary school level to take science and social science course on a ratio of 60%: 40%. However, it is a known fact that in Malaysian secondary schools the number has not yet reached 30% for the science course, and this situation has not really changed since the 1990s. The lack of interest in science from the young generation is certainly going to be a problem in the future, as it is difficult to get talented researchers, product development etc. Some research shows that Malaysian

students do not dislike or fear science, but they chose the social sciences because relatively they are more in control (KPM, 2013).

Biology is a part of science and known as natural sciences that specifically studies about living things and the surrounding environment. Thus, biology lesson is very important because it is directly related to students as living beings themselves (Cahaya, Ashadi & Karyanto, 2018) and have promising future (Khan & Masood, 2014). However, biology is one of the science subjects that has small number of student enrolment (Prokorp, Tuncer & Chuda, 2007). Bramwell-Lalor and Rainford (2014) claimed that students find that learning biology is complicated, and this caused low interest in learning biology. Surprisingly, most male students find it difficult to learn biology and show lack of interest. Students are not willing to take a science related path as there is an assumption that science is difficult with many science concepts to understand (Bramwell et. al., 2014). This is supported by the findings of KPM (2013) which mentioned that Malaysian students do not dislike or fear science but chose the social sciences because relatively students are more in control. Sumintono (2015) stated that low achievement of students in science in the country is worrying. Barron (2000) opines that biology is not a challenging subject as the learning focus requires memorising. This is supported by O'Leonard (2014) who stated that biology is a boring subject because it uses memorising method as the main approach in remembering various terms and facts that burden students. Ministry of Education, Malaysia (2010) reported that students use memorising technique in biology and usually they do not answer problem solving questions.

Biology is known as a hard subject where abstract concepts were generally taught (Brown & Schwartz, 2009) and students have to describe what cannot be seen (Roszelina, Suzilawati, Hasrina, Norlizawati & Kamaruddin, 2021). Çimer (2012) also mentioned that students visualise Biology to be difficult as there are lots of concepts, abstracts and complex processes that cannot be observed by naked eyes. These abstract concepts contributed to the difficulties in learning biology among the students (Khan & Masood, 2014). Various studies have reported on difficulties faced by students in learning Biology for example, topics considered hard to understand by students are genetic related topics, such as mitosis and meiosis, genes and chromosomes, and Mendelian genetics. Nature of the topic, teachers' style of teaching, and students' learning styles and attitude toward the topic are the main reasons for the learning difficulties (Cimer, 2012). Chiu, Dejaegher and Chao (2015) mentioned that invisible and abstract subject matter may cause difficulty learning or low achievements in courses. Saidin, Halim and Yahaya (2015) claimed that overgeneralization and false examples cause misunderstandings in learning biology.

Due to the conceptual nature of the content, students find biology difficult (Waghid, 2015). Rouse (2013) also supports this by stating that students lose interest and motivation in biology due to it being overly complex and difficult. Students are able to learn most difficult subjects like biology as students' motivation and engagement are prominent due to Kahoot! (Jones, Katyal, Xie, Nicolas, Leung, Noland & Montclare, 2019).

The learning process in most schools is still teacher-centered (Baeten, Kyndt, Struyven & Dochy, 2010). This is supported by Saleh and Aziz (2012) who stated that teaching method commonly used in Malaysian secondary education is teacher-oriented and there was minimal interaction between teacher and student during class. Connell, Donovan and Chambers (2016) similarly mentioned that teacher-centered style is used in traditional biology teaching where teachers use PowerPoint presentations where students less participate, listen, take notes and only memorise leading to students do not understand or unable to apply the information. The "chalk and talk" method is the most common intervention used by most teachers in teaching and learning as this method is the easiest in managing the class and helps in completing the syllabus fast (Becker-Weidman, Jacobs, Reinecke, Silva, & March, 2010). This method promotes inactive learning where teacher centered learning is conducted. There is no active communication between teacher and students (Razali, Talib & Othman, 2017). In this 21st century many modern tools are in usage and yet there are still teachers who are more into the classical and outdated teaching methods for example, teachers convey biology facts directly to the students and encourage note memorization for examination purposes (Chiel, McManus & Shaw, 2010). Students may face obstacles when they enter into higher education as in higher education, the student-centered approach is common. Students takes ownership of their own learning in student-centered approach (Baeten et. al., 2010). A student centered approach is when the teaching method shifts focus from teachers to students to give them the responsibilities to venture through the learning process and teachers as facilitators. The learning environment forces students to be independent and active in seeking knowledge (Herranen, Vesterinen & Aksela, 2018). Yeoh (2013) stated that group discussion creates effective learning because involves critical thinking and this helps

in students' achievement in biology. According to Payne and Zimmerman (2010), in current situation where the world is getting more complex with the usage of technologies, conventional teaching is irrelevant. Teaching and learning in the classroom need a teaching method that can attract students' interest and concentration (Fazilah, Othman & Azraai, 2017). To enhance meaningful learning, biology concepts must be related to real life contexts. This will also avoid a negative perception that learning biology is a burden (Hall, Reiss, Rowell & Scott, 2003). Therefore, more practices in making Biology learning interesting should be promoted to overcome the challenges and to improve Biology learning among students (Matawali, Bakri, Jumat, Ismail, Arshad & Din, 2019).

Students' science achievements are influenced by home and school environments (Juan & Visser (2017). According to Schulze and Lemmer (2017), family can play a very important role by promoting science learning. Learning achievements of students are also affected by their behaviour for example visiting the library, reading, following lectures, prepared for examination and surfing the net for course materials, and students' academic achievement is better when they often show positive learning behaviour (Tokan & Imakulata, 2019). Learning behaviour is supported by classroom atmosphere and infrastructures such as laboratory. Learning can be affected if lack of laboratory equipment and materials. Laboratories may be cramped, unclean and have unstable voltage (Tokan & Imakulata, 2019).

Tokan and Imakulata (2019) also claimed that habits too improve learning achievements for example asking if not understanding, listening seriously, reading before and after lesson, making summary, being punctual and discussing with friends.

Students' difficulties with many topics in biology have stimulated researchers to investigate why students experience such difficulties. Besides learning from text-based knowledge, visual illustrations improve students' activity and motivation. Thus, visualisation and visualisation technologies are important in learning biology (Chiu et. al., 2015).

The top 10 technologies in the 21st-century teaching are three-dimensional printers, mobile devices, gamification, digital electronic books, social networks, student response systems, digital videos, podcasting, lecture capture applications and simulations (Tomei, 2017). Osman and Hamid (2009) mentioned that technology has been immersed as part of the students' life in science teaching and learning. The learning styles of many students have changed due to rapid advances in technology. These students have grown up in a world where technology is second nature to them (Annetta, Cheng, & Holmes, 2010). To enhance student understanding and interest in biology, online social networking and electronic-based resources are increasingly being used (Musante, 2008). Effective and relevant teaching and learning strategies are necessary to fulfil the needs of today's learners who prefer digital resources to access information, communicate, and solve problems (Oblinger & Oblinger, 2005). Students nowadays are prone to games and more to video games. Among the reasons for the use of games in education is that classroom gamification may be appealing and motivating for the new generations of students that have grown up in the age of video games (Glover, 2013). Gamification is a powerful tool to attract students. A good gamification will attract their interest to learn and catches their attention for a long period of time (Freitas, Lacerda, Calado, Lima & Canedo, 2017).

Students' behaviour is also an important aspect in the learning process. Behaviour problems in the classroom leads to stress for teachers and students. The flow of the lesson is also disrupted and conflict forms in the learning objectives and the process of learning. Behaviour problems change the classroom dynamic by shifting the focus from academic tasks to distraction provided by unwanted behaviours (Parsonson, 2012). Nussey, Wilson and Brommer (2007) mentioned that correct behavioural responses depend on cognitive abilities and behavioural flexibility. Positive learning behaviour must be focused as it is important towards oneself and willingness to learn (Tarr, Reys, Reys Chavez, Shih & Osterlind, 2008). According to Abdul Rahim (2011), positive behaviour encourages enthusiasm and initiative for learning while Vellymalay (2011), further stated that positive behaviour encourages learning through self-awareness and self-commitment. Positive behaviour towards learning and the strength of attitude formation determines a person's success (Chin & Zakaria, 2015). Bergin and Bergin (2012) use the term prosocial behaviours to refer to behaviours that benefit others or has harmonious relationship with others. Honig (2007) mentioned that prosocial behaviours must be nurtured as they involve values such as discussion, teamwork, sharing ideas, fairness, tolerance, mutual respect and being open minded. Chin and Zakaria (2015) stated that positive behaviour can be enhanced through the integration of game activities in teaching and learning for example winning is a form of encouragement and will motivate a student to achieve success.

Shrestha and Gupta (2019) mentioned that personal behaviour differs from person to person and behaviour and characters of an individual are also affected by values. Gamage, Dehideniya & Ekanayake (2021) defined values as behaviours, attitudes and fundamental beliefs that have been approved and accepted as what is good by society while according to Shrestha and Gupta (2019), values shape choices, relationships and sense of who we are. Educational values or values in education are seen as a medium that brings positive changes in behaviour among students (Kumar, 2017) and provide the criteria by which we decide if something is good, bad, right or wrong (Shrestha & Gupta, 2019). According to Hong, Cheng, Hwang, Lee and Chang (2009) educational values such as emotional fulfilment, knowledge enhancement, mentality change, thinking skill development, spatial ability development, interpersonal skill development and bodily coordination emerged when children play DGs. According to Hong, Cheng, Hwang, Lee and Chang (2009), DGs have been assumed as an important place in the lives of children and adolescents. Gros (2007) explained that DGs are user – centred; they can promote challenges, co-operation, engagement, and the development of problem – solving strategies. This is supported by Panoutsopoulos and Sampson (2012). According to them, designing and implementing meaningful activities with the support of the selected DGs, offered opportunities for engaging students in problem-solving actions.

As a summary, it is very clear that students have problems in learning biology and some of the problems are related to the subject itself for example biology being complicated, boring, abstract, complex and difficult. Students too attempt to “learn’ biology by memorising, which often cause them to unable to remember. Teacher’s teaching style is also the contributing factor. Teachers use “chalk and talk” approach

as it is the easiest to manage the classroom during teaching and learning and helpful in completing the syllabus. Many classrooms are still teacher centered with minimal interaction between teachers and students during the learning sessions. Teachers teach and students are passive learners where they listen, take note and memorise without understanding or able to apply the information. Teachers convey the biology facts directly and encourage students to memorise for examination purposes. The classroom atmosphere affects learning behaviour of the students and learning achievement is affected by their behaviour. Behaviour plays an important role in learning. Positive behaviour encourages enthusiasm, motivates and initiates a student to learn. Teaching and learning require methods that attract students' interest, Teaching and learning using technology is a fruitful approach and positive behaviour can be enhanced through the integration of games. Many students spend long hours playing online games. Gamification is a powerful tool that can catch students' attention for a long period of time which helps attracting students' interest in learning. Students prefer games in education as games are appealing and motivating. Students prefer digital resources to access information, communicate and solve problems. Educational values emerge when students play DGs and educational values are seen as a medium that brings positive change in behaviour among students. To attract student's interest, this research used Kahoot as a DG approach to attract students to learn biology. At the same time, the educational values that emerge and the frequently emerging educational values are also studied. Frequent exposure to DGs may have effect on the students' behaviour. Thus, this research also focuses on the change in their behaviour.

1.4 Objectives of the Study

Consistent with the statement of the problem, this study aims:

1. to describe students' internet usage and gaming experience.
2. to describe the problems faced by students in learning biology and how they overcome them.
3. to identify the educational values that emerge when the students play DGs such as Kahoot.
4. to describe student's change in behaviour when playing DGs such as Kahoot.

1.5 Research Questions

Based on the defined research objectives, the following research questions are posed:

1. How are students' internet usage and gaming experience?
2. What are the problems faced by students in learning biology and how they overcome them?
3. What are the educational values that emerge when the students play DGs such as Kahoot?
4. How are student's change in behaviour when playing DGs such as Kahoot?

1.6 Research Theoretical Framework

The theoretical framework in this research uses Information Processing Theory, Behaviourism Theory, Gagne's Learning Theory and Cognitive Theory of Multimedia Learning. These theories are related to playing games, learning and change in behaviour.

Information Processing Theory is a cognitive theory of learning and was developed by Miller (1956) who believed that the mind receives the stimulus, processes it, stores it, locates it, and then responds to it. Individuals gradually build a capacity to hold and process information, which allows them to gain knowledge and skills. The information that has been received will be encoded, then stored in memory. The theory explains how a person learns information and can remember it for a long time. If the information is well organized, then the information obtained will be easier to process.

Behaviourism Theory can be described as a learning process that can be obtained its outcome based on the environmental conditions that the learners are exposed to (Kay and Kibble, 2016). It focuses on the stimuli that are given to the learner and the response given out from stimulus to the learner itself. This theory upholds the 'rewards and punishment' system by rewarding desired behaviour and punishing undesired behaviour. This theory rejected the internal mental state of an individual as it cannot be observed and be subjected to any interpretation.

Gagne's Learning Theory identifies five major categories of learning. They are verbal information, intellectual skills, cognitive strategies, motor skills and attitudes (Gagne & Glaser, 2010). Gagne (1985) stressed that different internal and external conditions are necessary for each type of learning, for example, in order to learn cognitive strategies, new solutions to problems must be practiced and developed. In the hierarchy proposed by Gagne, problem solving is the highest level of learning because it requires mastery of the next lower type of learning.

Cognitive Theory of Multimedia Learning is based on Mayer and Moreno (2003), who stated that learning from pictures and words using multimedia instructions as the vehicle that delivers the pictures and words for learning is known as multimedia learning. The static pictures are either animation or static, and in the form of graphs, diagrams, illustrations or charts while the words are on the screen or spoken as narration. This theory is based on three assumptions: dual channels, limited capacity and active processing. Learners' brain processes visual and verbal materials separately (Mayer and Moreno, 2003). According to Toh, Munassar and Yahaya (2010), relevant words are processed in verbal working memory while relevant images are processed in visual working memory. However, there is a limit to the amount of verbal and visual information that the channels can process. Learners' cognitive processing should be able to select, organize and integrate visual and verbal information presented with prior knowledge, for meaningful and deeper learning to occur (Mayer, 2009).

Figure 1.1 shows the learning theories related to this research.

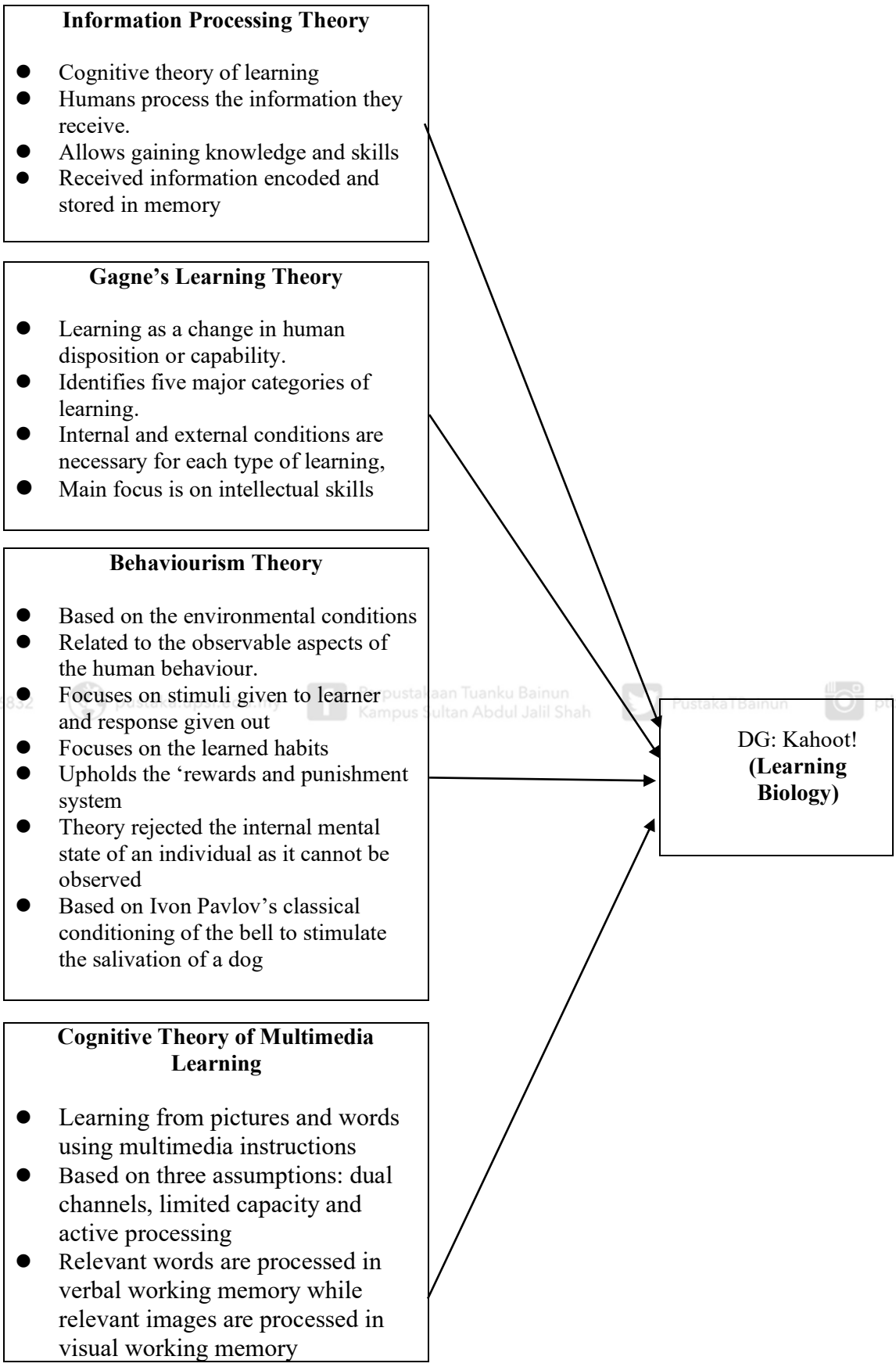

Figure 1.1. Theoretical Framework of the Research

1.7 Research Conceptual Framework

Based on Figure 1.2 below, problems in learning biology are identified. The students are exposed to DG in the form of Kahoot to give them a different approach in teaching and learning biology. The students play as well as learn in a fun way. Kahoot fits as what is suggested in Information Processing Theory, Gagne's Learning Theory and Cognitive Theory of Multimedia Learning.

Based on the Information Processing Theory, students' mind receives the stimulus in the form of the Kahoot, processes it, stores it, locates it, and then responds to it. The more organized the information presented while playing, the easier it is for the students to remember it. Information that entered into short-term memory will be combined with information on long-term memory so that it can remain in the students' memory system. The capacity and duration of working memory are very limited, so to be maintained in working memory playing Kahoot must be very often, because without repetition, the information will disappear after a while. When information is in working memory, the knowledge associated with it in long-term memory, also called permanent memory, will be activated and placed in working memory to be combined with new information.

According to Gagne's learning theory, interaction of various internal and external factors can help achieve learning (Cetin & Solmaz, 2020). Thus, interactive pedagogies like role play, pair and group discussions, think, pair and share activities, group interaction, brainstorming and gamification like Kahoot proved to be constructive (Jaiswal, 2019). The use of supportive technology may increase expected

performance (Cetin & Solmaz, 2010). In this research, students play Kahoot! and it involves problem solving skills too. According to Gagne, problem solving is the highest level of learning because it requires mastery of the next lower type of learning. Problem solving requires the use of prediction and the analysis of facts and principles to identify cause and effect relationships among physical phenomena in the environment.

In Cognitive Theory of Multimedia Learning, students' auditory and visual channels process the information when they are playing Kahoot. Information in the form of sounds are processes in the auditory channel while in the visual channel, information processed are in the form of visible objects. Both channels combine to process the multimedia information and channel to the sensory memory or the short-term memory and finally to the working memory. Logical mental constructs are produced by selecting and organizing materials in the working memory (Mayer, 2003). To successfully transfer knowledge, information must be integrated with prior knowledge (Yue, Kim, Ogawa, Stark and Kim, 2013). Multimedia learning occurs when students build mental representation from pictures and words to process information and integrating with prior knowledge.

In this research, the research believes outcome of playing Kahoot will cause the emergence of educational values. When students play together as a team with others, values like teamwork, socializing *et cetera* can be seen. When students play alone, educational values like hardworking and confidence are visible through their actions. Change in behaviour will occur when students play Kahoot! and this is as stated in the Behaviourism Theory. The stimuli in the form of Kahoot! is given to the

students and the response given out is in the form of change in behaviour. Positive change in behaviour for example managing time well and better interaction with others will help to reduce the problems in learning biology. Negative change in behaviour such as antisocial and bullying will further contribute to the problems faced by the students. Figure 1.2 below shows the conceptual framework related to this research.

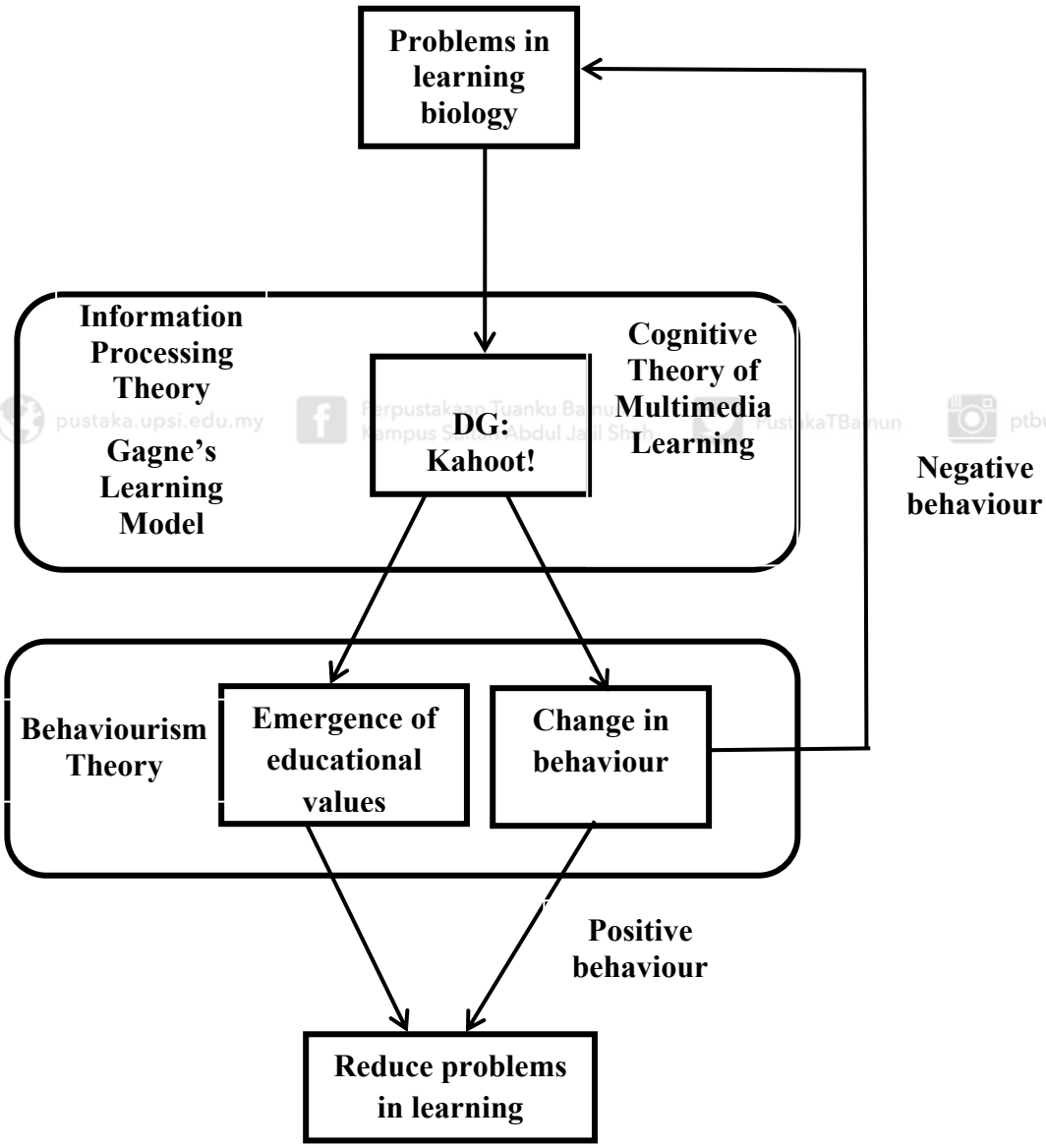

Figure 1.2. Conceptual Framework of the Research

1.8 Significance of Study

This study is important as it is attempting to reduce the problems faced by students in learning biology by suggesting DGs such as Kahoot. This approach is seen as an alternative approach to the traditional way of learning biology in the classroom or laboratory. The significance to students, teachers, school, State Education Department, MoE and CDC and others will be discussed below.

1.8.1 Students

The science curriculum for secondary school has been designed as to provide students with the knowledge and skills in science, develop thinking skills and strategies to enable them to solve problems and make decisions in everyday life (MoE, 2002). Zakaria and Iksan (2006) mentioned that education today must enable students to meet the challenges ahead and demands of the work environment and of daily living. Thus, students not only need knowledge but also communication skills, problem solving skills, creative and critical thinking skills in the years ahead. Students nowadays are very much interested in using modern online gadgets such as Facebook, Twitter, Skype, etc. Posso (2016) mentioned that due to internet revolution, many students spend most of their time playing online games. The findings of the study will be beneficial to the students as they could use DGs as their learning process and enhance their interest in Biology. There are many DGs related to chapters in Biology to enhance students' understanding of the particular topic and make development in the subject matter.

1.8.2 Teachers

To the Biology teachers, this is an advanced teaching method whereby students learn by themselves, and teachers facilitate. The DG is accessible through internet which is available in most schools nationwide and there will be more advanced tools which will be and are being used in the classroom as now students have their own laptops. Teachers can make this as an advantage by exposing students with DGs in the classroom and later get the feedback at the end of the lesson. The teachers can also plan their lesson accordingly to improve the learning process. To create a conducive environment for learning, teachers must be creative and being creative will assist in better learning outcomes.

1.8.3 School

Sijil Pelajaran Malaysia (SPM) is an important public examination for Form 5 students before leaving their secondary education. Every year the results will be announced in March. The percentage of passes as well as the best achievers for each subject is focused. The number of passes for biology is relatively low compared to chemistry and physics. One factor is because biology is content based where facts are more. This is a setback as most students do not like to read and prefer memorising. This causes them to lose interest. By attracting the students to learn biology by playing should help the students as well as increase the percentage of quantity and quality in SPM biology. This will be plus point to the school.

1.8.4 Ministry of Education (MoE)

The Ministry of Education will benefit from this as they can introduce the DGs in the revised Biology curriculum. Apart from that the manufacturers and courseware developers would also benefit because they can produce variety of DG software either offline or online for the use of students in schools. The current multimedia courseware, which is being used for teaching and learning Biology, given by the Ministry of Education since 2003, is less effective as there is lesser participation of the students during the teaching and learning process. According to Pandian and Ramiah (2006), the multimedia courseware was said to be unsuitable for low English proficiency students, as they were not able to understand the language used to deliver the content. DG is student friendly as students play and learns as well during the teaching and learning process.

1.8.5 Curriculum Development Center (CDC)

The Curriculum Development Center (CDC) will be benefiting from this research as they have more materials to be included in their syllabus. The implementation of the new biology syllabus from 2020 onwards will be the best way to introduce DGs in the syllabus as DG is a technology fused learning. The new syllabus focuses on the current trend in learning approach by incorporating technology-based learning. The officers from the CDC can incorporate with the schools to implement the DGs as it benefits both the students as well as the teachers.

1.9 Limitations of the Study

This study is limited to form 4 science stream students from a sub - urban school in a selected district in Perak state. The participants are chosen because they are not sitting for any public examination and due to that it will be easier to involve them in the research. Furthermore, the school administration will not allow researcher to conduct study on the form 5 students as they will be sitting for SPM (Sijil Pelajaran Malaysia) public exam. The form 4 students are learning Biology as a new subject in Form four, thus this group will be suitable for this research. The respondents in this particular class are of average and good, and they have adequate knowledge of using social media and playing online games as well. This school has only one science stream class with 34 students. Thus, it is impossible to generalise the findings to the entire state of Perak or Malaysia overall.

Since this research focused on Kahoot as a DG, the researcher had to introduce Kahoot beforehand in the classroom because some respondents are not aware of the existence of such a DG. They are exposed to the DG until the respondents are familiar with DG. In Chapter 3, explanation is given on how the choice of DG was finalized for the purpose of this research. Throughout the research, observations are made. For interview purpose, respondents are selected based on purposive sampling and the size of the sample depends on information saturation. The pilot test was conducted earlier, and necessary changes were made to suit the research.

1.10 Operational Definition

a) **DGs** - Digital Games - In this research, digital games (DGs) refer to Kahoot. It has questions that need to be answered in a given time frame by students. The scores appear at the end of tasks.

b) **Internet usage-** In this research, internet usage is defined as the duration spent by students accessing the internet using any electronic devices such as handphones, desktops, laptops *et. cetera* for gaming purpose.

c) **Gaming experience-** The experience of the students in playing electronic games using any electronic devices such as handphones, desktops, laptops *et. cetera*.

d) **Educational values**- Educational practices through which students are assumed to learn values. The aim of educational values was to promote children's understanding and knowledge of values so they can act according to these particular values as members of the society to which they belong (Halstead and Taylor 2000) and Thornberg (2008). In this research, educational values are defined as values that are expressed or seen among the students that has positive or beneficial characteristics when they play Kahoot.

e) **Student behaviour**- Student behaviour is the frequent habit expressed by each participant in this research. Any differences in their habit may be considered as change in behaviour. Change in behaviour is categorized into positive change in behaviour and negative change in behaviour. Any behaviour that benefits positively to

the participant or other participants, are considered as positive change in behaviour and vice versa.

f) **Learning problems**- Learning problems are issues that cause students to have problems in learning biology. These problems are due to various factors that affect the participant. These problems cause participants to have difficulties in learning biology.

1.11 Conclusion

Chapter one has presented a general introduction and rationale for this study. The problem of the study, which consists of a concise discussion of the background and statement of the problem, has been highlighted. In addition, the purposes, significance, limitations, and the definition of specific terms used in the study have been stated.