MOTIVATION IN INFORMATION COMMUNICATION AND TECHNOLOGY-BASED SCIENCE LEARNING IN TAMIL SCHOOLS

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ABSTRACT

The purpose of this study is to examine the impact of Information Communication Technology (ICT) utilisation in learning science to improve students' motivation. This study examined 100 students from Malaysian Tamil vernacular schools to learn ICT-based science.Research design used a mixed method approach involving quantitative and qualitative data. Students answered the Science Motivation Questionaire II (SMQ II) instrument based on the dichotomous scale that uses "Yes or No" questions. Open-ended questions were also analysed qualitatively. The instrument was divided into five categories, namely Intrinsic Motivation, Grade Motivation, Self-efficacy Motivation, Self-determination and ICT Motivation. The findings showed that all 25 items of SMQ IIhad significantly high level of motivation. 90.2% of respondents agreed that ICT-based learning of Science stimulated their Intrinsic Motivation. Respondents admitted that factors such as Elements of ICT (46.6%), Assisted Learning (30.10%) and Stimulated Interest (23.3%) had been their attraction towards the usage of ICT in learning Science. This study also identified that respondents regarded the level of internet accessibility (34.7%) and health (25.5%) as being the main obstacles to using ICT during Science learning. Findings from this study show health issues hinder the usage of ICT in learning Science. Therefore this new element should be taken into account so as not to become a constraint for their motivation. The significance of this study is to enable Tamil vernacular school students to show interest in studying science.

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Keywords: science learning, Tamil vernacular school students, ICT

INTRODUCTION

In the digital world today, the position of the computer and Information Communication Technology (ICT), remains on the front row.The integration of ICT in education is also growing rapidly. This means ICT can be an effective and interesting instructional medium of Teaching and facilitating (T&F) in education, especially in Science.The rapid development of ICT has become one of the attractive factors in enhancing the motivation of students (Granito & Chernobilsky, 2012; Ciampa, 2014; Fook & Sidhu, 2013; Granito & Chernobilsky, 2012; Ziden et al., 2011) find that ICT is capable of facilitating teaching presentation, diversification in teaching activities, making lessons more fun and interesting as well as improving student motivation. Furthermore, the use of ICT is identified as the best measure to confront the complexity of the science subject (Sin et al., 2013).

ICT and its motivation becomes an effective channel to improve the achievement of pupils in Science T&F. The goal of the Curriculum Development Division for Science subjects is to

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"inculcate the interest and to develop the creativity of pupils (Malaysia, 2012). In reality the capacity and the impact of ICT is not known in general (Granito & Chernobilsky, 2012). According to Naim & Tunggak (2014), teachers and parents need to realise that motivating students to excel in academics at school is a priority. This is proven when the target in science education Perkara 4.9, Dasar Pendidikan Negara (Abu Bakar et al., 2017) based on the ratio of 60 per cent of science stream students and 40 per cent of small letter arts streem students has yet to be achieved. In fact this trend of depreciation is increasingly worrying. Currently, the ratio is at 21:79 (Abu Bakar et al., 2017).

In addition to this scenario, the achievement in Sekolah Jenis Kebangsaan Tamil (SJK (T))Ujian Pencapaian Sekolah Rendah (UPSR) Science in Tamil vernacular schools in Perak, a state in Malaysia, has been on the decline since 2011 (Perak State Education Department,2017). MIB Cooperation (2017), expect that the gap between National Schools, Tamil Vernacular Schools, and Chinese Vernacular Schools can be reduced.However, the problem of self-motivation among students of Tamil vernacular schools and the decline in the achievement in Science is an agenda that should be given attention. Tamil vernacular schools were initially formed with various deficiencies without the existence of a clear consistency on the syllabus, guidelines and standards. Now, changes and development in the nation's education policies have brought about changes to the Tamil Vernacular School education system in Malaysia. At present, Tamil Vernacular Schools operate based on a standard syllabus, guidelines, textbooks, trained teachers and the pupils of year 6 will be sitting for the UPSR public examination. The syllabus has been the basis for the acceptance of science among students. The Science syllabus and Kurikulum Standard Sekolah Rendah (KSSR) science content in Tamil Vernacularschools is designed in accordance withthe National Education Philosophy where the knowledge of science and technology skills can be mastered. (Malaysia, 2012).

After the arrival of the British, the education system in Malaya developed more systematically.Vernacular schools were established in accordance with the Labour Act (1900). Tamil schools had features that reflected the different ethnic groups in the Indian community. Each of the ethnic groups sent their children to get education in schools that used their respective mother tongue.The British established these schools in accordance to the location of Indian settlements, and Tamil schools were placed in the rubber plantation estates.

The interest of vernacular schools was given attention in the Razak Report 1956. This report emphasises the importance of education system through the use of mother tongue. According to the Malaysia Commissioner of Law Revision. (1996) Act 550, ' National Primary Type Schools' refers to government primary schools or primary schools with government assistance that use Mandarin or Tamil language as the medium of instruction. The rationale behind the setting up of vernacular schools is to avoid racial issues in a country that has a variety of native languages and different lifestyles. Vernacular schools came about without the existence of a clear uniformity on the syllabus, guidelines, and standards. Currently, the building and facilities status of Tamil schools are experiencing changes that are encouraging, but the achievement of academic performance has not reached the achievement as seen in Chinese Vernacular schools. The level and standard of Tamil Vernacular Schools is expected to be well established with the application of ICT in Teaching and Facilitation (T&F). The effectiveness of ICT can be proven by the existence of studies in the use of ICT in Science T&F.

ICT includes "one software to convert, store, protect, process, transfer and acquire information" regardless of place and time. In line with the development of the world, Malaysia also applies technology in education which is experiencing constant changes. The development of a country is only meaningful when it is driven by mastery in science and technology (Abdullahi, 2014). In a world moving towards digital media, the role of ICT in education has become increasingly important. Students who do not master ICT, are considered as outdated witha lack of knowledge and poor academic achievement (Ahmad, 2016). This period is known as the information era with many communication channels such as email, SMS, internet browsing, messenger, web-meeting, viber, BBM, Google Talk, Skype,Web 2.0 Technologysuch asYoutube, Blog, Twitter dan Facebook (Atan, 2016). Now, various online software applications are designed with the aim to facilitate T&F on special topics for all levels (Garba et al., 2015).This situation has created space and broader opportunities for teachers to use ICT in their T&F. Moreover, ICT and the digital age has changed the way pupils learn and access information (Shivana et al., 2014).

Ministry of Education Malaysia has launched various strategies to encourage teachers to use ICT in class (Ahmad, 2014). However, its use

is still not widespread. Integrating ICT in the classroom is not as easy as it might be. The findings by Mohamed et al. (2012), show the percentage of computer ownership and the use of ICT in rural areas is low while on the other hand basic ICT skills are at a medium level. This discovery indicates a digital chasm which is an ongoing issue in rural areas.

Science education has become an agenda in the world arena. As the world is becoming globally closer and is dependable on intellectual resources, the question of how to achieve high scientific literacy for all children around the world becomes a priority for us to consider. Knowledge of science in a globalised world plays an important role in supporting and reinforcing economic and cultural globalisation (Chiu & Duit, 2011). Evaluation of Educational Achievement (IEA) on the other hand organises international benchmarking for the Science subject in order to enhance the performance of Science in the international arena (BERNAMA, 2018). In line with this international bench-marking, Thomas & Watters (2015), also admit that Science is the most powerful way in thinking and understanding in order to address the various problems that are shaking the world. According to Chiu &Duit (2011), Germany organised a symposium on standards in science education where it invites representatives from across the country to contribute their expertise and experience on the development of scientific standards in various cultures .

The lack of competency of teachers and equipment caused the deterioration in the performance of science in Tanzania (Kafyulilo et al., 2015). Cross & Board (2014) find that pupils (aged 10 to 14 years with the change in individual thinking from simple to a more complex level) showed no interest and a negative attitude towards inquiring about new findings in science. Based on these findings, it is clear that ICT has a role in improving the performance of science abroad. Even so, the decline in science achievement can be attributed to the lack of ICT usage.

Numerous research in the use of ICT by science teachers have been conducted in foreign countries. However,the findings cannot be adapted according to the culture and context in Malaysia. Hence,there is a need for an intensified study in Malaysia (Ahmad, 2014). This scenario clearly indicates that research on the use of ICT among teachers should be prioritised by educational researchers. In ICT, Power Point is an easy way to use as a content delivery tool and is an element of assistance for the elaboration of complex science concepts (Ahmad, 2014). Chua & Don

(2013), suggested that every school have a coordinator to handle ICT. He also proposed thatmodern computer labs be made available in schools. Science teachers should be given the opportunity to become ICT literate while in service. Ministry of Education Malaysia has provided all ICT facilities and given exposure to teachers under the platform of smart school. However the level of acceptance and the usage by teachers is still the main issue. The technical aspects of ICT usage are identified as key issues and becomes a stigma that inhibits the success of ICT and Frog VLE (Hamzah & Yeop, 2016).

Menon et al. (2012) found the use of Wikipedia in learning Science also carries some adverse effects such as involving long periods of time for search and discovery of materials based on links. There are also students who identifytheir lack of proficiency in English to be the main obstacle for them to learn online. In addition, the extensive syllabus becomes a hindrance in the use of ICT. As a suggestion 'The structured and constricted syllabus in the science curriculum has to be changed to meet the demands of virtual learning in line with the required 21st century skills (Menon et al., 2012).

The findings by Yasak et al. (2010), showed that the frequency of ICT use is moderate among Science teachers in Johor, a state in Malaysia, but the use of software in science education has helped the learning process and aroused a sense of fun among the students. Furthermore, students who are creative and innovative live in a cheerful atmosphere (Yasak et al., 2010). This situation becomes a reality with the presence of various elements such as graphics, animation and audio which are more interesting compared to textbooks.

Findings by Phang et al. (2014), found out the use of various forms of ICT in T&F were implemented in the science education in this country. In the implementation stage, the suitability in the use of ICT, particularly in science education, is very dependable on infrastructure equipment for the implementation of T&F using ICT, creativity and teacher's innovation and technical support staff, willingness and the interest of teachers and students to carry out T&F using ICT, the school administration using ICT in management (Phang et al., 2014). The study found that the levels of interest, willingness and ability of science teachers in using ICT in T&F are positive.

The study also shows that the integration of ICT in education sow the factors of childhood development in a more comprehensive way. Ac-

cording to Abdullahi (2014), the application of ICT in Science subjects, showed more success compared to other subjects.

Garba et al. (2015) reported that Malaysia is at a more advanced level in their efforts to realise the true potential of ICT in education. Malaysia has access to internet connection at home, at work, at school, and in public places. ICT teaching materials allow the materials to be used repeatedly: they can be used actively wherever the pupils are without a time limit. This situation motivates the teaching content data which can be delivered more easily through the use of ICT(Noor AiniAhmad, 2014).

Science-based ICT T&F in Malaysia (involving 10,000 schools) is progressing into a Virtual Learning Environment (Frog VLE). It allows pupils to be exposed where they can access a wider content, which is exciting and interactive. The use of Frog VLE allows teachers and pupils to access the learning of science no matter where they are without a time limit (Blueprint, 2016).The implementation of Frog VLE, has given space to ICT to act as a bridge to connect the urban and rural areas. Frog VLE network serves as the basis for the construction of the virtual learning platform that can be used by teachers, students, and parents to share learning resources, implement interactive learning, and virtual communication (Ministry of Education Malaysia, 2013). Furthermore the use of ICT can be identified as the best measure to confront the complexity of the science subject (Sin & Norishah, 2013). In an effort to instill a Science culture based on ICT, Smart Schools have been established. Thus, the ability to pursue and master the knowledge of science can strengthen Malaysia's position in the world arena. To achieve this agenda, the use of ICT in Science subjects need to be improved. This will motivate students to explore science.

Motivation in education refers to a set of beliefs about the behaviour that guides both teachers and students in a social environment because they interact with each other during T&F (Abu Bakar et al., 2017). According to Naim & Tunggak (2014), teachers and parents need to motivate students to achieve academic excellence at school which is a priority. Technological equipment and ICT have tremendously influenced the motivation of students and this will lead to changes. The 21st century generation who are so routine are the genuine users in the world of digital technology, will understand its use much easier. In such a situation, technological equipment will tremendously influence the motivation of students in T&F activities (Granito & Cher-

nobilsky, 2012). Yıldız & Aktaş (2015) emphasise the use of the computer as a medium of teaching in a constructive learning environment that encourages students to have more positive attitudes and motivation towards teaching.

ICT factors also contribute to an increase in student motivation. The rapidly growing ICT has become one of the major factors in improving student motivation, according toGranito&Chernobilsky (2012) and (Ananiadou & Rizza et al. 2010). According to Ziden et al. (2011) ICT has enhanced the motivation to learn more effectively and with quality. Ciampa (2014), Fook & Gurnam (2013), Granito & Chernobilsky (2012) find that ICT is capable of facilitating the presentation of instruction, diversification of activities and to make teaching and learning sessions more fun and attractive to students. Furthermore, Chua & Don (2013), found that computer-based testing mode has attracted the respondent motivation to participate in the study.

ICT helps to motivate students and at the same time increase students' performance (Sánchez-garcía et al., 2013). Each student has different needs. ICT fulfills the needs of the individual student and also helps them in their studies by motivating them to study. With these, students learn more effectively (Kler, 2015).

The use of computers and mobile equipment have turned into a new channel and is a rather new T&F culture in instructional media in the classroom (Nikou & Economides, 2016). This is because computer technology and mobile equipment can facilitate learning 'anytime and anywhere' (Nikou & Economides, 2016) and (Ahmad Rafaai et al., 2016). The ability to educate anywhere makesit an increasingly popular medium. Indirectly, this uniqueness has increased the intrinsic and extrinsic motivation and the efficiency of the students, Merino & López (2014) dan Ciampa (2014).This new and contemporary media has also increased student motivation among those who are mediocre and weak, to learn science.

Halili et al. (2011) found that a person's learning motivation has also been increased by the existence of video conferencing technology. With the use of audio and video, students are motivated for being able to see and hear around which raises their level of understanding.This suggests that the use of ICT does not only attract the interest of the students to follow the process of T&F better, but helps to increase the understanding and to make it convenient for teachers to deliver their lessons (Halili et al., 2011).

Students'motivation levels change and the affects are based on several factors. When the

psychological needs of students are met, then the level of their motivation to use assessment enhancement based on mobileequipment increases. When student autonomy and self-rule is supported and there is a positive social influence, students will feel more motivated.

The extensive addition of various low-cost mobile equipment can be obtained with wireless internet service being the main driver in this new era of education (Nikou & Economides, 2016).

In addition, students who have high intrinsic motivation show a lot of passion to learn and understand.The use of mobile technology also gives ample room for individuals to practise the culture of cooperation. Mobile technology can be a tool to convey instructions and functions as a medium to work together. Students can learn in their own way, hand in hand with others and offer advice to each other through a variety of applications (Ciampa, 2014).

Menon et al. (2012) that examines the role of wikipedia in learning Science, found that virtual learning guided by steps or process may increase the motivation of students studying science. In addition to improving motivation, such equipment is also found to increase the camaraderie between students, lifelong learning and create a conducive learning environment.

Fook & Sidhu (2013) find that ICT has increased the motivation to learn more effectively and with quality. Fook & Sidhu (2013) and Ciampa (2014) find ICT is capable to facilitate teaching, diversification of activities to make teaching sessions and learning more fun and attractive to students.

However, the findings by Granito & Chernobilsky (2012) show different results.His findings show that, if given a choice, students would wish to complete their tasks using paper-pencil method compared to using the computer. Lack of interest in computers because of the 'difficult to operate' mentality by the user, effectuate such conclusion.

The findings of this study recommend that children need to be exposed to the use of computers so they can be acquainted with the technology at a very young age. In addition to the idea of Granito & Chernobilsky (2012) and Abubakar (2015), described though, that using technology tools will not guarantee the success of the students, the students' skills and the ability of the pupils to compete globally.

METHODS

Tamil vernacular schools have pupils who study all subjects in their native language which is Tamil. Science is also taught in Tamil language except for the existing Dual Language Programme. The researcher surveyed the T&L Science using ICT and what is encouraging and inhibiting ICT usage during T&L Science.

Research design used a mixed method approach involving quantitative and qualitative data. Quantitative research questions in this study inquire about the relationships among ICT usage in T&L Science with studentmotivation. The qualitative data (open-ended question) is to make descriptive assertions about the student in using ICT during T&L Science lesson in class.

For the present study, the relationship between student experiences in usage of ICT during T&L Science by the teacher and student motivation was examined through a reliable instrument, the Science Motivation Questionnaire II (SMQ II). SMQ II by Glynn et al. (2009) comprises 25 items (each subscale has five items) used for monitoring: intrinsic motivation, ICT motivation, self-determination, self-efficacy and grade motivation.

Data from the questionnaire were measured quantitatively with a Dichotomous scale. The response pattern followed 'Yes' or 'No'. The goal of dichotomous scale was to measure students' interest in the usage of ICT by the teacher during T&L Science in class. The researcher used percentage to determine the level of the students' motivation. The qualitative analysis was also done to the attractive factors and factors which become an obstacle during the usage of ICT in T&L Science.

This study involved random sampling that was selected based on rural areas which have an average achievement in the UPSR examination. The criteria of the pupils were based on Standard Four pupils who were currently studying in rural Tamil schools. This study involved 10 Tamil vernacular schools that were homogeneous in the aspect of age, school infrastructure and trained instructors. The students examined in the aspect of ICT towards T&L Science based on SMQ II developed by Glynn et al. (2009). All schools of which achievement is moderate were chosen based on the median scale (Idris, 2013). The researcher chose 10 students (from each school) to

answer the questionnaires and to examine their motivation towards ICT usage. This study involved questionnaires (SMQII). SMQII instruments use dichotomous elements. Dichotomy items involve short responses items such as "yes" or "no" to enable respondents to choose one of the two options given. Dichotomic items are best suited for ten-year-old pupils.

There were two open-ended questions that needed to be answered briefly by students. The researcher has made Back-to-Back Translation for SMQ II which was originally in English. These SMQI I items were translated into Malay and then translated back to English with the help of an English language expert to ensure the validity of the instrument. Originally, SMQ had 30 questions which were reduced to 25 in SMQ II. For this study, the researcher took SMQ II with 25 questions but integrated it with ICT components and dropped components related to career motivation because they are not suitable for primary school students and more suitable for teenagers who will leave school. Previous studies such as Nikou & Economides (2016), Schumm & Bogner (2016), Chua & Don (2013), and Glynn et al. (2011) has observed university respondents, teenagers and secondary school students. However, for this study, the respondents were only primary school students. Thus, career motivation was dropped for this study. The researcher used percentage to determine the level of the students' motivation. The qualitative analysis was also done for the attractive factors and factors which become an obstacle during the usage of ICT in T&L Science.

The first Research Question was analysed using percentage. The answers were analysed manually by counting the percentage. The objective of this research is to examine the level of motivation among Tamil Vernacular school students. The motivation level for these primary school students was measured using the dichotomous scale whichonly involves two options "yes" or "no" as answers. For primary school children of 10 yearsold, it is a good way to analyse and it is an appropriate way to examine the level of their motivation.

For the second research question, data were analysed using the manual procedure. Themes and sub-themes were coded using manual reading because they involved short answers written by Year 4 students. For the content validation of data, the researcher used an expert from the language field (27 years' experience) to confirm the usage of the theme and sub-theme.

The Social Learning Theory was pioneered by Albert Bandura. Bandura introduced a learning process called 'Observational Learning' in 1986. The latest Bandura theory includes a dynamic system that describes human adaptation, learning and motivation (Woolfolk, 2010). According to Bandura, impersonation takes place through observations of the behaviour of the model in the person being imitated. In conclusion, imitation or modeling behaviour is the result of reinforcement. The culture of this model begins in school when students see teachers as a force to be respected. Teachers are also models of pupils because of the areas of expertise they have. The expertise in delivering knowledge based on current needs such as ICT divisors is highly regarded by students. Hence, students begin to show interest and motivation towards learning. Indirectly, culture imitates teachers as the latest expertise encourages motivation to learn among students. Among the implications associated with T&L is that as a teacher, it is important for teachers to give each student an opportunity to observe and emulate various types of ICT-based models in order to motivate their learning. Teachers can perform activities such as giving quizzes based on latest technologies such as ICT, which challenge students' minds so that their cognitive skills can grow continuously. The ability to imitate and self-efficacy help individuals to progress towards excellence. In this study, the use of ICT as one of the strategies that becomes the attraction and imperative will be examined.

Bandura's (1986) Social Cognitive Theory is one of the most influential theories in psychosocial and education field, especially applicable to understanding an individual's innovation of adoption in terms of their belief and attitude development (Leong, 2017). Bandura's (1986) Social Cognitive Theory emphasises on social learning through modelling. Students in this study who observed teachers adopting a particular innovation (ICT usage in T&L Science) may be more inclined to consider adoption themselves. By observing teachers using ICT, students acquire skill and knowledge, beliefs and attitudes. The research Model for the study as shown in figure below.
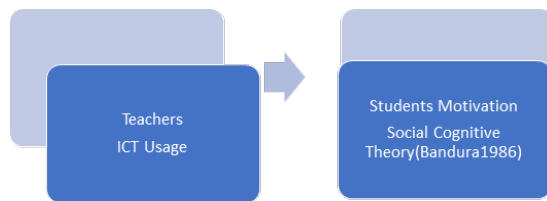
Figure 1. Research Model

This study aimed to figure out how teachers' ability and usage of ICT's impact on student motivation to learn Science in rural Tamil Schools. This research model will give an input to answer the Research Questions.

RESULTS AND DISCUSSION

This study involved 100 respondents comprising primary school students. Gender analysis data shows a total of 53 percent of the respondents are female and a total of 47 per cent are male students. All the respondents were pupils at age 10 and were studying at the Tamil vernacular school located in rural Perak in Malaysia. This study examined the level of learning motivation of science based on ICT. Figure 2 shows the level of motivation of each SMQ II component that shows a high percentage, theintrinsic motivation (90.2%) being the most notable element among the pupils who learned Science based on ICT. Intrinsic motivation is followed by self efficiency motivation (87.2%), grade motivation (87%), ICT motivation (83.4%), and self determination motivation (67.4%) respectively.
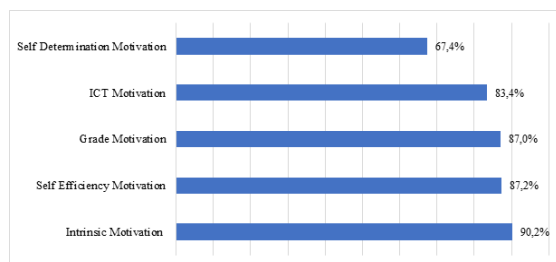
Figure 2. Motivation towards Learning Science Using ICT

The intrinsic motivation of pupils affected the learning of Science based on ICT. The finding shows the use of ICT in Science T&F motivate the research decision that shows: interest (98%), fun (96%), curious about the latest invention (94%), related to life (88%) and a more meaningful life (75%). All these items show the stages of acceptance of Intrinsic Motivation which are high among the respondents. The result of the finding is in accordance with the decision of Merino& López (2014), Ciampa (2014), and Nikou & Economides (2016) who claim that the ability

of ICT in educating anywhere is capable of evoking the intrinsic motivation of the pupils. Hamimah & Buerah (2014) suggested that the intrinsic motivation of the pupils can be enhanced by providing learning experiences that are fun with teachers increasing the number of activities or science assignments involving ICT.

In addition, the intrinsic motivation of primary school students who like to compete with their classmates are successful in evoking their internal motivations. Therefore every student wants to achieve the 'accessible maximum level' based on each and everyone's unique potential (Sri, 2013; Abdullah & Hendon, 2016).

However, these results differ from the study conducted by Schumm & Bogner (2016), which examines Science Motivated teenagers. The study found that the mean score Grade indicates a higher level compared to the mean score of Intrinsic Motivation. The Grade motivation in this study is at a high level but the motivation is in the third place after Internal Motivation and Self Efficiency Motivation.

Dimensions of Self Efficiency as a whole, recorded 87.2% for all items. Items I believe (95%) I am confident (95%), 'I'm certain' (94%) 'able to master' (89%) and 'do the best in the science lab' (63%) show a strong passion among the students in learning Science based on ICT. Self Determination Motivation recorded a high percentage because the atmosphere in the classroom has led to this motivation. In the classroom, pupils are usually surrounded by teachers and friends. Teachers will know the name of every pupil, check the daily attendance, to correct the books and become the driving force. In such situations, the students indirectly have had such motivation (Woolfolk, 2010). This decision is in line with findings from Schumm & Bogner (2016), which show the Self efficiency on recording high score. The Study of Merino & López (2014) and Ciampa (2014) also found that indirect uniqueness that can be used to educate anywhere has increased the internal motivation and self efficiency motivation of the students.

The Grade Motivational dimension shows that pupils are tied to grades that should be obtained. 4 Grade Motivational items show high motivation. Item with 'an A' (96%) 'earned a good Science grade which is important' (96%) 'I like to do better than other students' (95%) and 'get a high score' (93%) are often involving motivation that are associated with grades. Overall, Grade Motivation Dimension has registered 87%

Grade-based achievement is important for national exam-oriented students in Malaysia.

Upper primary students in primary schools are bound by this government public examination called UPSR.This achievement is considered to be important so that they are qualified to go to the secondary schools and enrolled into Form 1 (without going through Remove classes for one year). This constraint causes them to be motivated based on grades. The findings are similar to essential Grade Motivation similar to the studies by (Schumm & Bogner, 2016; Glynn et al., 2011).

ICT motivation has recorded 83.4% which is also thought to be high. This entry is considered relevant because the 21st century generation has been completely exposed to the world of technology. Information can be delivered and disseminated widely using the tools of modern technology. Smart phones that have internet network on its own are able to become learning aids that are capable of displaying dozens of search results. Accessibility has made this technology preferred by Education 4.0 century students where creativity and being innovative are emphasised.

Another aspect that was reviewed in this study are the factors that find the use of ICT an attraction in the classroom. The respondents have given a number of factors that have attracted them to use ICT. Figure 3 shows the factors that contribute to why ICT use in Science T&Fis attractive in the classroom.
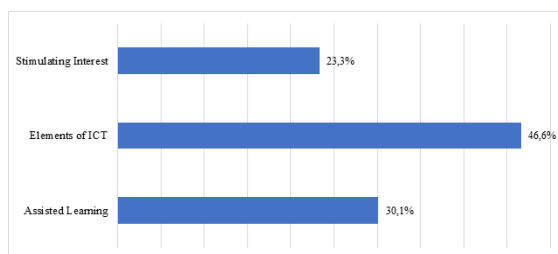
Figure 3. Attraction Factors of Teaching Science Using ICT

Figure 3 shows the attraction factors of ICT during Science T&F class that are categorised as helpful in learning, stimulates interest and ICT elements.'Elements of ICT' (46.6%) is'followed by assisted learning' (30.1%) and 'stimulating the interest' (23.3%) respectively.

Elements of ICTinvolves 46.6% of pupils who are interested in using ICT. Elements such as being 'colourful' (25.3%), 'audio' (7.5%), 'video' (4.8%) and 'beautiful' (4.8%) have been the main stimulus for students to be interested in ICT use during science T&F.

The output of this study is similar to the study made by Sidek & Hashim (2016) who found that pupils' motivation improve with the use of student-centered video clips. Finding by

Ziden et al. (2011) also showed that audio and video help enhance motivation and thus improve performance. They also support Science T&F fully which involves investigation and practical training based on ICT. This decision is also aligned with the theory of Bandura (1986) where delivering current knowledge skillfully such as infusing ICT in learning Science is highly regarded by students. Thus, the students begin to show interest and are motivated towards learning science. Indirectly, the teacher is imitating culture because the latest technology expertise motivates pupils to learn among themselves.

The outcomes of this study showed that audio elements have contributed to student motivation (7.5%) towards ICT-based Science Learning. This is similar to the findings by Yasak et al.(2010) which found audio-based science education software attract students to study science. A total of 30.1% of the respondents admitted that they liked to use ICT because ICT helped in their learning. Issues such as 'simple' (13.7%), 'informative' (9.6%) and 'assist learning' (3.4%) became the main reasons for respondents. On the part of the students, ICT and the digital age has changed the way students learn and how they access information (Shivana et al., 2014). Kler (2015) stated that ICT in T&F has changed the entire concept of education and has proven to be of great benefit to students. Furthermore, the use of ICT is identified as the best measure to confront the complexity of science subject (Sin et al., 2013).

A total of 23.3% of the respondents admitted that ICT has stimulated their interest to learn science. Elements such as 'interest' (5.5%), 'active' (4.1%) 'thought' (4.1%) and 'interesting'(3.4%) have become the main reasons to stimulate learning. This suggests that the use of ICT media not only attracts students to follow the process of T&F better, but helps to increase the understanding of students and makes it convenient for teachers to deliver their lessons (Halili et al., 2011). Fook & Gurnam (2013) share the same opinion in this study where ICT is found to build self-confidence, encourage creative thinking and make learning sessions more fun and interesting for students.

Such factors should be addressed by educators in classroom teaching. These factors will indirectly ensure that students are more focused in learning Science and, at the same time, able to improve their academic performance. Teachers need to find the best way to equip themselves with technological knowledge in line with the development of ICT and be able to provide constructive

input among students. Teachers need to employ the use of technology during the preparation and delivery in the classroom. The digital generation is definitely interested and motivated to be more actively involved in Science T&F.

Obstacles in the Usage of ICT During Science T&F

This investigation also aims to find the factors of barrier in the use of ICT in Science T&F. Figure4 shows the results of the study with regards to the obstacles in the usage of ICT during Science T&F in class.
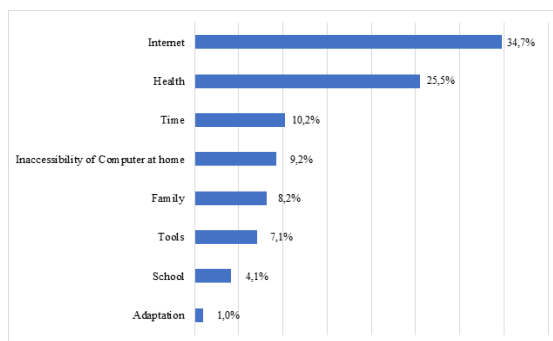
Figure 4. Barriers in Teaching Science Using ICT

Figure 4 shows the findings that there are various obstacles in the current use of ICT in Science T&F among students. The level of 'internet accessibility'recorded 34.7% followed by 'health constraints' which recorded 25.5%. Only a small handful of respondents said factors such as 'time' (10.2%),'inaccessibility of computer at home' (9.2%), 'family' (8.2%),'tools' (7.1%), 'school' (4.1%) and 'adaptation' (1%) became a barrier in the use of ICT during the learning of Science. The main obstacle in ICT usage is in terms of restraints of the internet. As much as 34.7% of respondents stated that they did not have the internet access at home. Even if there is internetaccess, the coverage is weak and cannot help in Science T&F at home or in school. Fook & Gurnam (2013) found just as much as 47% of the respondents agreed that they have an Internet connection at home. For this study, a total of 34.7% of respondents claimed not to have an internet connection at home. Fook & Gurnam (2013) observed that non-functioning computer softwares become an obstacle in the use of ICT during the learning process. For the sake of strengthening the commitment towards learning of T&F Science based on ICT, each respondent has to have a computer and an Internet connection at home.

The second obstacle factor involves health. 25.5% of the respondents claimed that inter-

net usage caused various health problems for them. The respondents argued that if the use of ICT continued for a certain period of time they wouldhave sore eyes, headaches and eye glare. This state is referred to as digital pressure against the eye. Proactive measures need to be taken to ensure these problems do not become a continuous barrier which will finally inhibit the use of ICT among the younger generation. Various parties such as governments, non-governmental organisations, parents and teachers can work actively so that this problem does not persist and should be addressed immediately in order to produce a competent young generation in the use of ICT and excel in the international arena.

The results also showed the disruption of tools (7.1%) has become a barrier in the current usage of ICT during Science T&F. Research by Garba et al., (2015) reported that Malaysia is at a more advanced level in its efforts to maximise the potential of ICT in education. Malaysians have access to internet connection at home, at work, at school, and in public places. Under the platform of the creating smart schools, ICT is provided to schools to ensure success in the process of technological integration in the learning process (Hamzah & Yeop, 2016). The study shows findings that are contrary to the findings by Garba et al. (2015) and Hamzah & Yeop (2016). The issue of internet barrier (34.7%) computer restrictions at home (9.2%), computer restrictions at school (4.1%) achieved 48% (almost half of the respondents) indicating this issue remains a primary issue in the country in the adaptation practice of ICT in Science T&F. This research is supported by the findings of Mohamed et al. (2012) which show the percentage of computer ownership and the use of ICT in rural areas are low. This discovery reflects the digital chasm which is an ongoing issue in rural areas. The government is paying attention to this ongoing issue. For the sake of addressing this issue (4G access is 74.88% but the speed is only 14.83 Mbps) Malaysia has implemented Universal Service Programme (USB). The Malaysian Communications and Multimedia Commission (MCMC), under USB, serves to identify locations in rural areas with low internet coverage (BERNAMA, 2018). The effort and concern by the government in overcoming the digital chasm between urban and rural areas should be ongoing.

This study also identified that time restrictions involved 10.2% of the respondents. Respondents said that theywould spend a lot of time in using ICT to search for information. Similarly, Menon et al. (2012) also found the use of Wikipe-

dia media in learning Science involves long periods of time for search and discovery of materials based on links.

All these restraints should be viewed seriously by the authorities so that this situation does not continue. If this situation continues, the government's efforts to put national education on par with international education standard will remain as a dream.

The lack of internet and ICT tools at home causes the use of ICT to be restricted among children. The family needs to provide ICT faciliities and internet access for their children's Science learning. Besides that, parents need to take care of children's health so that ICT does not affect the health of their children. The contributions of governments, parents and schools help students to learn Science based on ICT. The goal of the Sustainable Development Goal (SDG) 4, which is expected by the 2030s' is quality education for all 'can be achieved if the use of ICT is widespread amongs students especially those located in rural areas. ICT-based Science Lessons can enhance students' achievement.

CONCLUSION

In this study, Intrinsic Motivation has become the dominant component of the ICT-based Science education. Elements of ICT have become attractive factors while internet accessibility and health problems prohibit the use of ICT in Science T&F. Motivation improvement will increase achievement level in Science among students and will realise the aspirations of the government based on MIB Cooperation (2017) that would reduce the gap in the percentage of passes in UPSR subjects between Tamil Vernacular Schools, Chinese Vernacular School and National Schools in the next ten years to come. The ratio of science to art stream students which has fallen to 21:79 can also be improved with the availability of ICT-based motivation insertion in Science T&F. The ability to increase the involvement of students in Science stream will be increased. Following the increase in students' achievement, the country is also proud to join Education 4.0. Education 4.0 is compliant to the aspirations of modern technology that would certainly aggrandise Science based ICT T&F. The increase in pupils motivation based on this study will assist the achievement of Science and Technology Development Policy with a vision to make Malaysia a society based on Science, which is innovative and able to be a contributor to the progress of science and technology in future. Moreover, the increase

in motivation can also produce competitive students in international rankings through various creative and innovative creations, in addition to making the Vision 2020 Policy, which is emphasised by our new prime Minister of Malaysia, Dato Seri Dr. Mahathir Mohamad, a reality.

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