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CHANGING TRENDS IN THAI EDUCATION: A REVIEW ARTICLE ON ICT-ENABLED LEARNING

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ABSTRACT

ICT in Thai education as a facilitator is well documented. However, the incorporation of the developing ICT trends for advancement in the basic education establishment in Thailand has been slow. The objective of this study is to present a detailed overview of the advances in ICT-enabled education in Thailand. Through a detailed summary of the the past and present government initiatives, in ICT-enabled education are presented. Further, the barriers inhibiting the integration of ICT in the Thai education system are discussed. Resolutions are then assessed by reviewing some of the significant trends in ICT development and assessing their influence in minimizing barriers. The contribution of this paper will be organized into two parts. First, the paper will advance current knowledge by presenting an updated summary of past and current ICT applications in the field of education and barriers to ICT-enabled education in Thailand. Second, the paper will help examine how the innovative use of technological trends could potentially lower the barriers to integration of ICT and lead to an advanced education system in Thailand.

KEYWORDS: ICT, ICT-enabled education, Thailand, ICT integration.

1. INTRODUCTION:

Information and communication technologies (ICT) hold a remarkable prospect in facilitating globalization and development in various socioeconomic conditions and education (Bau et al., 2014; Pena-Lopez, 2015). "ICT" reflects the usage of computers and other types of smart technologies in different fields (Avgerou, 2010) encompassing information systems (IS), communication studies, and human-computer interaction (HCI; Walsham et al., 2007; Mansell, 2002; Dearden, 2008), with a small role of development studies (Wade, 2002). ICT plays a crucial role in providing access to knowledge irrespective of time and place, through networking enabling the sharing of information, interaction, and lifelong learning (UNESCO, 2013). The humanistic vision of education inspires UNESCO to assist the development in ICT by Internet connectivity which has interconnected people, solidified concepts, and improved the understanding of ICT (UNESCO, 2015). The foundation of the studies on implementation of ICT relies on the fact that ICT contributes to socio-economic improvements in developing countries (Sahay, 2001; Mann, 2004; Walsham et al., 2007). ICT adoption into education offers significant potentials for educational institutions and educators through its ability to facilitate digital education in today's world (Gul, 2015). Watson (2001) emphasized the remarkable transformation that ICT brings out in the education systems. Tinio (2002) described ICTs' usage in improving access, quality and application of education in developing countries such as Thailand which increased its potential by the development of technologies for effortless spread of these technologies (Kraemer et al., 2009) in realizing the institutional changes for technology-enabled learning's benefits in a developing society (Ma et al., 2005). Studies on ICT integration in Thailand's education presents the different aspects of the changing trends in educational settings and the ways to improve this integration for advancement (UIS, 2014; Zhang et al., 2016).

Despite the huge investments in ICT to school education, there still exist various concerns regarding its progress in Thailand (Dutta et al., 2015; Prajaknate, 2017). For Thailand, ICT policies are either stated in present education plans or ICT Master plans to cover several socioeconomic domains including education. Despite these policies, there still is a gap in the efficient integration of ICT in Thailand education (OECD, 2016). Though equal education is stimulated, there exists a gap (digital gap) in the access to ICT use in Thailand (ITU, 2015; Ness & Lin, 2015) impacting the efforts to implement ICT at all levels of the education system (Prajaknate, 2017). The Global Information Technology Report (2015) establishes that the gaps in access to ICT use are mediated by its development making the integration at different levels challenging. Moreover, with ICT advancement, the role and the ability of teachers have become even more crucial than before. Though many teachers have basic computer skills, they lack confidence in using technology to bring changes in pedagogy (Meleisea, 2008; Akarawang et al., 2015). This has been one of the major challenges as how to enable the prompt and appropriate integration of technology through teachers into the Thailand education system (Akarawang et al., 2016). Failure to address the challenges would mean a further broadening of the digital education gap and deepening of existing socioeconomic inequalities in Thailand. A holistic picture of the status of ICT in Thailand education system has not been properly reflected in the existing studies (OECD, 2016). Thus, the purpose of this review article is to discuss the benefits of ICT in education and its use for the enhancement of lifelong learning of students by encouraging policymakers, school authorities, and teachers to focus on successful integration of ICT in the education systems. Presenting a comprehensive summary of underlying research aspects regarding ICT integration within the broader educational context and examining the present advanced use of technologies in overcoming the barriers of ICT integration for a better cohesive education system in Thailand are the two aspects of the paper which highlights the benefits of ICT in education, existing policies, and past and current government initiatives for widening ICT integration and participation. The logistical, pedagogical, social, and technical constraints and the key changes in the integration of technology in this theoretical context are also explored through review of research articles published between 2007 and 2019 related to the implementation of ICT in Thailand education programs.

2. BENEFITS OF ICT IN EDUCATION:

ICT has contributed to an immense transformation in the education system by adding a new dimension to the teaching perspective in schools because of the amalgamation of different forms of interactive components like sound, graphic art, video, animation, and text (Sansanwal, 2000) and to the learning aspect through the introduction of simulation games facilitating intellectual learning (Cuban, 2001; Chandra & Patkar, 2007). A report by Meleisea (2008) illustrated that ICT technologies can help to expand the range of education and improve their outcomes. The Office of the Education Council (OEC, 2011) has identified problems in the development of education technology and has constantly emphasized raising educational standards. Gupta (2014) stated that ICT acts as a mediator of development by providing instructional tools for improvement in teaching through access to multimedia. Studies by Tongkaw (2013) and Akarawang et al. (2015) have shown that achievement in ICT-enabled education depends essentially on the association between school management and the teachers' competency in implementing ICT into the instructional practice to deliver education through learner-centric interactive approach. The utility of digital components in teaching reforms the traditional teaching technique, making it a student-centric process with the teachers being identified more like a guide. However, the effective application of ICT differs among the developing countries in Southeast Asia, including Thailand where the digital difference gap is more distinct due to infrastructure set-up and other technical issues (Pelgrum, 2001) such as Internet facilities at rural or urban schools (Anderson, 2010). Thus, the incorporation of new technological practices has gathered a lot of attention in the region to bring about educational reforms. Table 1 provides a comparison of traditional and ICT-enabled advanced learning methods.

Table 1: An overview of traditional and ICT-enabled learning

ICT use	Traditional approach	Advanced approach	Exemplary practices
Active learning	Teacher-centric approach	Learner-centric approach	SITES: Module 2 (M2)
	Instruction to the entire class	Instruction within small group	
	Uniform activities	Diverse activities	
	Program determines the pace of learning	Self-paced learning	

Collaborative learning	Individual learning Homogenous team	Learning in teams Heterogenous team	ilearn, Think.com
Creative learning	Generative learning	Learning by doing	Riverdeep, IntelliTools Reading Balanced Literacy
	Applying of known solutions to queries	Finding innovative solutions to queries	
Interactive learning	Absence of theoretical and practical connection Separate disciplines	Presence of theoretical and practical connection Integrating disciplines	Schoolnet
Blogs (teachers and students)	No use of Internet tools	Use of second-generation Internet tools with user-developed content	WordPress, Podcasting in the classroom
Probes and other basic research tools	Understanding of concrete concept	Understanding abstract concepts. Development of data-representation skills	The Concord Consortium

Adapted from Voogt, 2004; Mikre, 2011; and The Natoma Group

3. ADOPTION AND BARRIERS OF ICT IN THAILAND:

Thailand invested hugely in digital learning materials , but has no output for smart education in all the subjects of basic education system (Zhang et al., 2016) which was initiated in 1984 with the introduction of computer courses in Thai schools (Meleiseia, 2008). The Ministry of Education (MoE) in 2008 established the ICT curriculum standards in National education curriculum for 12th grade students in all subjects to drive transformation in the school education system. The Thai government had contributed to develop operative set-up to support the integration of advanced ICT skills (MoE, 2008; Ministry of ICT, 2009; Thai Consulate-General, 2015). MoE (2011) recorded a learner-to-computer (LCR) ratio of 14:1 in Thailand secondary education. Schools with fewer computers have been equipped with this hardware in the recent years, including a basic computer course at primary (1-5 hrs/week), lower (6-10 hrs/week) and upper secondary level (11-20 hrs/week) (Keris, 2013; UIS, 2014). However, the schools are still lagging behind in Internet facilities with good bandwidth and other computerized learning materials (Fraillon et al., 2014). Although schools have ICT tools (21%) and website resource (81%) facilities (UIS, 2014), progress of the students in the main subjects were below the international standards (Klainin & Soydhurum, 2004; OBEC, 2007; Klainin, 2010; OECD, 2016). National Electronics and Computer Technology Center (NECTEC, 2008) report states that development of ICT in Thailand was below average. Thailand's education system is comparatively at a lower rank of 70 than most other countries in the region like Singapore, Malaysia, etc (Jantrakool, 2010; WEF, 2014). Quality, affordability, policies, curriculum, and instructional practices limit the ICT integration into the educational establishments which has been summarized as below:

3.1 Physical and external factors:

Limited ICT resources, quality of resources due to the digital divide gap, and high levels of socioeconomic hindrances are limitations of ICT proficiency (OECD, 2013). The percentage of schools with Internet connection for computers was relatively higher in Thailand (95%) than other countries in the region (PISA, 2012), while International Computer and Information Literacy Study (ICILS) data found that the availability of online connectivity for schools with computers were only 74% in Thailand (OECD, 2013; Fraillon et al., 2014). The low LCR values in urban areas indicate greater access to ICT-enabled learning than in rural areas (MoE, 2011; Asian Development Bank, 2012). The use of interconnected PCs by users while using their monitors, keyboards and a single CPU and server minimizes the shortages of computers in the deprived areas. Cosgrove et al. (2014) elaborated that the specific use of the web-based resources and applications like assessment tools, textbooks, online communication, cloud computing, etc. need sufficient Internet connectivity for their easy use. The speed of Internet shared by Thailand schools is around 6-8 Mbps, similar to one family's use, and the majority uses unstable and slow speed satellites (Office of the Education Council, OEC, 2015). Thai government has proposed Internet access schemes for 30,000 schools by hiring networks at around THB (Thai Baht) 1000 million per year from 2014 in the basic education system in the Master Plan for ICT in Education, 2014-2018. OBEC (2013) evaluated the use of tablets in Thai schools and observed that 99% (28,413) schools had been provided with tablets (44% with defects and 28% with software connected). The 2013 ICILS data reported access of software and online resources in only 75% of the Thai schools instead of a minimum standard of incorporation in 84% (Fraillon et al., 2014). This necessitated the establishment of national curriculum and policies incorporating ICT-assisted learning, including OERs (Open Educational Resources).

3.2 Teacher-related factors:

MOE (2011) identified major barriers concerning ICT adoption including teacher competency and absence of other ICT integration methods for different subjects. Mayes et al. (2015) illustrated that many Thai teachers lack the basic computer skills to build-up an innovative pedagogical tool for teaching. Moreover, teachers with basic computer knowledge lack the specific training for ICT integration (Goktas et al., 2009; Makaramani 2013). This led to training of around 16,000 teachers by PiL (OEC, 2011). Akarawang et al. (2015) conducted a study among 377 teachers from 35 Thai schools and reported that training sessions for teachers are a necessity to enhance their ICT competencies for effective integration in the instructional practice. Studies have demonstrated that younger teachers have a more positive attitude towards improving their ICT skills (Apiola, 2011; Fajebe, 2013; UNESCO, 2013). Peer training has proven useful in Thai schools, with a smart approach to transfer training and feedback (Pearson, 2015). The teachers lack confidence in ICT usage due to poor training facilities seeking establishment of data-collecting techniques and an encompassing and rational ICT strategy to support the development of policies in this part of the region.

4. POLICIES FOR USING ICT IN THAILAND EDUCATION:

ICT has occupied a substantial part of the economic development strategies of Thailand for several years due to its ICT policies. These policies, which outlined the development plans as well as the ICT Master Plans, were developed to generate smart literacy to benefit the society (Ministry of ICT, 2009a, 2009b). The restricted integration of ICT in the Thailand education system has regulated the formulation of some ICT schemes for achieving the target of the education system in various areas. These policies include the ICT 2010 and ICT 2020 schemes, outlined the development plans as well as the ICT Master Plans (Ministry of ICT, 2009a, 2009b). The first national policy by the Thai government was implemented by the National IT Committee members in 2000, (ICT 2000) which aimed to remove any social inequality and promote economic well-being. The second National ICT Policy was the 2001-2010 policy (IT2010) which aimed to exploit the ICT resources to transform Thailand into a knowledge-based economy. This policy promoted aspects like long-term learning, online education, virtual learning, development of human resources, and contents (Makaramani, 2013). It was applied to the ICT for Education Master Plan I (2002-2006), following which some objectives of this policy were achieved and some were left unattended. Thereafter, Thailand expanded its ICT policies of four years in the basic education curriculum, where the initial segment of these policies was functional in the ICT Education Master Plan I (2007-2011) by the MoE. This plan included strategies to equip students with ICT skills and use these smart skills to survive in a digitally-influenced society (Ministry of ICT, 2009b). The MoE in Thailand established ICT Education Master schemes involving targets for 2008-2010 and 2011-13. The remaining part of the four-year policy was covered in Thailand ICT Master Plan II (2009-13) by the Ministry of ICT. Thailand announced the Eleventh National Economic and Social Development Plan (NESDP) from 2012 to 2016 with a vision for the next 5 years of lifelong learning and establishing a society enriched with innovative skills and equity. The third ICT Master scheme (2014-2018) involving additional targets was also established. Over the years, Thailand schools have developed ICT policies and established a separate course in the basic education curriculum and also as a skill throughout the subjects. In spite of these efforts, the 2013 ICILS report suggested that Thai students' ICT competency was still low due to deficiency in the policies implemented (Fraillon et al., 2014). UIS (2014) states that the policies introduced by the policymakers are the forces of change that are needed in an education system. This is substantiated by previous studies by Kozma (2003) where it was reported that 174 ICT-enabled digital classrooms were established in 28 countries and Jones (2003) illustrated 127 cases of positive influence of the national policies on the ICT-enabled education. Makaramani (2013) illustrated the effectiveness of ICT policies in the Thai education system reporting that 84.45% of the teachers used ICT to improve the teaching and learning of the school students. However, the introduction of ICT policy for transformation in education is not enough to mediate its integration (UIS, 2014).

5. GOVERNMENT INITIATIVES FOR ICT INVESTMENT IN THAILAND EDUCATION:

The education system in Thailand is regulated by Education Service Areas (ESA) and basic education by the Office of the Basic Education Commission (OBEC). Various initiatives were commenced to facilitate ICT competency in students, including introducing various ICT resources in school education. The National ICT for Education Master Plan (2001-2005) and the MoE Education Reform Roadmap from 2005 to 2008 directed the application of smart learning to enhance the educational quality in Thailand (OEC, 2006). The 2008 current standard-based curriculum modified the previous one by incorporating "capacity for technological building" as one of five fundamental applications in all subjects, and included ICT as a compulsory topic in all standards (OBEC, 2008; UNESCO-IBE, 2013). Thailand has made investments for the growth of smart learning resources through MOE initiatives such as 'One Tablet Per Child' (OTPC) during 2011 which provided tablets to school students between age group 7 years to 13 years (Pearson, 2015). The idea behind this policy was to promote self-learning in students, thereby enabling them to acquire knowledge based on their self-capability and speed of learning. The OTPC policy evolved

from another ICT policy, known as 'One Laptop Per Child' (OLPC) scheme which targeted to provide software installed laptops to school students as a constructive step towards school education in developing countries (Derndorfer, 2010). However, the Thailand's OTPC policy was soon replaced by the 'smart classroom' initiative in 2014, where the schools were authorized to have one smart classroom with ICT facilities, with an aim to integrate cloud-computing services and MS (Microsoft) Office 365 (Bangkok Post, 2014; The Nation, 2014). Charoen (2012) focuses on the impact of ICT in international standards of educational establishments in Thailand indicating that many institutions are undertaking advanced technologies for developing digital literacy and an intensive initiative was still needed to implement advanced growth of ICT applications. Thuvasethakul and Pooparadai (2004) and Williams and Williams (2007) indicated that ICT investments will only benefit organizations when it is supplemented by precise change agents, resources, planned projects, and communication. Most studies emphasize a specific type of ICT application in educational development (Waitayangkoon, 2007; Saekow and Samson, 2011; Rattankhamfu, 2016). For instance, Saekow and Samson, (2011) presented an assessment of smart learning through the Thailand Cyber University (TCU) project. Rattankhamfu (2016) illustrated the use of SchoolNet in Thailand schools for promoting digital literacy. However, there are very few studies that have illustrated past and current ICT initiatives in the educational context (Meleisa, 2008; OECD, 2016) without addressing current ICT developments in facilitating educational provisions and implementation. This paper presents an in-depth summary of diverse ICT initiatives under the government framework programs to support educational progress. Table 2 presents a summary of selected past and current government initiatives that focus on the application of ICT technologies in the educational context in Thailand where the Table also highlights the benefits of these applications.

Table 2: A summary of selected government initiatives that focus on the development of ICT solutions within the educational setting

Programs	ICT applications	Potential benefits
Schoolnet project Initially known as Thai Social/Scientific Academic Research Network (ThaiSARN) (Kiattananan and Koanantakool, 1998; Rattankhamfu, 2016)	Knowledge exchange across the network (Create an electronic library to provide additional information in ten subject-areas)	Promoted Internet connectivity in approximately 5000 schools throughout Thailand Enabled moulding of competencies of school teachers and also created an electronic library to provide additional information in ten subject-areas.
Schoolnet merged with National Education Network (EdNet) (Rattankhamfu, 2016)	Development of digital learning resources (Providing Internet access to around 34,000 educational organizations)	Internet access to around 34,000 educational organizations, including schools Promoted ICT skills among personnel in educational institutes
Uninet (Ngampornchai & Adams, 2016)	Access to Internet and e-learning materials	Improved centralized management of ICT
Lighthouse Project (Blurton, 1999; OECD, 2016)	Informal education at five locations in Thailand	Improves the digital learning environment Helps to create self-ideas
Second Information Technology in Education Study (SITES; Pelgrum, 2001; Waitayangkoon, 2007)	Collaborative and self-directed learning in primary and secondary schools	Enabled innovative technology-based pedagogical practices. Improved changes in pedagogy and ICT use in Mathematics and Science
ICT Schools Pilot Project (Office of the National Education Commission, 2003; Rumpagaporn, 2007)	Introducing ICT (1000 online lessons for 7 subjects) in elementary and secondary classroom environment	Facilitated independent self-pace learning Promoted students' self-learning activities
PiL (partners in learning) project (Meleisea, 2008)	Identify training needs localize curriculum, and identify teachers for training in various aspects of ICT literacy [22,682 school teachers have been trained for basic skills (16,575), peer coaching (820), master teachers (336), and the school leadership program (18)].	Improves the development of higher-order thinking skills for students
Flipped classroom project (OEC, 2011)	Facilitates classroom discussions and small group activities through video lectures out of the classroom	Engages students in dynamic learning activities Improves growth in the learners
National Strong Thai or Thai Kem Kang (TKK) project (Ministry of ICT, 2009a, b)	Provide computer facilities and digital content for every school in Thailand	Promoted creative education in Thailand
Imagination, Discovery and Sharing – Digital (KIDS-D@SW) project (Bacsich and Salmon, 2014)	Sharing of online educational resources (OERs) through digital libraries	Improves learning through high-quality educational materials Improves sharing of learning materials between institutes and students
EMATIC (Mathematics Education through ICT) project based on Intelligent Tutoring System (ITS; Gonzalez et al., 2014; Kularbphettong et al., 2015)	Cognitive learning and understanding of concepts	Helps to conduct simulated experiments Provides general and task-specific hints Accessible over the network Provides an automatic marking system
Teacher Professional Development (TPD) program by Institute for the Promotion of Teaching Science and Technology (IPST; Ulla & Winitkun, 2018)	Collaborative teaching (collaboration between schools and organizations such as universities)	Improve the skills of teachers in the use of ICT technologies Improve students' learning outcomes, particularly in Science and Mathematics Helps reach international standards
EmpowerICT project (Vrasidas, 2004; Soparat et al., 2015)	Professional development and collaborative curriculum development	Empowers teacher to improve ICT integration into classroom teaching Improves transformation in educational policy and assessment
E-Distance Learning TV (E-DLTV project, 2011))	Distance education via satellite technology	Classroom support from a variety of educators. Improves professional learning
Thailand Cyber University (TCU) project (Sombuntham and Theeraroungchaisri, 2006)	Sharing of e-learning courses (schools and other educational institutions offered 30 comprehensive online degree and training courses)	Improves the quality of online distance education
Kru Truu Educational TV and Tutor Channel Project (Laohajaratsang, 2010; Bangkok Post, 2014)	Televised educational content in 99% Thai households	Improves the possibility of students access to learning in deprived and rural areas
Braincloud Solution (The Bangkok Post, 2014)	Access to education materials via tablets	Improves interactive learning in rural Thailand
Living Library Project (Eg: ThaiLIS; Saekow and Samson, 2011)	Innovative learning environment at all grades	Improves sharing of information, learning courses and communication
Kidbright project (NECTEC, 2016)	Easy understanding of computers without any technology-dependency from abroad or importing needs.	Facilitates faster learning of programming
E-education under Thailand 4.0 framework (Bukht and Heeks, 2018)	Promoted value-based innovatve education and transformation into a digital society	Improves digital literacy in Thailand
MoE Game simulation project (http://meg.ibankstory.com/) (Todd, 2019)	Critical and evaluative thinking	Instructional elements help a learner explore Provide complete access to information Improves interaction among learners

6. EMERGING TECHNOLOGICAL TRENDS IN ICT EDUCATION:

The past and current initiatives of ICT (Table 2) are assisted by various technologies from the viewpoint of the educational setting. The understanding of these emerging technical advances in practice from an academic outlook is limited (Lim and Oakely, 2013; Wilaisakoolyong, 2015; Dahdouh et al., 2018). Therefore, this review will attempt to present an understanding of modern ICT advances and explore their possible effect on minimizing the barriers to ICT integration in Thai education as discussed in Section 3. By doing so, it is hoped that further investigation of these emerging technological advancements by educators and academicians in Thailand will be encouraged.

6.1 Wireless and web-based learning tools:

The evolution of wireless and web-based learnings have opened up avenues for educational institutions, educators, learners, and academicians to completely utilize the massive information available to them more easily and effectively. Remote learning devices, such as mobiles, laptops, tablets, projectors, etc. facilitate smart learning of the students through features such as streamlined instructions, graphics and text, ability to control the pace, audio feedback, and easy troubleshooting (Lim and Oakely, 2013). Interactive whiteboards (IWB) allow computerized images to be projected, dragged, modified, and clicked and also involves the entire class with a higher level of student engagement and interaction between teachers and students through e-mail, e-conferencing, blogs, etc (Manches et al., 2010). Dillenbourg and Evans (2011) indicated the use of IWB, for one-on-one interactions and understanding the concepts for improving the technology-assisted learning in Germany. Online digital sources like e-readers are electronic tools that contain a variety of books in soft forms acting as reading material to learners (Handsfield et al., 2009). The social networking tools facilitate students' organization of ideas and communication with others (Shang, 2007). These tools mediate information in various setups, such as text, graphics, audio, and video. Watts and Lloyd (2004) illustrated the importance of a network-based multimedia program, called Espresso on the collaborative learning of the school students. Yang (2009) illustrated the application of web-based resources in integrating ICT use in increasing the students' knowledge of designing a homepage and their perceptions of teamwork in Taiwan. Web 2.0 enables improvement in the learning skills of primary school children through the construction of texts and online discussions (Handsfield et al., 2009). Wei et al. (2011) explained the application of a Joyful Classroom Learning System (JCLS) in facilitating interactive learning among primary school students in Taiwan. Situational technologies include simulation games and virtual reality where the students engage in an environment of learning to the context and activities. Lim (2008) reported a case study in Singapore where learners associated themselves in a computer game situation, called Atlantis in the context of global citizenship. This tool helped the students to troubleshoot individually or collaboratively, indicating a positive effect on their motivation and learning practices. In an educational environment, it has been useful to get the latest information for a particular topic and use social network to share it among educator and learner communities, reducing the time and cost of person-to-person interaction.

6.2 Cloud computing:

Making investments in IT systems and purchasing expensive computer resources (hardware and software) could be unaffordable for educational institutions. Cloud Computing is one of the advanced alternative technology to the expensive ICT investments and reduces the user-related issues (Harris et al., 2015). This technology integrates and maintains the latest network, data, and infrastructure through Internet connections (Chengyun, 2010; Adhikari et al., 2017). It facilitates the use of applications among learners without any need for installation where the learners can access their files on any computer using the Internet. This has the potential to significantly influence the pedagogical process (Ercan, 2010). The resource materials in online-based learning can be easily updated and it also allows the teacher to include multimedia content to provide a user-friendly background and easy understanding of the concepts. It is regarded as a learner-centric approach which can address the intricacies in the teaching process, so that the teachers can evaluate their materials and re-use their shared areas of knowledge (Xiao, 2011). Mendez and Gonzalez (2011) reported a comparative illustration between traditional web-based learning and cloud-based online learning in Spain where the former required lot of investments without any output due to system set-up in the educational premises while the latter provides advanced learning provisions because the online learning is assigned to cloud computing providers and users which makes it a successful technology. The virtual learning, maintained by the online approach, supports the achievement of a higher level of educational practice than those of typical practices (Dong et al., 2009). Wilaisakoolyong (2015) illustrated the use of cloud computing to create virtual learning facilities for students studying in Thai-Nichi Institute of Technology where it reported a higher achievement level of the students using this technology-driven learning process benefitting students and teachers as it addresses the requirements of the user in a flexible and modifiable way, only accounting for the specific usage that is done. It enables educational institutions to manage the complexities of ICT-enabled learning and focus on their core educational strategies. This is important to schools located in areas without internal facilities and expertise to utilize sufficient ICT applications to support educational needs. One such illustration of cloud computing in educational context was reported by Saini et al. (2017) using the SaaS (Software as a Service) in institutions in Punjab, India because it does not incur any extra hardware costs, setup costs, and are accessible from any place.

6.3 Integration of Big data and web-based learning:

The online learning systems have met big challenges due to the changing trends in technology and diversity of learning resources. Managing and connecting the information from the above-mentioned technological advancements are utmost important. In this context, the ITS which supports the integration of the web-based learning tools with 'big data' is the solution for processing huge data from different clusters. Based on the magnitudes and advanced applications of the computing resources, an integrated platform of big data and web-based tools is a natural arrangement for the integration of data mining systems, like 'Educational Data Mining' with an ITS technology to develop datasets (Adhikari et al., 2017; Dahdouh et al., 2018). In Table 2, we have presented our findings related to government projects like 'EMATIC' which incorporates intelligence and logical capabilities. Big data integrated with online-based learning is the information accumulated by learners during the learning process as well as during an online training process. Grady & Chang (2015) illustrated The National Institute of Standards and Technology (NIST) report which describes big data as the efficient handling of new datasets that otherwise could not be processed by the traditional data constructs. Birjali et al. (2018) illustrated the usefulness of big data in addressing educational problems by accomplishing the learning objectives. They highlighted the usefulness of big data technology in anticipating impending performances of students and indicated how it can assist educational institutions in Morocco in formulating strategic practices. Dahdouh et al. (2018) demonstrated the usefulness of big data integration in a computing structure for learners, and the innovative applications and tools of big data in future e-learning in Morocco. Anshari et al. (2016) explored the efficiency of web-based learning tools integrated with big data for an improved quality of pedagogy in the educational context in Brunei. The integration can simplify learning contents, analyze findings, customize online learning materials, track learning patterns, etc. which enhances learning, quality of pedagogical resources, and satisfaction of learners (Hwang 2017). Thus, these integrated technological tools must be put into effect to enhance the quality and availability of smart learning systems as some educational institutions lack the infrastructure.

7. CONCLUSIONS:

In this paper, a detailed review of where past and current major initiatives by the Thai government in ICT developments in the educational context were combined and presented. was. Further, the extent and obstacles of integration of ICT applications in the Thailand educational establishment were discussed. The study indicates that there have been multiple initiatives to generate a user-friendly environment for ICT to act as a facilitator of teaching and learning. Simultaneously, the study has also highlighted several factors like infrastructure facilities, curriculum amendments, policies, capacity building for teachers, interaction among teachers, development of lead trainers, collaboration among educational institutions and government bodies which must be in place to bring about transformation in the classroom teaching and learning through ICT-assisted practices. Solutions were then explored by presenting a precise summary of the changing trends in ICT advancement and explored their influences on the barriers to ICT integration. A significant contribution of the review to the existing literature is that this study is a novel study, which links educational initiatives, issues concerning technology integration, and the changing trends in technology. The present study highlights important contributions to educators and academicians as there was a very limited inclusive and updated summary of ICT-enabled education in Thailand. The study's approach in presenting the government initiatives to capture the present ICT arrangement in the Thai basic education system is unique as previous studies tend to focus on a particular technology solution. Based on all these, many crucial aspects have been highlighted that should be considered before the integration of the present ICT initiatives in Thai schools. However, since this study includes secondary data, therefore there is a need for further investigation to better meet the local demands and educational needs. Overall, if considerations of the present study are focused along with the necessary steps and appropriate involvements, ICT can prove to be an efficient tool for minimizing the digital differences and enhancing the quality of education in Thailand.

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