Toward the Use of 21st Century Teaching-Learning Approaches: The Trend of Development in Malaysian Schools within the Context of Asia Pacific

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Abstract—**ICT Infrastructure and internet connectivity in educational institutions provides learners and teachers the opportunity of adopting 21st century teaching-learning methods that promotes the development of 21st century skills. The availability of internet connectivity in particular provides the platform for a shift from the use of teacher-centred pedagogy (content-based learning) to learner-centred pedagogy (inquiry and project-based learning) that is more interactive and activity oriented. But are teachers utilising these facilities to advantage? This study investigates the use of ICT and internet resources in relation to the use of 21st century technology-based teaching-learning approaches in Malaysia and Asia Pacific context from a global perspective. Qualitative research approach was used for data collection and analysis in the study. Findings from the study show a unique unexpected changing pattern in the use of computer and internet among school teachers; and new challenges associated with the integration of ICT and the use of 21st century approaches in classroom pedagogical practices were identified. As observed in the study, despite the facilities provided; the technological competence acquired by teachers; and, the increasing use of computer and internet by teachers; the approach to teaching and learning has not change as desired.**

Index Terms—**ICT Integration; School Teachers; 21st Century Learners; 21st Century Teachers; 21st Century Learning Environment**

I. INTRODUCTION

The global drive toward building sustainable knowledge-based society has made stakeholders of the education industry to recognize the potential need for ICT integration in education [1]. This is considered a necessary step in creating 21st century learning environment to prepare learners into becoming effective citizens of knowledge-based societies that is ICT driven. To achieve this, respective government of different countries in the world over in collaboration with other stakeholders have continued to make varying efforts to provide the ICT facilities needed in schools to create the desired 21st century learning environment and the training needed by teachers to integrate the provided ICT facilities in teaching [2]. Over the years, relevant technologies have continued to flow to schools as they emerged. But to what extent are these technologies used in classroom teaching? Is the global desire toward building 21st century learning envi-ronment getting achieved? What is the trend of development on ICT integration in schools? Answers to these questions would differ from place to place as countries adopted different strategic plans and policies in their attempt to achieve this global desire.

In its drive toward becoming an advanced (developed) nation by 2020, Malaysia recognises the critical role of education as the driving force of its transformation process into becoming a knowledge-based society as a necessary requirement of becoming a developed nation in the information age. Thus, the education industry is expected to train young learners into becoming competent citizens capable of making useful contribution in their respective capabilities toward the attainment of this national goal. To prepare the education sector for this task, policy-makers considered the full integration of information technology in the education system at all level of learning as necessary [3]. In achieving this, the government has over the years introduce new policies backed up with the allocation and use of huge resources to provide the infrastructure and facilities needed for ICT integration in the education sector [4]. This is aimed at creating 21st century learning environment [5] in Malaysian schools and institutions of higher learning to facilitate the development of information and technological competence of learners alongside their professional development. Thus producing the desired citizens needed in the 21st century for sustainable development in Malaysia as member of the global community in the information age.

Through a number of different programs at national and state level, schools and institutions of higher learning in Malaysia are provided with the basic ICT infrastructure (computers and internet connection) needed for technology integration in the teaching-learning process. Teachers at all levels are provided with basic training on the use of computer and internet through workshops and stand-alone courses [6]. In addition to the basic ICT infrastructure and facilities provided, virtual learning platform (such as Frog) are being introduced in schools at national level [3]. With this development, basic ICT infrastructure, internet connectivity and access to computers are no longer considered as issues in Malaysian schools. As such, recent studies in literature are reporting the readiness of Malaysian teachers for ICT integration [7]; thus, suggesting the high level of ICT literacy and competence of school teachers in Malaysia.

With this development, it is logically expected that teachers and learners in Malaysian educational institutions would make maximum and innovative use of the facilities provided. It is therefore assumed that, teachers in Malaysian schools must have over the years explore and develop new instructional strategies of blending their pedagogy with the available ICT facilities provided. As such, considering government effort, the commitment of other stakeholders and the nature of in-service training provided to teachers; it is expected that by now teachers in Malaysian schools must have adapted the role of being facilitators and mentors in the teaching-learning process; Thus, shifting emphasis from the use of teacher-centred pedagogy to the use of 21st century teaching-learning pedagogies [8]. This study attempt to investigate these assumptions and emerging issues associated with the use of internet connectivity provided in Malaysian schools.

II. LITERATURE REVIEW

21st century is characterised with amazing developments in information technology [9]. Development in computer and internet technology in particular has over the years revolutionised all aspect of human activities [10]. The integration of these technologies in socio-economic and political institutions is gradually making human interactions more and more dependent on these technological developments. Thus, increasing human interaction with computers and internet [11]; and, making knowledge and skills of using these technologies a basic necessity [12]. As visible in the banking sector, governance [13], modern information technology has a lot to offer in educational practices [14]. Apart from facilitating the day-to-day general administration of schools; ICT has unlimited potential use in the actual process of teaching and learning [15]. The World Wide Web accessed through the internet computer and mobile web browsers provide teachers and learners' with wide variety of unlimited information that can be accessed anytime anywhere. Teachers can access online information that can help them in their lesson plan, improve the content of their lesson note, learn new techniques and methods of teaching; and, update their knowledge of pedagogy and subject content [16]. Learners on the other hand can access useful information that can help to broaden their understanding of the subject content they are learning in schools [17]. The online social media forums provide teachers and learners with a platform for collaboration in teaching and learning at local and international level; and help to extend communication and discussion between learners and between teachers and learners beyond classroom [18].

In the teaching-learning process, the use of power point presentation and smart board technologies can facilitates teachers' delivery of subject content in classroom instructions [19]; making learning easier and concrete for the student particularly if the teacher uses relevant images, videos and documentaries in his presentations [20]. Effective and innovative use of these tools helps to retain students' attention and makes the learning process more of a fun in the classroom. Of recent there are variety of software applications designed for educational purposes to facilitate the teaching and learning of specific topics and courses at all levels of learning available online (for free and on purchase). SPSS software for example can be used to facilitate the teaching of statistics. At the school level teachers can select free appropriate software from a wide range of options online for class use. With such facilities, teachers can engage students with variety of learning activities using technology in the classroom; thus, making the teaching-learning process more activity-oriented and learner-centred. Thus, in societies where access to internet and computing devices is not an issue, learners are less dependent on teachers for information on subject learning content. This development is changing the role of a teacher from that of a knowledge giver to that of guide to knowledge development and understanding.

Efforts to harness the potentials of ICT in education differ from country to country. Even within a country, development may differ from place to place. Some are at the stage of policy initiation; infrastructure development and training; or at the stage of actively use as the case may be. In Southeast Asia, Singapore and Malaysia are at a more advanced stage in their effort to harness the potentials of ICT in education. Generally, citizens to these countries have access to internet connection at home, at work, in public places and in schools. Almost every family have access to desktop computers connected to internet for family use in addition to other computing devices (laptop and smartphones). Thus, children are therefore generally born with access to technology (digital natives of the 21st century). Such children naturally acquire technological competence as they grow to school age [21]. They grow to be more dependent on technology [22] for information (as they prefer to Google than to ask individuals); in the way they interact with each other preferring to use instant text messaging than to communicate verbally [23]; and prefers the active use of technology in their learning process [24]. Handling the digital natives as learners in schools requires a new environment (the 21st century learning environment) where the use of digital information technology is at the core centre of the learning system [25]; and 21st century teachers capable of using technology to engage learners in technology-based learning activities in and outside the classroom [26], [27]. Thus, building the desired 21st century learning environment for 21st century digital natives has been the concern of stakeholders in the education sector [22].

Getting teachers to use technology and 21st century approach to teaching and learning as expected of the 21st century teachers in handling the educational process of the digital natives is critical in building 21st century learning environment [28]. Having 21st century teachers is necessary in handling the 21st century learners who are characterised with: short attention spans, multitasking, and the desire for speed in communication and accessing information using digital technology [29]; preference for problem-solving activities, social learning [24] and unrestricted freedom to the use of technology for learning [30]. Because of their attachment with technology, they are audacious, self-motivated and more likely to set highly challenging learning goals for themselves [31]. Their curiosity and desire for more knowledge depends on their satisfaction with the learning process [32]. 21st century teachers therefore are expected to have a good knowledge and understanding of the 21st century learners' attachment with technology and what they do with it in their learning process [33].

III. METHODOLOGY

This study is design to find out how teachers utilises the ICT facilities provided in schools to determine the existing pattern of ICT integration in schools. The study was also intended to find out if teaching and learning in schools have changed as a result of the ICT facilities provided; to determine the changing pattern of pedagogical practices in schools. Two research questions were therefore raised for two research objectives. What is the existing pattern of ICT integration in schools? Is teaching and learning changing as desired in the schools where ICT facilities are provided? These two research questions were raised to determine: the pattern of ICT integration in schools; and, the pattern of pedagogical practices associated with ICT integration in schools (the research objectives). The study was conducted in two schools.

Data for the study were collected from three (3) sources (interview, observation and documents). Semi-structured interview was conducted online using Skype (video-calls and Chat-room) and email. Correspondence via email with the participant was made to make appointment for the interview sessions. An average of six interview sessions was conducted with each participant over a period of one month. The Skype online interview conducted was on one-on-one bases between the researchers on one hand and the individual participant on the other hand. Time and dates of the interview session for each participant differs. No group interview session was conducted for the participants. Duration of the interview sessions differs. The interview sessions conducted at night takes longer than those conducted during working hours (mostly at lunch time). The interview session with minimum duration was conducted in forty eight (48) minutes while the maximum was for one hour thirty five minutes. After the interview, follow-up correspondence via Skype chat room and email were made between the researchers and the interviewees (individually). Items in the interview protocol were developed based on the assumptions earlier built by the researcher and structured prior to the interview. Three (experts) help in validating the interview protocol. Key items (questions) of the interview protocol were designed and structured to generate data that can help the researchers to find out the state of ICT facilities and infrastructure in schools; level of technological competence of teachers and how teachers use the technology readily available in the schools. For example, is your school provided with ICT facilities? This is a key question that every participant was made to answer. The question lead to other sub-questions like what are the ICT facilities provided? Based on the responses provided participants during the interview sessions additional key question were raised and used.

Data were also collected through observation using a rubric scale developed by the researchers. Two research assistant help in the observation. Two of the researchers assisted by the two research assistant observe classroom teaching for a week in each of the schools using the observation rubrics to record their observations. Teaching sessions were observed to find out how and when teachers use ICT in their teaching. Existing policy document and literature on ICT integration at the global level and in Malaysia were also used as source of data.

A total of eight (8) teachers from two (2) two schools categorised as rural schools in the state of Kedah in Malaysia participated in the study. Simple random sampling technique was used in selecting one out of the total number of mathematic teachers in each of the schools. Same procedure was used in selecting one English, science and one from the arts and humanities subject from each school as the participant. Four (4) participants were finally selected from each school; all the selected participants (six females and two males) are teachers with Bachelor Degree in Education in their respective area. All the participants give their permission and consent for their involvement in the study.

Thematic analysis was used in analysing the data collected by the researchers. The data collected from each of the three sources mentioned earlier were sorted out separately and triangulated during the analysis to develop the emerging themes. The data were first transcribed, then coded and tabulated for triangulation. An example is provided in (Table 1).

IV. ANALYSIS AND FINDINGS

The data collected for the study were sorted; thirty nine (39) concepts (explanatory ideas) were identified and coded from the data. Closely related concepts were grouped into sixteen (16) categories. Related categories of the coded data were further merged to form themes of the study. Four major themes (each broken into sub-themes) as presented in table 2 were identified in the study.

As shown in (Table 2) above, findings from this study indicated that there are still issues relating to ICT facilities and infrastructure in the rural schools where the study is conducted. In terms of basic ICT infrastructure, all the schools are provided with computer laps equipped with desktop computers; cable and wireless internet connectivity is also provided. But, the computers provided

TABLE I.
SAMPLE PROCEDURE OF DATA TRIANGULATION AND CATEGORISATION

Issues investigated	Coded interview data	Coded observation data	Documented data	Triangulation of data/concept identification	Categorisation of related concept/development of emerging themes
ICT facilities in schools	*Interviewee A:* "yes, we have ICT facilities. But they are not enough" *Interviewee B*: "what we have available is just the computer labs. We also have internet connection"	The schools are supplied with computers. Computers supplied to the schools are for the computer labs. Most of the teachers have lap tops.	All schools are provided with computer labs. Computers are supplied to the labs. Teachers are provided with lap tops. Internet service not stable.	Schools have computers and internet connection. Available facilities in schools not enough.	ICT facilities for teaching in schools is still an issue.

TABLE II.
THE EMERGING THEMES

S/No	Emerging Themes	Emerging Sub-themes	
1	Issues in ICT facilities and Infrastructure	a.	Basic Institutional ICT Infrastructure;
		b.	Teachers and Students Access to ICT facilities;
		c.	Technical support and maintenance.
2	Issues in ICT Literacy Skills and Competence in educational practices among teachers	a.	Technological knowledge and skills;
		b.	Technological content knowledge;
		c.	Technological pedagogical knowledge;
		d.	Technological, pedagogical and content knowledge;
3	Changing trend of ICT usage among teachers	a.	Increase in computer and internet usage among rural teachers;
		b.	Declining use of the computer and internet in pedagogical practices.
4	Emerging challenges of ICT integration in pedagogical practices	a.	Demotivating factors;
		b.	Limited knowledge of TPACK;
		c.	Technological development and emerging need of new knowledge and training.

are limited in number (and are kept in the computer labs only). The conventional classrooms remain the same without a computer and the much needed LCD overhead projector. Teachers have access to personal lap tops (some provided by the government while others are self-acquired) and smart phones with internet connection. But, for the students, not more than 50 at a time have access to computers in the school. The available limited facilities provided requires regular maintenance but technical support staff are lacking in the schools. Most of the existing computers at the time of the study require update and some maintenance touches.

Despite the series of in-service training and workshops provided, there are still issues associated with the teachers ICT literacy skills and competence for technology integration in their professional practices. The previous trainings provided have helped teachers in acquiring basic technological literacy (the ability to use the computer) and basic information literacy (the ability to access and use online information and resources). Based on the interview responses provided and the data generated from our observations, technological knowledge and technological content knowledge (skills of using technology in accessing subject-content knowledge) among teachers is no longer an issue. However, the teachers are yet to acquire technological pedagogical knowledge (knowledge and skills of integrating technology in teaching); and the knowledge of integrating technology with pedagogy in teaching and delivering subject-content (technological, pedagogical and content knowledge—TPACK).

The researchers have identified a changing trend of ICT usage among school teachers in the rural areas where the study was conducted as one of the emerging themes of the study. Contrary to our earlier assumptions, we discover that teachers actively use their computers and smart phones in accessing variety of online information and resources that help them in building their lesson plan and developing their lesson notes for student. But, we have discovered as well that the use of computer and internet in classroom teaching was on the decline. The increase is associated with the teachers increasing technological and information literacy. But the teachers decline in integrating technology in their pedagogy has to do with some new challenges.

The emerging challenges preventing teachers from integrating technology in their pedagogy are common to all the schools. The absence of overhead LCD projectors

and desktop computers in the regular classrooms is one among many other demoting factors that frustrates teachers' effort in using power point projectors in their teaching for example. Engaging students in web-based content inquiries during class section is also being frustrated by lack of enough computers in the school. The available computers in the lab are in most cases reserved for IT subjects; and for the few period when they are free demand for use by other teachers is high. When they are secured for use (in rare occasions) the software intended to be used may not be readily installed in the computers and there are no technical staff to support. The internet takes long to connect for teachers to use web-based applications as alternative. In addition to this, the teacher's knowledge of TPACK is limited. Therefore, the teachers' skills of blending technology with pedagogy in designing classroom instructions suitable for subject-content delivery are lacking.

V. DISCUSSION

A. ICT facilities and Infrastructure

Issues associated with adequate ICT facilities in classrooms particularly in rural schools is a global issue [34] but the degree of the issue differs among countries [35]. Availability of a computer and overhead LCD projector for teachers use in the classroom is a critical factor that affects the integration of ICT in classroom teaching. Generally, the integration of ICT in classroom teaching at the very basic level starts with the use of a computer and the LCD overhead projector. With these facilities, teachers can bring real life situations to the classroom by projecting relevant video clips, images and animated short-stories (locally generated or available online) in teaching subjects [36]. Thus, helping learners to see the relevance of what they are learning in real life situation [37]; making learning more meaningful and concrete [38]. Because of this critical role, the availability of a computer and the overhead LCD projector for teachers use in every classroom (rural or urban) is a considered a basic necessity for ICT integration in pedagogical practices. If these two critical tools are not available in the classroom for teachers use, the process of teaching and learning may continue to take the pattern of a traditional approach. Teaching and learning of respective subject content may continue to be more abstract than concrete. Thus, leaving learners with the trouble of

wondering alone to figure out the relevance of what they are learning as it applies to real life situation on their own.

The availability of these tools is not an issue in many of the schools situated in the urban schools throughout Malaysia. This situation is creating disparity in approach to teaching and learning between urban and rural schools; creating a feeling that quality of teaching and learning in schools that are more equipped with these facilities (urban areas) as higher. Though, from our findings, teachers in rural schools have the interest and the willingness to integrate the use of these tools in their teaching; but difficulty in having access to the available (one or two pieces in the school) at the time of need due to long queue of teachers waiting to use it has frustrated teachers to retire to traditional mode of teaching. Providing a permanently fixed overhead LCD projectors and at least a computer in each class in addition to the computer labs and internet connectivity already provided in Malaysian schools would:

1. Help rural teachers to kick-start basic ICT integration in their teaching;
2. Create a balance of approach to teaching and learning between rural and urban schools;
3. Help in creating uniform opportunities for innovative teaching and learning between teachers irrespective of their location.

Teachers' access to internet connectivity and computing devices (be it in form of computer, tablet or smart phone) in Malaysian schools is no longer an issue. But students' access to computers in classroom during teaching is limited to only those in the computer labs at the time. Providing one-on-one computing devices (desktop computer, laptop, smart phone or tablet) is necessary for teachers to move to a higher level of ICT integration in their teaching. The increasing human interaction with digital communication technologies in the recent years has necessitated the emergence of 21st century learning environment designed to provide 21st century education and skills for 21st century learners. Building the 21st century learning environment requires the provision of internet connection and one-on-one computing device for both the teacher and the learners in the classroom [39]. Providing 21st century education and skills requires the integration of web-based technology and resources in classroom teaching [30] and a shift in pedagogy from teacher to student-centred approach [40]; where teaching and learning is more activity oriented, inquiry and project based. Every country is making effort toward creating such a learning environment but level of progress varies from country to country depending on their commitment available resources [41]. The issue of internet connectivity in schools is to a large extent taking care of in Malaysia through different national ICT in education programmes [42]. This development has made Malaysia among the countries considered to be making reasonable progress in their attempt to create the desired 21st century learning environment. However, providing one-on-one computing device for learners is still an issue to contend with. Though, our findings from existing document shows that the government of Malaysia (as stated in Malaysia Education Blueprint) intend to provide one-on-one computing device for all students. This is an on-going project that when completed the actualisation of creating

21st century learning environment for 21st century education would be a logical conclusion.

Providing one-on-one computing device for learners in Malaysia as proposed in Malaysian Education Blueprint 2013-2025 in addition to the existing internet connection and the FVLP would:

1. make the provision of basic ICT facilities and infrastructure for 21st century learning environment in Malaysia complete;
2. Facilitate the transition from the simple use of ICT (power point presentation) to a more higher level of integration with emphasis on hand-on-technology learning activities;
3. Provide the platform of re-directing teaching and learning toward the development of 21st century education and skills;
4. Facilitate the desired shift from teacher to student centred learning; and,
5. Facilitate the shift from content-based cognitive learning to a more applied learning approach for problem-solving using the inquiry and project base learning. Therefore,
6. Facilitating transition of teachers from knowledge providers to facilitators of learning.

However, apart from providing the facilities and infrastructure needed the services of technical support staff would be much needed. Lack of adequate manpower for this service at the moment had affected the use of the existing facilities provided in the schools was this study was conducted. The situation is similar to other schools both rural and urban [43]. Technical support is needed for the day-to-day maintenance of the existing facilities available. Permanent staff for this service needs to be employed for each school; such staff can provide useful services that can help to facilitate teacher's use of technology in their teaching. Apart from the regular hardware and software maintenance (and update) such staff can help teachers to get acquainted with the technicalities involved in handling new technologies as they emerge.

B. Issues in ICT Literacy Skills and Competence for Educational Practices among Teachers

Findings from our study shows that practicing teachers in rural schools have acquired basic knowledge of technology (knowledge of computer use and application); and, basic technological content knowledge (the use of technology in accessing their subject content knowledge) through series of in-service workshops and training provided by government. Acquiring these categories of knowledge in addition to knowledge of teaching subject is necessary but not enough for effective use of modern technology integration in teaching [44]. Innovative use of technology in teaching-learning process as desired in 21st century learning environment require teachers to have good technological pedagogical knowledge (knowledge of the interplay between technology and pedagogy) and the skills of its application in teaching subject content (technological, pedagogical content knowledge). Now that teachers even in the rural areas are acquiring reasonable level of basic ICT literacy skills and competence; focus of in-service teacher training should now be geared toward the developing knowledge of the interplay of technology and pedagogical approach in teaching school subjects

(TPACK) among the teachers [44]. This would help teachers to acquire the competence needed in teaching 21st century education in 21st century learning environment. The basic ICT literacy skills and competence acquired by teachers coupled with their limited knowledge of TPACK and the skills of its application in teaching has created a peculiar trend of ICT usage among teachers as identified in this study.

C. The Changing Trend of ICT usage among School Teachers

Based on our earlier assumptions, that the available facilities (computer labs and internet connection) provided to schools and the computer training provided to teachers, we expect to find increasing use of ICT in teaching among school teachers. Contrary to our expectations, we noticed an increasing use of ICT (computer and internet) by teachers *but not in teaching*. Teachers are now actively accessing the internet through variety of computing devices mainly for personal use (email communication), social networking, computation of student's assessment record and in accessing information that can help them in lesson planning and preparation. Despite this level of teachers' engagement with ICT, teachers as observed in this study hardly use technology in their classroom teaching. This is an indication that ICT literacy skills and competence is no longer a challenge to many teachers in Malaysia as may be applicable to other countries. Yet even with the improvement of teachers technological competence, ICT is not being integrated as desired in teaching [45].

D. Emerging Challenges of ICT Integration in Pedagogical Practices

The decreasing trend for ICT integration in teaching as identified in this study can be associated with some new challenges. Such new challenges as mentioned in the findings of this study have discouraging effect on teachers' interest and motivation toward the integration of technology in their teaching. Earlier studies reported poor ICT infrastructure [46], teachers' low level of technology (computer) knowledge and teachers' negative attitude and anxiety toward the use of computer as the barriers to ICT integration. But findings from this study reveal that these are no longer issues in Malaysia. Instead, we discover limited knowledge of TPACK, administrative issues and fast emerging technology as the new emerging challenges preventing teachers from utilizing available facilities in their teaching in the context of Malaysia. These demotivating factors faced by teachers are not only applicable to Malaysia. They are more global in nature [47]. Similar challenges are being faced by teachers in Brazil, China, India and African countries [48], [49] among others reported in literature.

There are striking similarities of the factors that influences ICT integration in rural schools globally. For instance in rural India, technology access to individual school children and teacher's limited knowledge of TPACK was equally an issue in addition to the need to exploit application of local language within technology and curricular content [41]. Teachers in urban areas too are not free from this challenge. Consequent of these challenges, the use of ICT in schools during classroom sessions has not gone beyond the use of power point (in the few urban schools where overhead LCD projectors are

provided in reasonable number) in teaching core regular subjects. Because of this situation, students have little or no exposure for learning using hand-on-technology in learning the regular subjects (with the exception of IT courses that are being taught in the computer labs). As the basic infrastructure is already in place in many rural schools; efforts should be concentrated on providing new form of training that can help teachers to have reasonable understanding of TPACK and in acquiring the skills of its application in teaching [50]. Teachers' limited knowledge of TPACK can be associated with the nature of teacher training program provided. Generally, the structure of pre-service teacher education does not provide teachers under training with the knowledge of TPACK [11]. What the teachers under training get is usually the knowledge of pedagogy (not being link to any particular subject content); knowledge of teaching subject without being link to the knowledge of pedagogy; and, knowledge of technology being linked to pedagogy and subject content [44]. Thus, teachers have little or no knowledge of how to relate technology and pedagogy in the teaching process [20].

The continuous emergence of many newer digital technologies presents yet another challenge to teachers. This is because access to training on how such new technologies can be used to advantage in educational practices may not be handy. This situation has made teachers handicap in integrating existing technologies in teaching as may be appropriate; making it difficult for teachers to adopt 21st century teaching learning approaches that emphasizes hand-on-technology [51]. Though, teachers in rural schools would do well by augmenting online content to share best practices starting with a video library of the best teachers delivering lessons in critical subjects. Alternatively, if they could afford it, it would be better to organize targeted ICT training sessions based on specific subjects and their relevant technology integration strategies.

VI. CONCLUSION

In a 21st century learning environment, digital electronic communication technology is the key factor. Teaching and learning has to centres around the innovative use of existing and emerging technologies. Two things are therefore necessary in building the much desired 21st century learning environment for our digital natives of the information age (21st century learners). First, providing the basic ICT infrastructure and facilities and getting teachers to use the facilities in teaching and learning. The second thing is getting the teachers to adopt the use 21st century teaching learning approaches and methods in their classroom practices. Teachers and technology are therefore the key role players in a 21st century learning environment. Basic ICT infrastructure and facilities in 21st century learning environment goes beyond the provision of internet connectivity and one or two computer labs for the schools. One-on-one unlimited access to computing device and internet connection to teachers and learners during classroom instructions is necessarily needed as part of the basic facilities required at all levels of learning. Meeting up with this as a basic need of educational institutions is a global challenge. Further studies may want to explore how individual countries can address this issue.

Getting teachers to use technology and to adopt the 21st century teaching learning methods also present a complex challenge. Training teachers to integrate ICT need to go

beyond providing teachers with knowledge and skills of computer operation as the case is in most countries. In-service teacher training for ICT integration has to be directed toward building teachers skills and competence of applying technological knowledge in pedagogical practices. And, additional knowledge domains for teacher education as introduced in TPACK theory and framework need to be operationalized in teacher education. Further researchers can consider undertaking new studies that can help in building new approach for in-service teacher training in due respect. Operationalization of TPACK theory and framework in teacher education also requires further studies in relation to specific existing structures as may be applicable to respective countries.

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