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A Framework for Utilisation of Modern Instructional Technology in Teaching Agricultural Education

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Abstact: The study proposed a framework for effective utilisation of Modern Instructional Technology (MIT) in teaching Agric education courses to achieve student's critical thinking skill. The development of MIT poses a challenge to the instructors to improve educational quality to meet the educational need of the 21st century digital students. The study explored the MIT methods and equipment used in teaching Agric vocational courses and proposed a framework for effective utilisation of the Modern Instructional Technology (MIT) equipment and methods. The modern instruction design model was adapted from basic lesson design sequence for direct instruction model. Then, the kinds of knowledge that teachers would ideally use to design modern instruction in Agric education were added. The model indicated areas of overlap which mark where these knowledge and expertise domains converge and the resultant output the students will exhibit which is critical thinking skill. Therefore, the proposed framework for evaluation of the role of MIT in teaching Agric education was derived from that model based on RED model theory of critical thinking. The framework argued that if MIT methods were effectively utilised using available MIT equipment at appropriate subject area and with good usage behaviour, critical thinking skill will be achieved. Therefore, this review provided ideas on how the use of MIT stimulates teaching of Agric vocational courses, how to encourage young individuals to embark on vocational skills and proved that use of MIT leads to critical thinking that leads to new innovations

Key words: Modern instructional, technology critical, thinking agric education, modern instruction, equipment modern instruction method

INTRODUCTION

It is a reality that the role of technology is highly significant and has become a globally discussed issue in contemporary education policies (Nwezeh, 2010). Modern Instruction Technology (MIT) encompasses design, development, use, management and evaluation of process and resources for instruction (McDonald *et al*., 2005). It aims to promote the use of validated, practical procedures in the design and delivery of instruction. MIT methods encourage students to solve problems by gathering data, organizing data and attempting an explanation. Students can even analyse strategies that they can use to solve problems. Students can discuss contents of such solutions with their instructors using telephone conferencing, video clips and video conferencing.

The use of MIT methods also provides a platform for groups of students to work together and solve a problem or complete a task these can works well online nowadays using the internet. Students can also converge online from different geographical locations to receive lectures and carry out academic activities. They can even compete with each other one to-one or team to-team to determine which individual or group is superior at a given task such as egg hatching or farm project competition (Cruickshank *et al*., 1999).

Zhou *et al*. (2010) described how Integrating MIT equipment into classroom practice has been on the agenda of the many governments over a long period of time. The need for MIT knowledge from agricultural teacher is increasing with the technological development. In Canada, for instance, the Information and Communications Technology Integration Performance Standards which was designed for grades 5-10 (ICTI) are intended to support teachers and students as they use MIT to enhance learning across the curriculum (Zhou *et al*., 2010). The ICTI Performance Standards provide the guidelines within which teachers, students and parents can examine a range of authentic learning tasks that are supported by the use of ICT processes, tools and techniques in their schools.

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However, Singapore operates on the basis of a systematic MIT equipment in-service training program. Singapore, engaged in MIT equipment education policy (Master Plan 1) since 1997 which was intended to provide access to new MIT equipment education (Master Plan 2) in 2002 (Zhou *et al*., 2010). In Master Plan 2 (MP2), the training was targeted toward helping teachers integrate MIT effectively into the curriculum. Hence, teachers were introduced to various types of MIT resources and the ways to evaluate and select appropriate MIT resources for teaching. The MIT training program included how to use MIT resources to research, organize, analyse and present information. MIT equipment education in Korea consists of MIT equipment literacy education and MIT equipment application education. The Korean government announced the MIT equipment literacy curriculum for students in 2000 and the 'ICT Skill Standard for Teacher (ISST)' for teachers in 2002 (Zhou *et al*., 2010). The MIT equipment literacy curriculum focused on the usage of application program (Zhou *et al*., 2010).

However, the instruction stage is the most important and difficult stage in the use of MIT. A study by Aburime and Uhomoibhi (2010) on student's level of MIT knowledge revealed that there is much work to do in facilitating student's acquisition of the necessary technology skills to engage in active learning. The study indicated that 60% of the students have to memorise their subject content, they have difficulty in picking out important information although they do try to relate lecture to real life, 40% research without the chance of understanding what they are studying and they have difficulties in remembering facts and treat information holistically. Such problems negatively affect progress and later development of student's critical thinking.

This is totally against the goal of effective learning which promotes deep learning for improved understanding of what has been learned (Marzano and Brown, 2009). Edgar *et al.* (2012) cited that both Agric students and lecturers agreed that courses related to MIT use are very important to student's future competitiveness in the job market. However, it has been observed that teachers in vocational and technical schools use MIT most frequently for managerial purposes and least in teaching and learning processes (Mumcu and Usluel, 2013). Edgar *et al.* (2012) noted that despite huge efforts to position MIT as a central tenet of university education, the fact remains that many students and faculty make only limited formal academic use of MIT during their teaching and learning. Therefore MIT skills are importance and should be integrated into course syllabi and instruction in an effort to create successful outcomes in teaching and learning that are content specific.

Literature review: Educational Technology was defined by Association for Educational Communications and Technology (AECT) as the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources. The improvements in technology, especially computer technology, bring changes and makes things easier for every part of daily life. It is a reality that the role of technology is highly significant and globally discussed issues in contemporary education policy (Nwezeh, 2010). Arteaga, Cortijo and Javed advocated that is necessary to move from a traditional teacher-centred instruction approach to a learner-centred approach, where the student, instead of absorbing material transmitted by the instructor, learns how to learn.

Therefore, Minocha (2009) summarised that the benefits of using social software methods and tools in learning and teaching to students and educators of using cannot be over emphasized. The use of Web 1.0 allowed knowledge to be disseminated electronically and accessed widely. The interactive nature of social media allows students to participate in collaborative work, whereby to high quality learning outcomes, participants in the process benefit from both peer recognition and peer review, both excellent preparation for more modern collaborative teamwork. Social software methods and tools to actively engage learners both individually and in groups whilst still providing opportunities for differentiation since the individual contributions may be identified and tracked.

Messina and Tabone (2012) viewed that Technology Knowledge refers to knowledge about technology, ranging from traditional (book, blackboard, etc.) and semi-traditional ones (video camera, photo camera, etc.) to new digital technologies (computer, software, etc.) and must be intended not only as strictly instrumental knowledge installing and removing peripheral devices, installing and removing software programs and creating and archiving documents (Mishra and Koehler, 2006) but also as media language knowledge which can develop teachers confidence and students critical thinking. In respect of the teacher competence, Li (2009) cited that there is a need for vocational technology teachers to take in MIT course in order to experience how to use it effectively to improve instructional quality and integrate MIT into instruction so that to enhance teaching and learning efficiency and effectiveness. It will also help the

teacher to enhance their self-learning abilities, professional development and MIT literacy. In order to generate creative ideas, Agric students could be asked to withhold judgment or criticism and produce a very large number of ways to do something such as resolving a problem (Cruickshank *et al*., 1999). For example, learners may be asked to think of as many measures as they can for eliminating world hunger. Once a large number of ideas have been generated, they are subjected to inspection regarding their feasibility.

Zhou *et al*. (2010) observed that based on social cognitive theory, a person's belief in performing a behaviour or a task can lead to the successful completion of the task. Sharifi and Imani (2013) cited that according to previous researches, knowing and applying ICT by students affects their educational achievements and deeps learning on them. Apart from complexity of technology, lack of proficiency, knowledge and positive view toward MIT, makes it impossible to be applied (Sharifi and Imani, 2013). The multimedia instruction method also highlights the importance of learners viewing cases in an interconnected way (Pridmore *et al*., 2010). MIT was found to have a greater effect in learning when used to support instruction rather than for direct instruction (Tamim *et al*., 2011; Lee *et al*., 2013). Zhou *et al*. (2010) also pointed that one of the factors that determine educational innovation in general is teachers as they are the ones to use the modern technology investments for educational development. Because technology does not have an educational value in itself, it becomes important when teachers use it in instruction process (Tezci, 2009).

Higher education institutions provide opportunities for learning and skill development for the students to enhance student's performance in a real-world work environment (Pridmore *et al*., 2010). The High education institutions design skills acquisition for students include a good understanding of technical concepts and how to apply those concepts in their respective areas of study. While it is easy to identify desired skills, it is more difficult to teach them. Communicating highly technical concepts of Agriculture in a way they can be comprehended continues to be an issue of concern for both academicians and practitioners (Pridmore *et al*., 2010). Hamidi *et al*. (2011) observed that universities are the major centre where MIT are used for the collection, analysis and production of scientific information. It is very important to equip universities with any technological tools that transfer information. Sanchez *et al*. (2014) revealed that in recent years, MIT plays a vital role in changing the world of higher education. Experience of using MIT tools can improve the learning of Agric vocational courses when properly used.

Technical and vocational education courses such as Agric education are carrier courses offered in middle school, high school and community technical colleges and other post-secondary institutions around the world to provide skills training that addresses the need of high-growth industries (Chang *et al*., 2011). Career and technical education makes a very great impact to both instructor and student they benefited very much as it emphasizes the application rather than just acquisition of knowledge. It also makes student much more interested in the professional field and these serve as motivation to foster competence in the core skills (Chang *et al*., 2011). Agric vocational education directly benefitted by the development in technology. Now a days with MIT tools, Agric vocational students can learn virtually at any time and at any place. MIT makes learning a private and personal experience and these motivate learners (Laal, 2013). The advent and use of MIT and related technologies have meant rapid development and ability of teachers and students to operate at improved levels in Edgar *et al*. (2012) noted that most colleges of agriculture graduates need MIT skills to enter and advance in their professional careers.

Syafii and Yasin (2013) stressed that modern instruction innovation is needed in the teaching and learning of Agriculture to increase the quality of the knowledge acquired. This innovation process can be done by understanding and improving instructional methods in High education institutions which can assist students in improving their problem-solving abilities and concept mastery so that they can apply the acquired knowledge in a practical situation. Pridmore *et al*. (2010) pointed that an additional benefit of this environment is its flexibility and students can learn to apply their knowledge in either individual or collaborative settings, thereby gaining in introductory agriculture courses require instructional methods that combine the theoretical emphasis and structure of lectures and the practical relevance and flexibility of multimedia instruction methods. Laal (2013) observed that the advent of MIT improve the quality and effectiveness of teaching Agric vocational courses in higher institutions of learning which resulted into the development of a variety of learning technologies and the incorporation of a number of new elements into Agric vocational courses, examples of these new elements are- video films, multimedia course ware and live lesson delivery.

Framework for modern instructional technology utilization in agricultural education: Teaching is the primary source of student learning because it prepares students to be qualified on whatever carrier, it is important

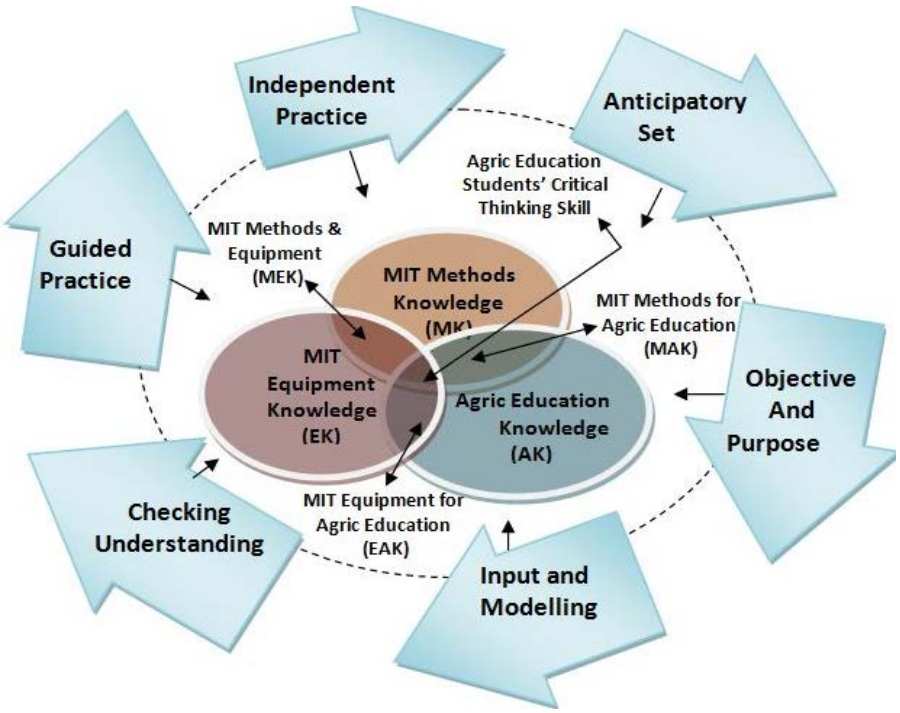

Fig. 1: Modern instruction design model (Heick, 2013)

to provide them education that imparts, improves and develop the requisite skills needed for such position. Some of the important things that teachers need to improve agricultural vocational teaching are modern instructional methods and materials. Adopting appropriate instructional methods that are conducive and congruent to the expected outcomes is vital in improving learning. One of such methods is multimedia method, multimedia method is the use of a computer, mobile devices internet to present text, graphics, audio and video with links and tools that allows the user to navigate, interact, create and communicate (Gaytan and Slate, 2003) multi-media method are a major contributor to improvements in the quality of learning in the classroom.

Therefore, to design an effective direct instruction, there is need for the knowledge of MIT methods and equipment as well as contents knowledge of the subject area. Heick (2013) cited the research of Robert Marzano (What Works in the Classroom) where he added an interesting component to basic lesson design sequence for direct instruction model, established by Hunter (1982) (Fig. 1). Initially, the model consists of 6 fundamental steps of anticipatory set, objective and purpose, input and modelling, checking for understanding, guided practice and independent practice. These are the components of teacher usage behaviour in critical thinking perspective, whereby the teacher is expected to demonstrate effective and professional use of modern instruction equipment and methods. A book by Hunter (1982) on effective teachers concluded that for a teaching to be effective and develop student's critical thinking, there should be predefined methodology when planning and presenting a lesson and this methodology is based on six elements in his Model of Mastery Learning (Heick, 2013). The elements presented in Figure 1 can be summerised as follows:

- Anticipatory Set: This refers to an activity by teachers before starting actual lesson to attract attention of the students. An example of such activities is review of previous lesson
- Objective and Purpose: Students should know what they are supposed to be learning and why they need the particular knowledge
- Direct Instruction: Input and modelling; the teacher should present to students what is required for them The lesson should be planned and interactive and practical
- Check for understanding: Teachers can ensure students understanding by asking questions
- Guided practice-students should practice the new learning under direct teacher supervision through class work

Fig. 2: Conceptual framework for Modern Instruction Technology (MIT) utilisation in agric education

- Independent practice: This is assigning independent practice to students by the teacher like homework

However, the kinds of knowledge teachers would ideally use to design modern instruction were integrated in the model which are pedagogical knowledge, content knowledge and technological knowledge as in TPACK framework (Spector *et al*., 2008). Content Knowledge (CK) refers to the subject contents knowledge that a teacher is expected to have acquired in a particular profession such as Agric education in this context. The Pedagogical Knowledge (PK) refers to the teacher's knowledge on the MIT methods that are expected of the teacher to achieve student's critical thinking skills. The Technology Knowledge (TK) is the teacher's knowledge about both traditional and MIT equipment that can be applied in instruction (Spector *et al*., 2008). These were presented as Agric Education Knowledge (AK), MIT Methods Knowledge (MK) and MIT Equipment Knowledge (EK) in the agric student's critical thinking model (Fig. 1). More importantly, however are the areas of overlap included in the model that mark where these knowledge and expertise domains converge and the resultant output the students will exhibit which is critical thinking skill.

Hence, the propose framework for evaluation of the role of MIT in teaching Agric education in Fig. 2 was drive from Fig. 1 based on RED Model of critical thinking by Watson (1980). The model is based on 3-factors; recognise assumptions, evaluate arguments and draw conclusions. Recognising assumptions here is the ability to differentiate between fact and opinion. Hence, this was substituted by the student's ability to identify the MIT equipment and methods. The evaluation of arguments here refers to students identifying the usage behaviour of teachers in respect to the MIT equipment and methods. A drawing appropriate conclusion which is the student's critical thinking skill defends on the available evidence of MIT equipment, methods and teacher's usage behaviour. As demonstrated in Fig. 2, the framework argued that if MIT methods are effectively utilized using available MIT equipment at appropriate subject area and with good intention to use, critical thinking skill can be achieved. This can show the usefulness of MIT in teaching, hence enhance students problem solving skills in the study area and critical thinking skill in general. The framework suggested that MIT method can influence students 'critical thinking skill in the teaching of Agric vocational course if there is available equipment with teacher's good behaviours towards the use of the equipment. Therefore, if there is available MIT equipment with good teacher's usage behaviour, the appropriate MIT methods can be used and student's critical thinking skill will be achieved. However, if there is no MIT equipment and appropriate MIT methods, student's critical thinking skill cannot be achieved.

To improve dissemination and integration of educational innovations of MIT, McEachron *et al*. (2012) recommended among other things that all improvements should match the instructor's learning goals. In other words, the innovation needs to solve a real problem as perceived by the instructor. This is to embed the innovation into current practice rather than attempt to revise everything at once. Thus, change should be gradual or as Schwartz in McEachron *et al*. (2012) put it the "right size byte". He further suggested that educational innovations should be flexible and able to be adapted to local conditions and means or method should be provided to evaluate and reflect on the results of applying any innovation. In order to implement successfully, Englert *et al*. (1993) recommended providing the principles underlying an innovation as well as the historical context in which the innovation developed. Innovation must also be supported by the administration and faculty of the institution to ensure sustainability.

Therefore, MIT methods put learners into seemingly practical situations where they can make decisions and experience the outcomes of their decisions with and without risks. Such student's engagement intends to give the real life appearance or have the true-experience which in the final stage develop their critical thinking ability. Therefore, availability of MIT equipment and media together with the use of MIT methods can make learning interesting and highly educative.

CONCLUSION

The framework suggested that MIT method can influence students critical thinking skill in the teaching of Agric vocational course if there is available equipment, with teacher's good behaviours towards the use of the equipment. Therefore, if there is available MIT equipment with good teacher's usage behaviour, the appropriate MIT methods can be used and student's critical thinking skill will be achieved. However, if there is no MIT equipment and appropriate MIT methods, student's critical thinking skill cannot be achieved. Meanwhile, the framework intends to postulate that usage behaviour can influence the causal relation between MIT equipment and method with critical thinking skill in the teaching of Agric vocational courses. Hence, even if there is available MIT equipment with appropriate MIT methods used in teaching Agric vocational courses, the teacher's usage behaviour can enhance student critical thinking skills in Agric vocational course. Further empirical studies were recommended to prove the effectiveness of this framework. The studies can identify the MIT equipment and methods used for teaching Agric vocational courses and prove the relationship between MIT method and equipment with student critical thinking.

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