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Model for Integration of Technology in Authentic Education -An interpretation of a literature Review

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***Abstract*— This literature review is conducted to identify, appraise and synthesize empirical evidence of a filtered list of recent literature regarding methods in which technology could be integrated to facilitate authentic learning pedagogy. A protocol was developed to carry out a search for screening[1]. iDiscover search engine of University of Cambridge library was used for selection and filtering of the articles for their appropriateness. Critical appraisal was performed and data was extracted to map, conceptualize and synthesize the proposed tripod model for integration of technology in authentic education. This model depicts the findings in three zones namely, foundational layer, operational layer and the stage which is the platform for authentic education. Understanding the landscape of the tripod model for integration of technology in authentic education could be quite decisive in selecting the best-fit technological tool. This article argues about how technological interventions could enhance the outcomes of authentic education and the need of an appropriate pedagogical strategy to align such interventions to the elements of authentic education.**

Keywords—authentic education, technology integration

I. INTRODUCTION

Critical proclamations are made by education reformers on the irrelevance of schooling to the real world at the beginning of the 19th century. Their claims were related to the formal and abstract education that has minimal application to everyday life leaving students unprepared to utilize theoretical/conceptual knowledge to overcome everyday challenges. There is a necessary requirement to connect these two worlds in order to make school education relevant for the real-world [2]. Two persistent maladies that make school education irrelevant to the real world are debated extensively. Firstly, it is about student work not allowing them to use their minds and having no intrinsic meaning or value to students beyond achieving success in examinations. Secondly, it is about the student activities which were not interesting and relevant enough for adequate student engagement [3] . In other words, the lessons were focusing exclusively on theoretical components than the real-world practical components.

Enabling a student to explain what is authentically happening around him/her could perhaps be the most important purpose of education [4]. John Dewey who was a renowned and influential pragmatist, progressivist, educator, philosopher, and social reformer believed that school should be representative of the social environment and that students learn best in a natural social setting. Further he believed that students were all unique learners. Therefore, traditional classroom would not be developmentally appropriate for young learners [4]. Hence, if the classroom setting mimicked the real world, it would enable students to make connections between knowledge and skills learned at school to the challenges faced in the real world. This approach would provide a sense of purpose for learning in school and enhance student ownership of learning.

Dewey with Hans Freudenthal from The Netherlands put forth a bottom-up ‘authentic pedagogical process’ named ‘re-invention’ where relevant real-world contexts and personnel were made to be part of the teaching and learning process in the classroom. This would then make the classroom learning experience similar to ‘real-life’ and thereby expose the students directly to various real-world social situations [2].

Direct instruction knowledge is largely transferred to students as `inert knowledge’ [5]. Students act as passive listeners without much opportunity for the application of knowledge. According to Vygotsky, knowledge is considered to be developed and used in a social and physical environment to which it inseparably binds rather than being an abstract entity [6]. The structure, content and coherence of the

concepts are determined by the respective situation or context [7]. The concept of learning in situational contexts or 'Situated learning' came to limelight amidst an environment of such an understanding [8].

Experiential learning and authentic contexts are strongly inter-connected aspects in education. In the early nineteen hundred learning through real life contexts, learning by doing, learning through projects, learning through problem solving were considered as key pedagogies of experiential learning. However, by the end of 19th century these pedagogies were aligned with the three criteria of authentic learning which are inductive approach for solving problems using the knowledge learnt, student's active participation and application of knowledge beyond classroom contexts to real-life settings [9].

A. Constructivism and Authentic Education

In constructivism knowledge was considered as a direct product of a learner's activities. It was not merely the result of dissemination. Rather, knowledge was constructed by the learner through relating new knowledge to already existing cognitive structures in the learner's mind. The learning of knowledge is done by actively participating in different social contexts and experiencing the realities of those contexts. In constructivism the student has different options for learning independently[2]. Authentic education displays many similarities to constructivism. It is an active process in which the student interprets and negotiates new information by himself in contrast to the traditional setup of teacher-centered education.

Authentic education recognizes that student learning depends upon past experiences or pre-knowledge of students. Therefore, teachers are expected to facilitate requirements of the learners arising from their past experiences, by being a coach, guide or a mentor directing students through meaningful learning. Facilitation is enacted through collaborative learning which is recognized as 'cognitive apprenticeship'[10]. This enables the student to develop higher-order thinking skills beyond simple reproduction of information. Learners will be motivated to interpret, evaluate, compare and contrast information to come up with innovative solutions to real-world problems without limiting themselves to mere recovery of information. Learning in the constructivist paradigm is more powerful when students can draw meaningful connections between their classroom learning and personal experiences in the real-world [11]. In this paradigm the learning takes place while immersed in the real world, whereas in conventional direct instruction the real-world experience comes much later at the end of schooling.

B. Characteristics of Authentic Education

'Authentic Education' concept integrates core principles of learning into one pedagogy. Authentic education does not have a single definition. However, few widely accepted frameworks explain the core concepts of the pedagogy. Roelofs argues that any education setting has a degree of authenticity according to the characteristics of the frameworks that are considered for identifying authenticity. [2].

C. Herrington's 9 Principles of Authentic Learning

Among numerous strategies put forth for authentic education, the framework by Jan Herrington is well-accepted [12]. Based on constructivist approach Herrington has put forth a model for authentic learning. It specifies nine critical characteristics that can be identified in authentic learning environments [13]. Further research has proposed effective instructional guidelines for the aforementioned situated learning framework for creating authentic learning environments. These 42 guidelines put forth by Herrington under each element is summarized in Table 1. 'Context' is the teaching and learning process using a realistic scenario which leads to meaningful/purposeful learning. Factors such as motivation and empathy could be argued to be automatically generated in such a situation. 'Authentic activity' is expected to mimic the complexity of a real-life situation as well as open-ended to have more than one solution. The activity should keep the student engaged for a considerably long period of time as per Herrington's model. 'Expert thinking and modelling' are where she suggests streamlining of thinking processes via the use of real-time expert tools. Facilitating communication and reflection through multiple perspectives obtained from peers, experts and teachers through collaborative learning encompass three elements of this framework. Articulating the findings in verbal or in written medium is another aspect in Herrington's framework. Coaching and scaffolding renders a supportive aspect that is missing from the conventional 'didactic model' of teaching. Finally, assessment is expected to be integrated within the task itself through the development of polished products which gives the learning process a 'value outside of the learning environment'.

Table 1. Checklist of guidelines for the instructional design of a learning environment which enables the situated elements to be operationalized [14],[15]

Element of Authentic learning – Herrington's model	**Guidelines for design and implementation of learning environment**
1. Provide authentic context that reflect the way the knowledge will be used in real-life *-Contexualizing education by situating the instructions and event of teaching and learning within a realistic scenario to provide meaning for learning.*	A situated learning environment should provide: -a physical environment which reflects the way the knowledge will ultimately be used -a design to preserve the complexity of the real-life setting with 'rich situational affordances' -a large number of resources to enable sustained examination from a number of different perspectives - a design which makes no attempt to fragment or simplify the environment
2. Provide authentic activities *-Complex, open-ended, realistic task requiring*	-activities which have real-world relevance -ill-defined activities

Element of Authentic learning – Herrington's model	Guidelines for design and implementation of learning environment
long time to complete and not simple tasks that can be completed quickly.	-an opportunity for students to define the tasks and sub-tasks required to complete the activity -a sustained period of time for investigation -the opportunity to collaborate -tasks which can be integrated across subject areas
3. Provide access to expert performances and the modelling of processes *-Modelling expertise;distributed expertise to be tapped using technological tools.*	-access to expert thinking and modelling processes -access to learners in various levels of expertise -opportunity for the sharing of narratives and stories -access to the social periphery or the observation of real-life episodes as they occur
4. Provide multiple roles and perspectives *-Ensuring that teaching and learning is not relying on a single source.*	-different perspectives on the topics from various points of view -the opportunity to express different points of view through collaboration -the opportunity to criss-cross the learning environment by providing more than one investigation within a resource sufficiently rich to sustain repeated examination
5. Support collaborative construction of knowledge *-Provide opportunities for students to collaborate.*	-tasks which are addressed to a group rather than an individual -classroom organization into pairs or small groups -appropriate incentive structure for whole group achievement
6. Promote reflection to enable abstractions to be formed *-Provide oppotunities for students to reflect both in task and on task* [15].	-authentic context and task -the facility for students to return to any element of the program if desired, and to act upon reflection -the opportunity for learners to compare themselves with experts -the opportunity for learners to compare themselves with other learners in varying stages of accomplishment -collaborative groupings of students to enable reflection with aware attention
7. Promote articulation to enable tacit knowledge to be made explicit *-Provide oppotunities for students articulate their growing understanding in speech and in writing when overall task and activities are completed.*	-a complex task incorporating inherent, as opposed to constructed, opportunities to articulate -collaborative, groups to enable social then individual understanding -public presentation of argument to enable articulation and defense of learning
8. Provide coaching by the teacher at critical times, and scaffolding and fading of teacher support *-Provide scaffolding and coaching in the learning environment through less didactic approach through a more supporting role* [15].	-a complex, open-ended learning environment -no attempt to provide intrinsic scaffolding and coaching -collaborative learning, where more able partners can assist with scaffolding and coaching -recommendations that the teacher implementing the program is available for coaching and scaffolding assistance for a significant portion of the period of use
9. Provide for integrated assessment of learning within the tasks *-Using authentic assessments to assess products with a value outside the learning environment, in a realistic setup ratherthan implementing separate tests. Realworld clients can be used in this case and genunine polished products of students could be used in their working lives.*	-fidelity of context -the opportunity for students to be effective performers with acquired knowledge, and to craft polished, performances or products -significant student time and effort in collaboration with others -complex, ill structured challenges that require judgement, and a full array of tasks -the assessment to be seamlessly integrated with the activity -multiple indicators of learning -validity and reliability with appropriate criteria for scoring varied products

[1]

II. METHOD

Literature review was done through an electronic search of articles. All selected articles were from peer-reviewed journals. The main search terms used were Authentic education and technology. Peer reviewed articles written in English published between 2010 and 2021 for which full text is available online were used for the search. The initial search resulted in 307 journal articles, 02 reviews and 01 book chapter. Out of which 30 most relevant items from the initial search results were chosen based on where they have used technology within the teaching and learning setup, in order to support the elements of Herrington's framework. For example, context designing, assessments, collaboration, communication etc. Those were further filtered based on technological tool terms such as 'Audio, Video, Computer, Digital, Mobile, 3D, Simulation, Computational, Modelling, Cloud sharing, Data storage, Data base management, Web, Artificial intelligence, Virtual reality, Internet, Learning management systems, e-portfolio, Blog and Social media'. This resulted in a comprehensive analysis of 09 studies as listed below in Table 2.

Overview

Table 2. Summary of literature for technology integration in different educational setups

Description of Study (Research Design/Subject/ Source/Analysis)	*Remarks (Findings/Technology tool/s used)*
-Qualitative data from student comments on educational blog, interviews & classroom observations -History -USA School students -Rubric based comment analysis-Thematic [16]	(a) Students engaged in analysis while working in the blog environment (b) Upon cultural experiences, they were able to better use their prior knowledge (c) a variety ofaffordances related to blogging encouraged and supported students as they completed their work (d) Blogging activities were constrained by the limits of students' literacy and subject specific skills, and the limits of technology. - *Web, Social networking blogging tool Web 2.0*
-Survey and in-depth interviewing -Wide array of subjects -265 higher educators; South African university -Statistical Analysis	-The highest levels of authenticity were found for element authentic context and task, wherein lowest was found for articulation. -Moderate correlation identified between levels of authenticity and the

Description of Study (Research Design/Subject/ Source/Analysis)	Remarks (Findings/Technology tool/s used)
[17]	role played by emerging technologies in achieving the authenticity, showing a potentially symbiotic relationship between them. *-Digital media videos/mobile phones/web/online tutoring platforms/blogs/Channels such as Wikis and Google docs*
- Design based research-written material, artifacts collection, interviewing and evaluation report -09-University educators; Australian university -Thematic analysis [18]	-Professional learning community (PLC) would enrich understanding of teaching with mobile technologies and would enhance teaching. -Enriched engagement with m-learning may be promoted by the establishment of a PLC *-Mobile Technology-Podcast/audio/texting/blogging/use of social media*
-Review -Special education [19]	- The use of online digital portfolios has satisfied both the need to evaluate teacher candidates' performance in special education settings and encourage deeper reflection through the use of interactive digital technologies. -Evidence for learning important instructional technologies by implementing them in authentic settings. -The author suggests the implementation of digital portfolios may reinforce best practices in special education. *-Phone, text, video hangout, Video, pictures, and graphs, Google Doc, Online chat functions, Learning Management Systems*
-Design based action research -Language studies -School students; San Diego [20]	- Effective participation in peer review and constructive response -Provision of assistance in setting up networking flatforms rather than setting up them on their own -Students could authentically see the value learning *- Facebook, Twitter, Myspace, video chats via Skype, e-portfolio application called Mahara-social networking and friending*
-Action research -Climate change education -Primary school learners; Greece - Self-reflective analysis [21]	-Successful application of the ExConTra learning paradigm-Experiential, Constructivist, Transformative-Changing, Reflecting and Acting -Cross-thematic and interdisciplinary curricular approach, -Learning activities that are long-term, interdisciplinary, student centered and integrated with real-world issues and practices in which students planned, implemented and evaluated projects with real-world applications beyond the classroom *-Web-based learning environment-hypermedia technology, open-source learning technologies, ICT tools-concept maps (Text2Mindmap), spreadsheets (Zoho Sheet), presentations (280slides), paint tools (Pixlr), word processing (Zoho Writer), Venn diagrams (classtools.net), largely elicited from the Web, Drupal – an open-source content management system (CMS) similar to platforms like Joomla and Moodle*
-Quantitative survey -Nursing, education, liberal arts and sciences -Southwestern university students in the United States -28 online courses at in size from 8 to 25 enrolled students with a total survey response of 392 -Structural equation modeling (SEM) approach [22]	-Student-centered learning in the online setting vs online learner satisfaction was studied. -Learner relevance, active learning, authentic learning, learner autonomy, and computer technology competence has proven to predict students' perceived satisfaction with online courses and web-based distance education at a statistically significant level. *-Online learning environment*
-Quasi experiment-pre-test and post-test questionnaire -Health education -Elementary school in northern Taiwan-Classes of fourth graders, 52 students comprised of 28 boys and 24 girls in the experimental group and 52 students comprised of 29 boys and 23 girls in the control group -Statistical analysis [23]	-Digital game-based learning, contextual learning, contextual decision-making, learning achievement, learning motivation, problem-solving ability -Improved the students' learning motivation, but also their learning achievement and problem-solving competences. -Significant two-way interaction suggested that the contextual game-based learning approach benefited the higher motivation students more than the lower motivation ones in terms of the advanced knowledge, showing the importance and potential of applying contextual games to health education activities. *-Multimedia learning-digital game-based learning*
-Classical Structural Equation Modeling (SEM) -Quantitative research approach -Information Technology -308 undergraduate students from a public university in Turkey - Statistical analysis [24]	-Students' information management (i.e., retrieve, store, share, and apply) practices were found to be significantly associated with their attitudes, which were in return significantly associated with the behavioral intentions. -Employing the Mobile cloud computing (MCC) services for personal information management should be supported and encouraged in the higher education by designing authentic learning environments and by scaffolding the students in using such services. *-Mobile cloud computing (MCC), electronic databases (i.e., Scopus, WOS, and Google Scholar), MCC services (i.e., OneDrive, Dropbox, and Google Drive)*

III. FINDINGS

According to the literature survey, it was evident that technology had been used in various forms and levels in educational setups. They range from classes and learning environments in kindergarten to tertiary and higher

educational levels. However, very few studies were found investigating all characteristics put forth in Jan Herrington's framework of authentic teaching and learning environment. Out of the 42 guidelines put forth by Jan Herrington in achieving the 09 elements, only one or few are considered in most of the referred studies [14]. Many studies used technology for various teaching and learning activities. In most of the studies technology was widely exploited for basic communication. However, communication among the main stakeholders of authentic education namely students, peers, senior students, facilitators/teachers, experts/outside world and public are not adequately considered. Although, technology could have been a vital part of facilitation of collaboration as an outcome was not adequately discussed. Technology was often used in creating various pedagogical contexts and content. However, it was rarely used for instruction or scaffolding purposes in authentic education setups. Furthermore, use of technology in design and conduct of assessments (both formative and summative) and providing timely feedback also might need further research. Considering the findings of the referred individual studies it is evident that the success of most of the implementations within these studies have depended upon three common factors. They are;

1. **R**esources
2. **E**fficacy[25],[26]
3. **K**nowledge

Access for physical resources such as hardware and software and access for professional development programs for knowledge and skill upgrade are considered as vital pre-requisites enabling teachers to select and apply the best-fit technique/s as per the situation [16]. Efficacy could be self-efficacy as well as organizational support[27]. Individuals who take the initiative of integrating technological tools to enhance their teaching and learning could be encouraged and motivated to uplift their self-efficacy to use technology in a personalized context, provided that the technological tools they use have favorable system efficacies[28]. It could be argued that, all three factors mentioned above would require support from the existing system/organization as well in addition to the individual acceptances; to result sustainable and collective change at the ground level. Therefore, these three factors (**REK**) could be regarded as the key pillars upon which the success of integrating technology in any educational setup would start its implementation process. In the proposed model REK appear at the foundation layer. Thereby, the resulting change could be made a sustainable one, if continuous update and upgrade occurs within the system especially in terms of physical resources, knowledge and skills. Further, efficacy could be assured via various positive reinforcements such as provision of motivational setups with appropriate recognition, reward for novelty and etc.

Aforementioned interpretation could be graphically represented by a 'Tripod' model as illustrated in Figure 01. The three 'pod legs' consist the foundation layer upon which two 'pod base' layers operate with varying degrees of freedom corresponding to their variation, usage and importance in an educational setup. These two operational layers are connected through the 'central column' technology in various ways and hoist the 'stage' which is the environment where 'Authentic Education' could take place. Above the foundation layer the two levels of the operational layer which encompass Context, Content, Communication, **C**reativity, **C**onnectivity and **C**ollaboration (the 6C's) appear in varying strengths.

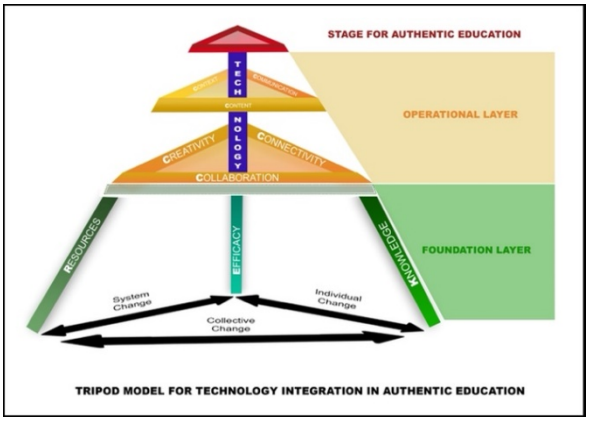

Fig.1. Proposing model for integration of technology within authentic education

In most studies **C**ontext, **C**ontent and **C**ommunication appear to be the factors with the highest diversity where most educators prefer to employ technology [16],[17]. This could be due its large scope considering subject variations, content variations and other cultural, social and demographical variabilities. Compared to context, content and communication there is limited diversity in collaboration, connectivity and creativity. It is difficult to justify which one is of more importance than the other. Since there cannot be education without context, content and communication in any pedagogy, it could be considered as a highly evolving layer subjected to increased diversity. **C**reativity, **C**onnectivity and **C**ollaboration stand comparatively selective in educational setups, therefore could be argued that these exist at two different levels in the operational framework. Considering the function of these elements these could be presented as the operational layer within which various technological tools could be integrated to appropriate pedagogical strategies. The two different levels which encompass the 6C's would construct the operational layer together in the model proposed.

IV. CONCLUSION

This paper has summarized evidence for achieving authentic educational components through use of technological tools. A wide array of technological tools used in different educational setups for various subject disciplines were published in the literature. This shows the proven

general use of technological tools in aspects of authentic education. Some studies have intentionally used technology to implement authentic learning whereas some have discussed about the vital components of such a setup separately without mentioning or referring to any authentic education framework. High variation of technology was observed in context, content and communication. However, it can be argued that technology is not adequately integrated for peer, expert, teacher and senior student interactions. High creativity is required for the design of educational activities in the authentic learning paradigm. However, very limited studies show evidence explaining the effect of technology in successfully enabling connectivity, collaboration and creativity. Apart from those aspects, individual qualities and attitudes such as motivation, student achievement, engagement, performance is also found to be enhanced through technology integrated teaching and learning setups. However, it can be argued that these are always underpinning the latter with or without the researcher's acknowledgement in most of the studies. Therefore, further studies via qualitative approaches could assist in understanding more about the aforementioned individual qualities and attitudes and their intra and inter relationships along with the limitations and challenges connected to such implementations in educational setups. In addition, such studies could further be able to explain/expand the foundational layer and its components in the technology integration model proposed. Training is required for both knowledge and skill upgrade regarding educational technologies and design of creative educational experiences. Professional development programs aiming teachers revisiting the methods of access to resources, initiations for change of attitudes, beliefs and self-efficacies could be the most vital pillars to ensure continuous stability. This could also require a system change in terms of changes in policies and practices within a system encouraging technology integrated individual teaching approaches.

Considering such concerns, technology could not possibly be a 'bolted-on' aspect in an authentic educational setup. The current model promotes 'technology enabled learning' rather than its simple integration and will have to be coupled with creative pedagogies and strategies further explaining how technology could be best integrated within the 6Cs of operational layer proposed within the model.[29]

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