Conceptual Framework for Effective E-collaboration and Didactic Enhancement

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Abstract—**E-collaboration environment through social media technologies is a promising pedagogical approach for teaching, learning and research. It will support student-to-student, student-to-lecturer, and student-to-content interaction and collaboration in a higher educational institution. Despite these benefits, many educators are still reluctant to start experimenting or using it. Drawing on current developments in social media software, a literature review on online collaborative teaching and learning, theories of learning, basic concepts, as well as action research using social media technologies, this paper reviewed and described eight existing frameworks for e-collaboration and five learning theories using nine and four criteria respectively. Following an analysis of the frameworks and learning theories, a conceptual framework for effective e-collaboration and the didactic enhancement is proposed for higher educational institutions with support for planning, design, development, implementation and evaluation of such an environment. The findings, conclusions and implications for future research in this area are further provided.**

Keywords—E-collaboration; Framework; Didactic; Social-Media- Technologies; Synchronous; Effectiveness

I. INTRODUCTION

Collaborative learning implies working with others, usually in pairs or small groups, to achieve common learning goals. It supports co-laboring, co-creation, co-sharing and sees students as active partners in the community of learners, where meaningful learning can occur and where knowledge is produced socially by consensus [1]. When the above happens using electronic means it is termed e-collaboration. [2] also described user-contributed information in Web 2.0 as a collective intelligence where a group of people bring their ideas together to form a coherent whole. According to [3], collaborative teaching and learning is widely supported by theories and research undertaken and has numerous advantages for learners in the form of content creation and knowledge construction [3]. It has the advantages of improving learner motivation and allowing learners to gain experience from others [4] anytime, anywhere. It will also lead to co-creation of knowledge, greater understanding, and skill development [5]. It is convenient, cost-effective, consistent, media-rich, repeatable, and it is easy to monitor progress, give quick feedback and assess students.

Despite the above benefits of e-collaboration through social media technologies (SMTs), its current experimentation

and prototype implementations in higher educational institutions (HEIs), little has been adopted and incorporated into Malaysian HEIs. Most Malaysian HEIs' learning management systems (LMS) or e-learning systems are still based on the traditional ideology that view learners as passive information consumers instead of active co-producers of knowledge [6], [7]. The former leads to low motivation and isolation of learners. A literature review in 2010 by [8] also revealed that the adoption of social media for collaborative teaching and learning is slowly emerging and in most cases it's at the experimental stage. The preliminary studies carried out in Universiti Teknologi PETRONAS (UTP) in 2013 also revealed that about 82% of the students surveyed had never used well known SMTs for teaching and learning [7]. The didactic-perspective of lecturing rather than social interaction can be due to it being the preferred style of teaching by teachers, the constraints imposed by institutional structures [8], and students attitude. This limits learners to tackling educator's course objectives, and does not allow the learner to go back and experience the class again to review and reflect on the time together with classmates and educators; it does not cater for learner absence, shyness and distraction [9]. Finally, educators lack of confidence and experience with social media is a barrier for successful implementation within Higher education contexts [8].

This calls for research of this nature, in support of current trends in instructional technology for HEIs. The adoption and use by HEIs in Malaysia would be timely and beneficial. In addition, the significance of using SMTs for collaborative teaching and learning in HEIs demands an effective and efficient e-Learning platform that will be applicable to a particular context, organization, and culture. Achieving such effectiveness and efficiency necessitates a well formulated framework that would serve as a guideline and enabler in planning, design, development, implementation, and evaluation. The framework will also specify users, their specific roles, collaboration process and supporting SMT technologies.

The aims of this research are twofold. The first aim is to review and analyze existing frameworks, models, and theories for an online collaborative teaching and learning environment (OCTLE). The second aim is to develop a conceptual framework for effective collaboration and didactic enhancement. In order to achieve the above objectives, the researchers pose the following questions: What are the

pedagogical and didactical rationales for online collaborative learning? What do existing frameworks and models depict in terms of the teaching and learning Objects, and didactics? How can the proposed framework be derived?

At the end of the research, three contributions have been made to the world of education and particularly the Malaysian HEIs. First, the work adds to the body of knowledge in the field of e-learning and related areas. Second, a framework has been developed that will serve as a guideline for researchers in the development of OCTLE. Finally, an indication of the usage of the derived framework as a methodological lens for the planning, design, development, implementation and evaluation of e-collaboration environment by designers and developers has been given.

II. RELATED WORK

This section outlines the concepts, themes, and principles that underpin the development of the conceptual framework. The researchers reviewed eight current state of the art e-collaborative frameworks and models and five learning theories, and their support for online collaboration spanning

from 2009 to 2012. The summary and critical appraisal of the frameworks including gaps in the literature, are presented in Table 1.

A. Didactics Versus Constructivist Didactics Method

According to [3], the incorporation of suitable learning and teaching methods into e-learning would result in effective collaboration. In addition, easy access to content, the context of the learning environment, as well as guidance and feedback mechanisms have to be considered in designing the teaching and learning methods.

Didactics, as opposed to open-learning or experiential learning (where people can learn by themselves in an unstructured form), is a teaching or instructional method that follows a structured scientific approach or educational style to impart knowledge or skill to the learner. It includes various structured teaching or instructional styles, strategies or activities. It encompasses the activities of educating or instructing or that are used to impart knowledge. 'Didactics' is sometimes synonymous with 'pedagogy,' (educational Theory) [10].

Table I: Partial Critical Appraisal of Frameworks or Models

Paper title	Name of Model/ Framework	Objective of framework	T&L Objects	Learning theory(s)	Learning Style(s)	Didactic/Teaching Methods	Principles	Research Gap
Application of Web 2.0 Technologies in E-Learning Context By: Liyong Wan (2010)	An integrated framework of using web 2.0 technologies in e-learning.	To help researchers understand the web based e-learning architecture.	Not mentioned	Activity theory	Informal learning and social learning	Community of Practice, Collaborative learning, Syndicated content, Mobile learning and games, social search and communication.	People-driven models of learning, Interaction and collaboration culture	It did not demonstrate development processes to be followed by e-collaboration designers and developers.
Added Value Model of Collaboration in Higher Education by: Ilona Béres and Márta Turcsányi-Szabó (2010)	Project based online collaborative teaching/learning model	To explore what effect of learning styles in online collaborative learning environment has on the student's attitude, efficiency and quality of learning	Individual work, group project and evaluation	Connectivist theory, Vygotsky theory,	Felder – Silvermann Index of Learning Styles (ILS)	Mind maps, sequential and/or global e-learning materials, Problem-Based, Project-Based, Inquiry-Based, Evaluation, Multimedia, Interactive games.	Interactive, students' differences, student centered activities with problem-based approach,	It did not demonstrate the collaborative and development processes for development of e-collaboration environment

In this study we specifically refer to constructivist didactics which implies constructivist teaching methods. This method of teaching ascertains that learners have prior-knowledge/schema and that learning takes place through active participation of learners rather than passively receiving knowledge. Active participation will motivate learners, enable them to think critically, and make them independent, enabling them to take control of their own learning [10]. Through collaboration they will experience others' viewpoints, discuss, discover, analyze and make a conclusive decision. They will also develop meta-cognition (the ability to learn how to learn) resulting in a motivated and independent individual. Constructivist didactics also defines the roles of educators and learners.

One drawback of this approach is the belief that the extrovert students in a group may dominate group discussions and conclusions [11]. [12] however suggests the use of guided discovery, which is a mix of direct instruction and hands-on activity, rather than pure discovery, in order to

derive the full advantage of constructivist learning. Other drawbacks include "misleading or contradicting known findings [13]", which can be minimized or eradicated with adequate planning and implementation strategies as well as final validation of content by educators. Hence, these drawbacks have to be observed and mitigated.

B. Review of Frameworks and Models for OCTLE

According to [14], it is important to evaluate different theories or frameworks available within a topical area of interest before selecting one. E-learning model should also demonstrate "on what pedagogic principles the added value of the 'e' was operating" [15]. In addition, an e-learning system should answer the what, how, why [16] and who questions. The above questions will be applied to derive the conceptual framework.

In this study, nine different frameworks and models of collaborative teaching and learning have been methodically investigated using the following nine criteria for evaluation: author and years, objective of framework,

teaching and learning objects, learning theories, learning styles, teaching methods/didactics, principles or requirements for designing e-learning, name of model, and research gaps. (See table 1).

The Community of Inquiry (CoI) model by Garrison et al. in 2000 described three elements - "social presence, cognitive presence and teaching presence" [17] [18, 19] - as the elements of an online learning community. Even though CoI model has been adopted and adapted by many researchers over the years, it has also been criticized by some researchers using different perspectives. One of the criticisms is by Annand [20] whose investigation and analyses have led to the development of the practical inquiry model (PIM), an instrument consisting of about 34 to 37 items. The validation of PIM together with other findings by Shea and Bidjerano in 2010 has led to the modification of the CoI model to include a fourth construct - learner presence [20, 21]. The modified CoI, framework together with CoI codes, would form an important component in evaluating the derived framework on e-collaboration environment. Even though the CoI model emphasizes neither SMTs nor the didactic method, this research supports the idea that an online collaborative environment should constitute the four presences.

[3] developed a project-based collaborative e-learning methodology using an on-line LMS. Their goal was to investigate the impact of learning styles on student's attitude, efficiency, and quality of learning and on the output resulting from group work in an (OCTLE). The experiment, which included 32 participants in a multimedia course, provides added value within the framework. They concluded that an online collaborative environment must be based on connectivism theory, be adaptable and be flexible [3]. These elements will be incorporated into the proposed framework. However, the model did not demonstrate the collaborative and development processes for generic development of an e-collaboration environment.

The authors of [4] created an adaptive learning framework (ALEF) consisting of two main models, the domain and user models. Experimenting with this framework to create a course for learning the Lisp programming language was reported by the researchers to have improved the efficiency and the outcomes of learning [4]. The ALEF framework clearly indicates how learning and collaboration take place using a set of learning activities. It does not, however, demonstrate clearly how teaching and cognitive presence can be achieved through online collaboration.

In addition, [9] proposed a conceptual e-learning framework based on andragogy, Transformative Learning Theory, and Media Synchronicity Theory. The framework supports the self-directedness learning process, learning that originates from transformative crises, and the learning of transformative threshold concepts. Despite these, the framework does not fully support the objective of this research on e-collaboration.

The conceptual framework in [22] was derived from three international benchmarking projects – the Excellence+, the eLearning Benchmarking Exercise, and the First Dual-Mode Distance Learning Benchmarking Club. These, together with desktop studies, revealed that a successful e-learning system should encompass the following seven elements: personalization; flexibility; interactivity; participation; accessibility; productivity; transparency. The researchers also believe that the model could be used for planning, developing, implementing, internalizing, and quality evaluation of e-learning within higher education [22]. This framework provides important guidelines for e-learning characteristics, but it did not support online collaboration using constructivist didactic methods.

[23], on the other hand, proposed a collaborative method that is centered on learners and the use of Web 2.0 technologies to develop e-learning 2.0 systems. Their methodology, which is made up of four iterative steps – grouping, collaborating, validating and publishing, has useful elements for our study. Thus, it will form an important component within the proposed framework.

[24] also developed a comprehensive e-quality framework that incorporated factors such as socio-cultural reasons, national and regional ICT infrastructures, policies, student's workload and attitudes towards e-Learning [24]. Even though the framework is used to help achieve quality enhancement and assurance and has included pedagogical, technological, institutional, instructional, evaluation, and student and faculty support factors, it did not emphasize on how to deliver both content and instructional methods in an online collaborative environment. Also, the framework did not illustrate the e-collaboration process or activities.

[25] proposed an integrated framework consisting of three sections: Web 2.0 tools, e-learning 2.0 application and e-learning 2.0 modes. According to the author, the framework, which was derived from models analyzed in the current literature, has yet to be experimented and validated [25]. Even though the framework supports collaboration through social media, it did not demonstrate the development processes to be followed by e-collaboration designers and developers.

Finally, [26] developed a theoretical framework for building online communities of practice with social networking tools. They believe that the mode of learning has evolved beyond the traditional classroom to include collaboration, interaction, synchronous and asynchronous learning through social networking tools to facilitate collective intelligence [26]. Drawn on the Community of Practice Model, socio-cultural, socio-constructivist and activity theories, the proposed social networking spiral consist of six phases. Even though the framework has supporting features for the research, it did not include the development process for e-collaboration as well as development process for designers and developers.

C. Review of Learning Theories

According to [3], the majority of e-learning problems could be eradicated by systematic analysis and use of learning theories. In addition, most pedagogical design and pedagogical models and frameworks are supported by learning theories [8, 15]. In view of the above, the following five learning theories and their implications for online collaborative teaching and learning are presented under this section.

1) Social Cognitive Learning Theory

It was proposed by Albert Bandura and emphasizes that learning occurs in a social context and that much of what is learned is gained by observing what others do and do not do in a particular environment. These processes are central to understanding personality. The three factors influencing this kind of learning process are the environment, behavior, and cognition, as indicated in the Triadic Reciprocal Determinism model [27-29]. The theory's four processes of goal realization: self-observation; self-evaluation; self-reaction; and self-efficacy will be useful for our e-collaboration development and evaluation.

2) Situated Learning Theory

It was proposed by Jean Lave and Etienne Wenger as a model of learning in a community of practice. It argues that learning should not be viewed as simply the transmission of abstract knowledge from one individual to another, but as a social process whereby knowledge is co-constructed; they suggest that such learning is situated in a specific context and embedded within a particular social and physical environment. It puts emphasis on adult learners, social interactions and authentic learning. This type of learning allows learner to learn by socialization, visualization, and imitation [30, 31]. These elements are in agreement with what learners would involve themselves during the learning process in our proposed system.

3) Socio-Constructivism Learning Theory

This theory, proposed by Lev Vygotsky, extends constructivism into social settings for the collaborative co-creation of knowledge. It emphasizes the critical importance of culture and the importance of the social context for cognitive development. Learning, then, is viewed as primarily a process of enculturation into a community of practice. He proposed the "zone of proximal development" (ZPD) [32] concept, which argues that students can, with help from adults or children who are more advanced, master concepts and ideas that they cannot understand on their own. ZPD focuses on learning with assistant from teachers, parents, adults and colleagues. The aim is to help the learner develop skills that can be independently practiced. Thus, "What the learner is able to do in collaboration today he will be able to do independently tomorrow" [33] as the teacher withdraws his or her services to the learner. Four principles are applied in any Vygotskian teaching [32]. The main focus of this research is collaborative learning which is fully supported by this theory.

4) Connectivism Learning Theory

This theory, proposed by George Siemens in December 2004 is mostly referred to as "A Learning Theory for the Digital Age" [34]. He believes that technological advancement has great potential for the transformation of teaching, learning and society at large. He described learning as "chaotic, social, collaborative, and connected with other activities and interests" [35]. He criticized the three major learning theories (behaviorism, cognitivism, and constructivism) because they did not reflect the type of learning that occurs in today's digital age nor do they meet the needs of today's students [34]. Nevertheless, he still finds some good elements in them in support of a formal learning system. Siemens admits that "No one concept or theory is universal in its application" [35]. He further outlined eight principles of connectivism [34]. This theory will support the social, collaborative and connectedness of students through the use of digital devices.

5) Media Synchronicity Theory

It was proposed by Dennis et al. in 2008. The theory ascertains that the capability of media should support synchronicity. The theory suggests two processes of communication, which are conveyance (the transmission of information and its processing by the receiver) and convergence (the process of mutually agreeing or disagreeing on the meaning of the information). Thus, effective communication involves conveyance of knowledge and skills from the sender to the receiver and the resulting convergence between them [9]. They also suggested that for a given media to function effectively, it should have five capabilities [9]. This theory will be important in the selection of SMTs for developing an e-collaboration environment that will be user-centered and easy to use by all participants.

III. METHODOLOGY

This research adopted three approaches: a review of literature on learning theories and frameworks; action research of the exploration of SMTs for online collaboration; and explanatory research to describe important concepts and views. First, important concepts, learning styles, and learning objects in relation to OCTLE were reviewed. Second, a review of the literature on supporting frameworks (or models) and theories related to OCTLE were critically analyzed using nine and five criteria respectively. These frameworks and theories were considered in order to understand the constituents and how they can be integrated into this study. Third, the researchers explored, through demonstrations and practical work, SMTs such as Facebook, wiki, blog, slideshare, and Google Docs. These varieties of methods enable the researchers to analyze a variety of SMTs on their support for OCTLE. Finally, an emerging conceptual framework (Fig. 1) was proposed.

IV.   RESULTS AND DISCUSSION

Drawing on the reviewed SMTs, frameworks, models and theories, as described in the literature review, this study proposed a conceptual framework for effective e-collaboration and didactic enhancement for HEIs as illustrated in Fig. 1.

A.   Derived Conceptual Framework

The derived framework in Fig. 1, integrates five parts: users and their respective roles; the development process; the collaboration process; supporting theories for e-collaboration; the use of SMTs for synchronous and asynchronous communication. These are described below:

1)   E-Collaboration Process

The collaboration process is illustrated within the framework (Fig. 1) with thick arrows. The process starts with students identifying themselves with group members by presenting their respective profile (prior knowledge, learning style, qualification, strengths and weaknesses). These enable the educator to know the learners; and students to know one another. The lecturer then forms groups consisting of different categories of students; finally, he/she post learning materials and a guide and facilitates the teaching and learning process through e-collaboration. The students, in this regard, are to collaborate with their group in order to either solve a problem or to learn; they are to create, edit, link and publish meaningful contents, give feedback to colleagues and instructors using SMTs. Finally, the tutor or the facilitator is to validate and provide feedback. All this collaboration process is to be carried out using social media technologies, as described in section 4.1.4.

2)   Users/Participants and Their Respective Roles

The users, as illustrated at the topmost part of the conceptual framework, consist of the lecturers, students, tutors and developers. Each role is given in a column. The roles are spread across the development process as illustrated in Fig. 1.

3)   Development Process

The development process, as illustrated at the immediate left of the conceptual framework, consists of four main stages: requirements gathering and analysis; prototype design and pre-release; collaborative instructional delivery; and evaluation (formative and summative). The development process is iterative in nature. Users' roles at each of the stages are illustrated under user-categories.

4)   Social Media Technologies

SMTs for undertaking synchronous and asynchronous e-collaboration are illustrated at the center of the framework. The synchronous environment allows real-time communication and use of SMTs such as instant messaging, chat, conferencing. In the asynchronous environment, on the other hand, no real-time communication takes place and content and information are delivered for later use by participants. This is supported by technologies like blogs, wikis, and discussion forum.
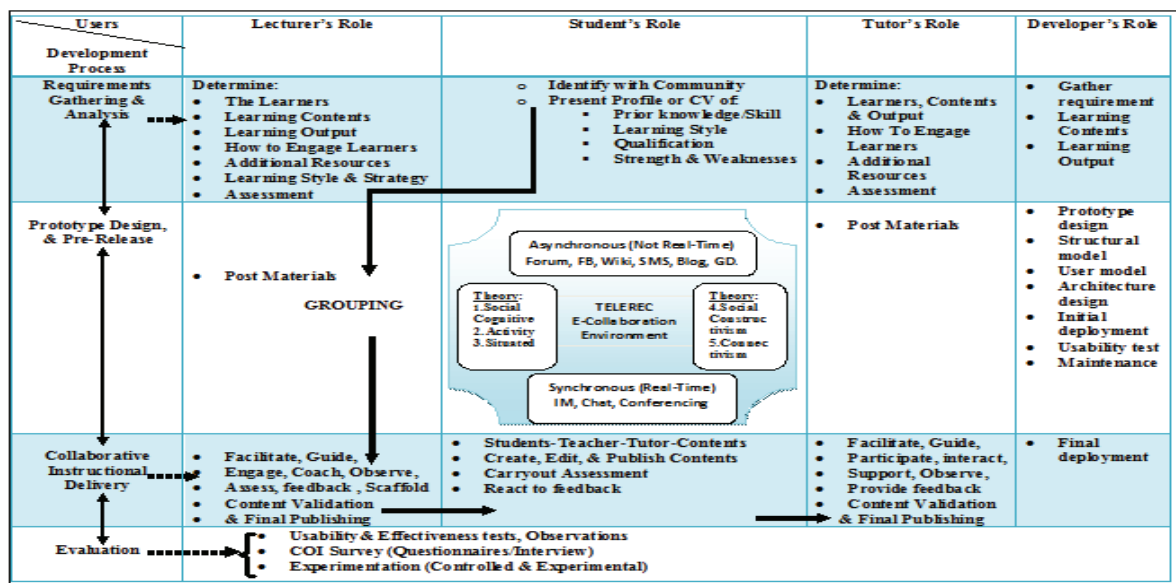

Fig. 1: Conceptual Framework for Effective E-Collaboration and Didactic Enhancement

5)   Supporting Theories and Didactic Methods

The critical appraisal of five learning theories, as described in the literature review, revealed that they all support e-collaboration; they have guiding principles and a variety of didactic methods. Gaming and inquiry-based are the most mentioned didactic methods. This is followed by demonstration, coaching, scaffolding, collaboration, problem-based, project-based-learning, mobile-learning, social-learning and mind-map. In this study, we specifically refer to constructivist didactics, which is described in sub-section A of the related work section.

V. CONCLUSION AND FUTURE WORK

An important conclusion drawn from the current studies is that e-collaboration is not just about the presentation of content, but involves incorporating student-centeredness, collaboration, suitable learning theories, appropriate technologies, and pedagogy/didactic methods. This holistic view has to also incorporate the roles and diversities of participants (students, lecturers, tutors and designers) in the various stages of the collaborative process. The derived framework has incorporated all these elements.

The derived framework is comprehensive and clear enough to guide research. It can support teaching, learning and research. In addition, it focuses upon answering the questions: why/motive?; how?; what?; who/parties involve in collaboration? The framework is also a guide to both designers and developers through a laid down development process. The resulting output of the framework supports synchronous and asynchronous, intrapersonal and interpersonal, formal and informal teaching and learning and is an aid in the delivery of other information relevant to both learners and instructors. It is therefore our belief that when the derived framework is used in the development of e-collaboration system, it will lead to effective experiences.

A limitation of this research is that it has not yet been prototyped and empirically tested. The testing will be realized when an online collaborative teaching and learning environment has been developed as an online educational platform and its usability and effectiveness has been confirmed through series of evaluations. Therefore, our future work will be based in these directions.

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