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Table of Contents

International Journal of Information and Communication Technology Education

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Users' Intention to Share Knowledge Using Wiki in Virtual Learning Community

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ABSTRACT

Many educational organizations are using Wikis to enhance virtual learning to encourage knowledge sharing inside between students and instructors. Wiki is an ideal tool for the online knowledge sharing at educational organizations which help to achieve more collaborative work environment between students and instructors. However, educational organizations sometimes fail of building successful virtual community and users abound Wikis for several reasons. This research explored the use of Wikis to share knowledge in virtual learning community. A proposed conceptual framework was developed examining the UTAUT model in new context by using it to test the behavior intention to share knowledge through the Wiki technology in virtual community. A survey to postgraduate students shows that social influence, performance, and effort expectancy have impact on students' attitude to share knowledge through Wikis.

KEYWORDS

Knowledge Sharing, Technology Acceptance, UTAUT, Wiki

INTRODUCTION

Knowledge management is an essential part of developing and consolidating the core competencies of organizations (Fatt and Khin, 2010). Many educational institutions and organizations tried to encourage sharing knowledge by implementing virtual learning communities (VLC) (Chen et al., 2009). To build virtual communities, many computer mediated communication technologies were used such as emails, instant messengers, discussion forms, chat rooms, video and audio streaming and recently weblogs and Wikis (Cheung and Lee, 2007; Limongelli, 2015). As a social technology, Wiki enables users to work together to build knowledge in collaborative way (Scardamalia and Bereuter, 2003). Wiki is fast, economical and appropriate tool for environments where knowledge is decentralized, located with multiple owners and for ad-hoc knowledge building (Jiang and Chen, 2014; Limongelli, 2015).

While the promise to use the Wiki to establish a virtual learning community is great, the successful implementation of virtual communities cannot be accomplished by simply grouping people together, offering them a communication system and invite them to engage in a collaborative way (Jiang and Chen, 2014). To achieve the most effective use of the Wiki in enhancing education, there is a need to investigate users' intention towards using Wikis to construct successful virtual learning and share their knowledge. Reviewing the literature shows few researches which investigated this issue in developing countries. Accordingly, this research seeks to answer this research question: What are the factors that affect users' intention to share knowledge using Wiki in virtual learning community?

The paper structure starts by presenting the theoretical background for understanding the literature review about e-democracy and social networks. This is followed by proposing a suggested e-democracy model. The methodology used in research is discussed in the following section and followed by the results and discussion.

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THEORETICAL BACKGROUND

Knowledge Sharing

Knowledge is mix of data, information, experience, values, ideas, intuition, expert insights and intelligence skills (Davenport and Prusak, 1998). There are two types of knowledge, explicit and tacit knowledge (Hamel, 1991). Tacit knowledge is what resides in people's mind e.g. experience. Explicit knowledge exists in the form of physical material hence it can be easily captured and transmitted (Stevens et al., 2010). External Knowledge can be coded and stored in a database to be easily accessed by anyone in organization (Civi, 2000). Knowledge sharing occurs between certain group members using a form of communication in order to acquire knowledge from each other. Davenport and Prusak (1998) stated that the success of knowledge sharing depends on the successful transfer, absorb and use of the knowledge, which in turn creates positive changes in the behavior of the knowledge receiver.

According to O'Dell & Grayson (1998) knowledge management is a strategy used to help people to improve their potential and upgrade the performance of the organization by sharing knowledge among them, thus the right people can get the right knowledge at the right time (Charnkit, 2010). Gold et al. (2001) stated that KM has main four processes starts by the capture of embedded knowledge (O'Dell and Grayson, 1998). Then moving to the second step which is conversion process by moving from tacit knowledge to external knowledge by informal interaction and discussions which is called knowledge transfer (Tan, 2011). Knowledge transfer requires group cooperation to share knowledge and achieve common benefits (Syed-Ikhsan and Rowland, 2004). The third step is disseminating knowledge by making knowledge available, which is considered a very important to achieve the required benefits of this knowledge in the right time (Syed-Ikhsan and Rowland, 2004). Finally, knowledge utilization which refers to events and activities related to the application of knowledge (Tan, 2011).

Virtual Learning Community Using Wiki

The recent knowledge management researches emphasized the importance of knowledge management interactive technologies; i.e. virtual communities including the individual human side into the equation of knowledge management (Ardichvili et al., 2003). The technical features of interactive technologies are used to unleash the enthusiasm of knowledge sharing in organization (Paroutis and Al Saleh, 2009). Online virtual communities bring people from different backgrounds together to facilitate the knowledge creation through the collaboration and collective knowledge sharing among the community members (Marsico, Sterbini, and Temperini, 2015).

One type of virtual communities is virtual learning communities (VLC) which consist of teachers and students with a common goal to share knowledge through the internet. The goal of visual learning communities is to encourage participants to explore or share knowledge through the internet in order to enhance learning performance (Chen et al., 2009). Wenger et al. (2002) stated that the online learning communities are not just database of resources, but they are groups of individuals who incorporate in online cyberspace to learn and build relationship and this process creates mutual commitment.

Choosing the appropriate software application is very important in facilitating the communication and a sharing among communities (Sauer et al., 2005), thus the selected knowledge sharing system should be flexible to support the various forms of tacit or explicit knowledge (Watson and Harper, 2008). Wiki is one of Web 2.0 most popular applications. Wiki is a collection of web pages, interlinked together and stores information; it is like a hypertext system involves a database of pages, and each page can be easily edited by other users (Schwartz et al., 2004). In Wiki users can not only read the Wiki content but they can also add to it, modify or reorganize its content such as text, videos and images (Augar et al., 2004).

In Wiki, users can share many types of media (images, videos, etc.), which can be used to capture the incidental, informal and tacit knowledge and convert it to explicit knowledge (Jackson, 2010). Moreover, users can describe and structure the information using metadata and immediately

update and share it (Jackson, 2010). Wiki is open editing; which means that anyone can edit the Wiki content; moreover, users can trace all the changes and control the different versions of content (Wang and Wei, 2011).

The Use of Wiki to Share Knowledge in VLC

The characteristics of Wiki make it the most appropriate tool for knowledge building and sharing. The knowledge business value chain could be achieved using Wikis and virtual community (Charnkit, 2010). Knowledge value chain is sequence of tasks or processes through it the knowledge workers create the organization's competitive advantage value, these processes are acquisition, storage, dissemination and application (Civi, 2000) which could be achieved through using Wikis as the following:

- Knowledge acquisition: Virtual learning community is considered one of the expert knowledge networks; hence, we will use Wiki to create virtual community to acquire the knowledge.
- Knowledge storage: Most of Wiki applications use databases to store the knowledge.
- Knowledge dissemination: Using the Wiki as an intranet portal we can disseminate the knowledge between the members of the community.
- Knowledge application: We can use the developed knowledge in decision-making or in enterprise applications.

However, user acceptance to share knowledge through Wikis is an important issue (Dillon and Morris,1996) since users might not use Wikis, it is important to understand students' to accept using Wiki to share their tacit knowledge among each other would provide better delivery of courses (Limongelli, 2015). Over the years, several models and theories were developed to explain the acceptance and adoption of technological innovation. Koçak-Usluel and Mazman (2009) stated that to study the users' intentions could be done using different models and theories. This includes the diffusion of innovation theory, technology acceptance model (TAM) and unified theory of acceptance and usage theory (UTAUT).

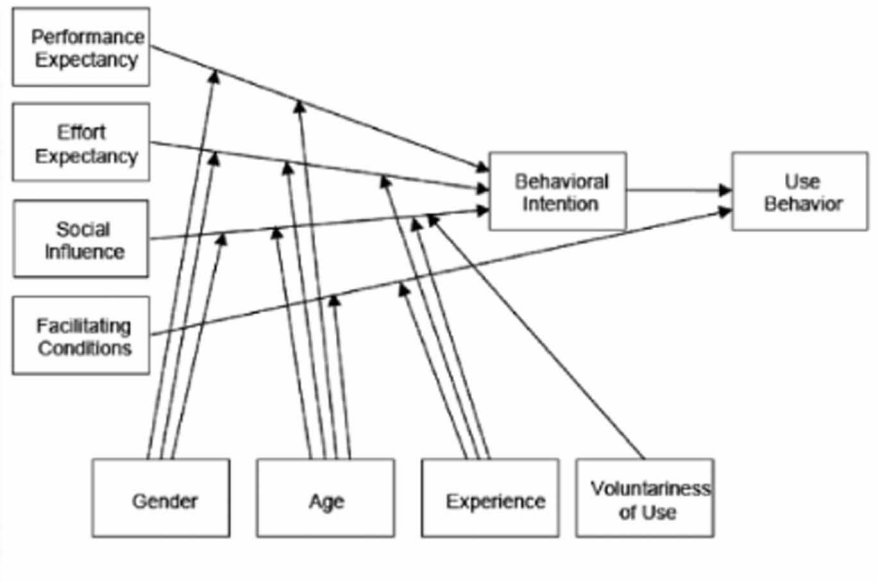
The main criticism to TAM is that it did not consider the external factors of the organization which affect the adoption (Wells et at., 2010) and focused mainly on the attitude of the decision maker (fuchs, 2010). While UTAUT included the social influence and facilitating condition constructs which represent the organization external factors (Brown et al., 2010). UTAUT allows the researchers to understand the factors that affect the adoption of new technology in the context of social impact, innovation and psychology (Venkatesh et al., 2003).

Venkatesh et al. (2003) developed a unified model based on TAM principle and called it the unified theory of acceptance and use of technology (UTAUT). UTAUT integrated the important factors of 8 models and theories including innovation diffusion theory (IDT), theory of planned behavior (TPB), reason action theory (TRA), technology acceptance model I and II (TAM), motivational model (MM), model of PC utilization (MPCU) and social cognitive theory (SCT) to develop a unified model (Venkatesh et al., 2003). The developed model has four main constructs, performance expectancy, effort expectancy, social influence and facilitating conditions, these constructs influence the behavioral intention and/or the use behavior as shown in Figure 1.

Behavioral intention is capture how people are willing to perform a certain behavior (Chen et al., 2009). The intention is considered the most important factor for the individual actual behavior, which means that persons are most probably sharing their knowledge when they have the enough intension to do that (Zamiri, 2012).

The entire UTAUT model or part of it was validated and replicated in many studies since it was developed in 2003, these studied covered different variety of technologies such as internet banking, e-learning, ERP systems, education and social medial applications. Table 1 presents some of studies applied UTAUT in various technologies.

Figure 1. The UTAUT model (Venkatesh et al., 2003)



PROPOSED CONCEPTUAL MODEL

This research employed the UTAUT to assess the users' intention to use Wiki to share knowledge in virtual learning communities. Since UTAUT made a balance between the technological, external and social dimensions of using information systems, however there is a need to cover the knowledge-sharing dimension by including the factors that motivate the knowledge contributors to share their tacit knowledge online as it will affect the behavior intention to use the Wiki.

The proposed model also extended the UTAUT model by adding other three knowledge-sharing factors that influence the user behavior to share knowledge online. The developed model posits that performance expectancy, effort expectancy, social influence, reciprocity and attitude to share knowledge together affect the behavior intention to use the Wiki for knowledge sharing in virtual community. The proposed conceptual model is shown in Figure 2.

Performance Expectancy

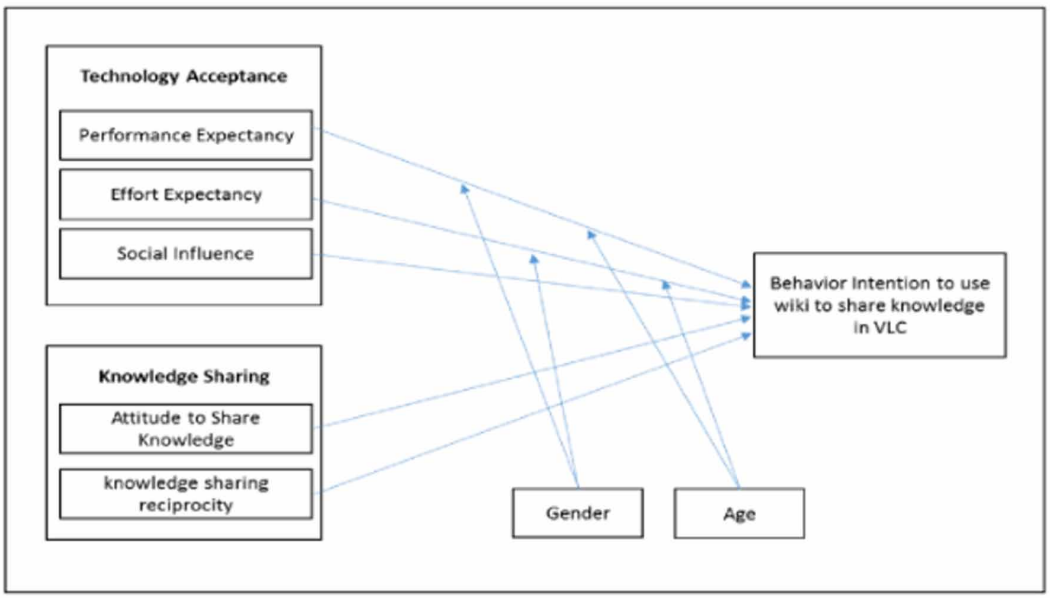
Performance expectancy is defined as 'the degree to which an individual believes that using the system will help him or her to attain gains in job performance' (Venkatesh et al., 2000). The performance expectancy construct is considered to be one of the strongest factors for the behavior intention (Dillon and Morris, 1996). Thomas et al. (2013) used UTAUT to study and explain how factors such as performance and effort expectancy affect the intention to adopt mobile learning in Guyana. Accordingly, performance expectancy would encourage students to use Wikis to increase their performance by sharing knowledge among each other. Based on this we assume the following:

H1: Performance expectancy (PE) significantly affects the intention to use Wiki to share knowledge in virtual learning community

Table 1. Previous researches used UTAUT

Research	Purpose
Oye et al. (2011)	The study uses the UTAUT model to understand the behavioral intention of the high education teachers to adopt and accept ICT.
Wu et al. (2012)	The study investigates the acceptance and use of electronic ticket system created using g RFID by using the UTAUT model.
Tan (2013)	The purpose of this study is to investigate the core factors that affect the attitude of the university students to use computerized placement test.
Tai (2013)	This study investigates the intention of stock investors to use mobile stock trading using a modified UTAUT with perception of risk.
Shu and Chuang (2011)	This study adapts the UTAUT by adding the user involvement factor to investigate the behavior of Wiki users
Yu (2012)	This study investigates the factors impact people to use mobile banking by employing the UTAUT.
Pardamean and Susanto (2012)	The study Investigates the adoption of the blog technology using the UTAUT model.

Figure 2. Proposed conceptual model



Effort Expectancy

Effort expectancy is defined as the degree of ease associated with the use of the system (Kang, 2011). Venkatesh et al. (2003) used this construct to capture the other models' concepts such as ease of use. Effort expectancy was found to be strong predictor wither it is used in mandatory or voluntary contexts, however its significance decreases with the time it is being used (Lahtinen, 2012; Jiang and Chen, 2014). Based on this we assume the following:

H2: Effort expectancy (EE) significantly affects the intention to use Wiki to share knowledge in virtual learning community

Social Influence

Social influence is "the degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh et al., 2003, p. 451). Social influence was found to be not significant in the voluntary context and significant in the mandatory context especially at the beginning of the adoption process. Social influence captures similar constructs in the other models, subjective norm, social factors and image. Based on this we assume the following:

H3: Social influence (SI) significantly affects the intention to use Wiki to share knowledge in virtual learning community

Attitude to Share Knowledge

Ajzen and Fishbein (1980) stated that the attitude has been found an influence on the behavioral intention. In a study conducted by Kolekofski and Heminger (2003) to examine the factors which influence the behavioral intention to share knowledge, they found that the attitude positively affect the user's intention to share their knowledge (Chen et al., 2009). Wixom and Todd (2005) also found that the attitude to use information system is strongly associated with the intention to use information system. Based on this we assume the following:

H4: Students' attitude toward knowledge sharing significantly affects the intention to use Wiki to share knowledge in virtual learning community

Knowledge Sharing Reciprocity

In knowledge sharing, reciprocity refers to the improvement in relationship among knowledge contributors and the future help that they expect from others by their contributions (Kankanhalli et al., 2005). Reciprocity could be considered as a motivation for individuals to contribute to a system as they expect to receive help quickly when they need it (Connolly and Thorn, 1990; Rheingold, 2000). Based on this we assume the following:

H5: Reciprocity significantly affects the intention to use Wiki to share knowledge in virtual learning community

Moderators' Hypotheses

H6: The influence of performance expectancy on behavioral intention will be moderated by gender.
H7: The influence of performance expectancy on behavioral intention will be moderated by age.
H8: The influence of effort expectancy on behavioral intention will be moderated by gender.
H9: The influence of effort expectancy on behavioral intention will be moderated by age.

RESEARCH METHODOLOGY

The design of this research is based on quantitative approach which helps to answer the research question: What are the factors that affect users' intention to share knowledge using Wiki in virtual learning community? To give students an overview upon the usage of Wiki for discussion and sharing resources in virtual community before they fill the survey, a demo using Wiki was created as a virtual

community for the participants and uploaded it to one of the free Wiki spaces available online. The demo shows the activities performed and how the navigator is designed to simulate the main majors in a postgraduate program.

Pilot Study

Before the main study was carried out, a pilot study was performed to find out any problem in the measurements and the data collection procedure. Pilot testing is used to test reliability and validity of the measurement instruments, after which the researcher can start the data collection with the sampled population (Bhattacherjee, 2012). For this purpose, the questionnaires were distributed to a sample of 30 students whom have similar characteristics with the target population characteristics. The respondents filled the questionnaire and their feedback was taken into consideration to improve the quality of measurements.

Data Collection

Questionnaires were used as they are precise, quick and give participants' time to form their answers, and could be used to reach a wider spectrum of participants (Ghauri, and Gronhaug, 2005). The questionnaires were developed by the researcher based on the literature review. The population for this study includes postgraduate students who are studying in Egyptian universities. In Egypt, 20 public universities and 23 private universities. Two Egyptian universities were selected (one public and one private universities) to distribute a self-administered questionnaire to collect data from postgraduate students. The students were postgraduate students come from diverse business sectors and seek to have a postgraduate degree. Out of 130 questionnaires collected, 124 were valid and used in the data analysis. The collected data is then analyzed using SPSS.

Questionnaires Design

The questionnaires were divided into two parts; the first part collects demographic data such as age, gender and previous experience in using Wikis. The second part contains 24 questions assess the variables in the proposed model. Likert (1932) scale was used to measure ordinal data using five points scale (Bhattacherjee, 2012). In this study 5-point Likert scale is used where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree (Table 2).

ANALYSIS AND RESULTS

General Demographic Analysis

Descriptive analysis run to summarize the results of the demographic data of the sample. The results are summarized in Table 3. The majority of respondents are between the ages of 30 to 40 (57.3%) and there is almost equal gender distribution in the sample. Although many subjects in the sample used the Wikis on daily, weekly and monthly base, only 25.8% of subjects used it in discussion.

Internal Consistency Reliability

The pilot testing is performed to find out any problem in the measurements and the data collection procedure. The result shows that the questionnaire had a good degree of reliability for all factors (Table 4).

Correlation Analysis

Correlation analysis is used to evaluate the relationship between each independent or predictor variable (performance expectancy, effort expectancy, social influence, attitude to share knowledge, and reciprocity) with the dependent variable (behavior intention) (Table 5).

Table 2. Instrument development

Variable	Measure	Factors
Performance Expectancy (PE)	Measures the level that individual believes that by using the Wiki will gain learning benefits.	Expected General Usefulness Expected Learning quality The Speed of task accomplishment Learning productivity Getting better grades
Effort Expectancy (EE)	Measures the level that individual believes that Wiki is easy to use.	System clear and understood Effort needed to use the Wiki Ease of use Time needed to operate Wiki
Social Influence (SI)	Measures the level of importance that individual believes that other opinions, instructors and university support using the Wiki.	Influence of other students Influence of the instructor University support
Attitude to Share knowledge (AK)	Measures the degree that individual believes that sharing knowledge is important.	General Usefulness of sharing the knowledge in different learning activities
Reciprocity (RE)	Measures the degree that individual believes that others will give him feedback as a result of sharing his knowledge	Expected to get feedback for future inquiry By sharing knowledge, get knowledge when needed
Behavior Intention (BI)	Measures the individual intention to use the Wiki in future	intention to use the Wiki in future
Gender	records the gender type male or female	
Age	records the age category	

Table 3. Demographic analysis

Variable	Category	Percentage
Age	19-29	32.3%
	30-40	57.3%
	41-51	10.5%
Gender	Male	51.6%
	Female	48.4%
Previous experience of using Wikis	Daily	11.6%
	Weekly	41.9%
	Monthly	14%
	Rarely	14%
	Never	8.5%

The result shows that there is a strong positive significant association between the performance expectancy and behavior intention ($r = .681$, $P < .01$). Moderate positive significant association between effort expectancy and behavior intention ($r = .583$, $P < .01$). Moderate positive significant association between social influence and behavior intention ($r = .451$, $P < .01$). Moderate positive significant association between attitude to share knowledge and behavior intention ($r = .594$, $P < .01$). Moderate positive significant association between reciprocity and behavior intention ($r = .485$, $P < .01$).

Table 4. Reliability result

Factor	Cronbach's Alpha	No. of Items
Performance Expectancy	0.763	6
Effort Expectancy	0.758	4
Social influence	0.773	4
Attitude to share knowledge	0.716	3
Reciprocity	0.813	4
Behavior Intention	0.771	3

Table 5. Correlation matrix

	PE	EE	SI	AK	RE	BI
PE	1	.562	.338	.576	.431	.681
EE	.562	1	.357	.516	.454	.583
SI	.338	.357	1	.460	.349	.451
AK	.576	.516	.460	1	.398	.594
RE	.431	.454	.349	.398	1	.485
BI	.681	.583	.451	.594	.485	1

Multicollinearity Analysis

Since multicollinearity might exist in regression analysis and negatively affects the predictive ability, computing the variance inflation factor (VIF) of each variable might help to detect multicollinearity (Myers, 1986). If the VIF of an explanatory variable exceeds 10, the variable is considered to be highly collinear and it can be treated as a candidate for exclusion from the regression model (Kleinbaum et al., 1988). As their VIF values are not close to 5 (1.650 to 3.268) (Coaks et al., 2008), so it is possible to proceed with the regression tests without the need for excluding any variables.

Multiple Regression Analysis

To assess the accuracy and relative importance of the independent variables on the behavior intention, multiple regression analysis is used (Table 7).

The result shows that the linear combination of all the independent variables is significantly related to behavior intention, $F(5, 118) = 33.526$, $p<0.05$. The correlation coefficient is 0.760, which indicates that approximately 58.7% of the variance in behavior intention can be accounted by the linear combination of the independent variables.

The below hypotheses in Table 8 provide answer to the research question. The model proposed 5 factors to influence the user behavior intention to use the Wiki and the results that only 4 factors have significant effect on the behavior intention and the reciprocity effect was insignificant relative to the other 4 factors.

DISCUSSION

To understand the factors that contribute in users' intention to use Wiki to share knowledge, a proposed model was developed to assess the users' intention to use new technology. The proposed model is

Table 6. Multicollinearity test results

Variable	VIF
Provision	1.935
Collection	1.692
Interface	2.246
Multimedia	1.243
Emoticons	1.878
Privacy	2.916
Security	3.268
Influence Groups	1.650

Table 7. Regression model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.766	.587	.569	1.25927

Table 8. Research hypotheses status

Hypothesis #	Hypothesis path	Status
H1	PE→BI	Accepted
H2	EE→BI	Accepted
H3	SI→BI	Accepted
H4	AK→BI	Accepted
H5	RE→BI	Rejected
H6	Age→(PE→BI)	Rejected
H7	Gender→(PE→BI)	Accepted
H8	Age→(EE→BI)	Rejected
H9	Gender →(EE→BI)	Rejected

based on UTAUT model and extended to include other factors, which motivate users to share their knowledge in online virtual community. A survey was conducted to 124 postgraduate students who are studying in Egypt to examine the proposed model. Findings show performance expectancy has positive significant influence on behavior intention. Performance expectancy shows the level that students find that Wiki is useful and relative in their learning activities. Performance expectancy was the strongest predictor to behavior intention to use the Wiki as the students found the Wiki useful and relevant for discussion and collaboration in different topics out of class, which is a major concern for postgraduate students, coming from diverse business sectors and have limited time for discussion in or after the class. This result is consistent with the result of previous researches (Venkatesh et al., 2003; Pardamean and Susanto, 2012).

Using Wiki in learning would help students to gain more knowledge through discussion between each other. This would help student to overcome the time and space limitations and students will freely

response to other inquires and give feedback. This could be confirmed through the significance of the effort expectancy where students found that using Wiki help them to gain more knowledge without the need to making much effort. Accordingly, effort expectancy shows the level of ease of use. The result showed that the lower effort in using the Wiki contributed in the student intention to use it. This result is consistent with previous research of Venkatesh et al. (2003) where he confirmed that effort expectancy is a strong predictor wither it is used in mandatory or voluntary contexts.

Social influence also did show significant influence on behavior intention. Social influence impact shows how the others' opinions are important to use the new system especially between students who are studying in Egypt. This indicates that the opinion of friends, instructors or group members is considered a powerful force to students' intention to use the Wiki. It was expected that the power of this predictor will be weak during the pre-implementation phase, as the researchers found that social influence is considered an important factor only when directives exists such as government regulations (Venkatesh and Davis, 2000).

From the knowledge sharing prospective, it was found that the attitude to share knowledge significantly influence the behavior intention to use Wiki in virtual learning community. This was expected as the main purpose of Wiki is to share knowledge to improve learning activities thus if the user does not have a positive attitude toward sharing the knowledge in general, they will not accept to use the Wiki. This result is consistent with previous researches (Chen et al., 2009; Bock et al., 2005; Wixom and Todd, 2005). To avoid the failure of the implementation of this new knowledge sharing system, it is important to promote the culture of sharing among the Egyptian students.

Reciprocity on the other hand did not show a significant influence on behavior intention inside the mode. This indicates that the knowledge contributors will share their knowledge with no expectation to receive future help when they need it. This result was against the expectation and inconsistent with other researches (Kankanhalli et al., 2005; Bock et al., 2005). Justification is that the Egyptian culture played a role in this factor as the Egyptian tries to help each other without waiting for a return.

The effect of gender as a moderator factor was found to be not significant on the interaction of the effort expectancy, my justification for this is that both genders have similar capabilities to use the social networks such as Wikipedia and Facebook and found ease of use factor the same for them. The interaction of age on performance expectancy was not significance on both performance expectancy and effort expectancy, which is inconsistent with Venkatesh et al. (2003).

Research Contribution, Limitation and Future Research

This research contributes by extending the UTAUT model to new context by testing the behavior intention to sharing knowledge through in virtual community. Accordingly, the research succeeded in contributing a conceptual model for assessing the intention to use Wiki to share knowledge in virtual learning community. On the practical side, the research highlighted the use of the Wiki as an effective tool for knowledge sharing in virtual communities which lead to having better virtual learning community.

Research limitation includes the limited number of the sample size compared to the population size. Moreover, the research is limited to postgraduate students only who are studying in Egyptian universities where culture factors might differ from one country to another. It is recommended to extend the study to different universities in different countries. Also, it is recommended to combine qualitative approach to the quantitative approach to get more in depth understanding of other factors that contribute in the student's intention to use the Wiki.

CONCLUSION

This research explored the use of Wikis to share knowledge in virtual learning community. The research examined the factors that contribute in the user intention to use or discard of the Wiki to share knowledge in academic environment. A survey was conducted to 124 postgraduate students

who are studying in Egyptian universities. The result confirmed that the three factors used from the UTAUT (performance expectancy, effort expectancy and social influence) have significant influence on the behavior intention to use Wiki to share knowledge in academic context, which is consistent with findings in the literature review. The result also confirmed that the attitude to share knowledge is an important factor to use the Wiki in the context of knowledge sharing.

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Threaded Discussion:
The Role It Plays in E-Learning

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ABSTRACT

This article presents the results of two studies that focus on the role that threaded discussion plays in student learning. Over a period of three and one-half years, researchers conducted a series of surveys of graduate and undergraduate students at a private, nonprofit university in Southwestern Pennsylvania to determine how students viewed the value of threaded discussions in enhancing their ability to learn course material. Students were asked which types of threaded discussions they preferred; whether they found the threaded discussion to be a better tool for learning than a written assignment; and, which learning environment they felt was more conducive to learning, classroom or online. Results from the combined studies revealed some statistically significant differences based on enrollment status and gender. Upon comparing study results, researchers found statistically significant differences with regard to a preference for classroom versus online instruction and the usefulness of threaded discussions to learning.

KEYWORDS

Critical Thinking, Enhanced Learning, Expectations, Feedback, Interaction, Online Instruction, Perception, Value

INTRODUCTION

In 2014, Jung and Gilson declared online learning an innovative approach to overcoming the constraints of distance, time, location and differing learning styles made possible by technological evolution. In their report, Allen, Seaman, Poulin, and Straut (2016) characterized the growth of online education as continuing to outpace enrollment at institutions of higher education. While many institutions of higher education in the United States are experiencing a decline in traditional student enrollment, those with online components report increases. The authors found an 11.3% increase in distance learning enrollments at private nonprofit institutions from 2013 to 2014. Leaders at institutions of higher education with online offerings continue to support the proposition that being able to offer distance education is a critical element for success. As to the question of which is more effective for learning, onground or online instruction, the authors report that 71.4% of respondents in 2015 rated learning outcomes in online education as equal to, or better than, learning outcomes from classroom instruction.

Threaded discussion is an instructional tool used to promote critical thinking and reflection (Rizopoulos & McCarthy, 2009). Threaded discussions are asynchronous conversations among participants – students and instructors - in a web-based forum. Jung and Gilson (2014) maintain that asynchronous communication is the dominant form of educational computer-mediated communication

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today. Threaded discussion can create online dialogic communities, communities which Rizopoulos and McCarthy state "have become a ubiquitous tool that transforms student learning and course delivery" (p. 373).

The argument is made that a key element in successful online instruction is the effective use of threaded discussions. They are the "beating heart of nearly every online course" (Sull, 2014, p. 11) and standard features in distance education (Maurino, Federman, & Greenwald, 2007). Edelstein and Edwards (2002) suggested that a critical element of any successful online course is the incorporation of a means to facilitate ongoing student interaction. It might be said that the threaded discussion is the means, if not the lynchpin, for facilitating student-to-student and instructor-to-student interaction.

Kleinman (2005) proposed that to maximize active learning and interaction in online courses, instructors should look to improving instructional design. Kleinman maintained that a satisfied learning community is the result of an online environment that nurtures engaged learning and provides the necessary support to help students understand course expectations. Swan (2001) determined that interactivity was key to effective online course design.

It goes without saying that the development of critical thinking skills is an important outcome for any institution of higher education. For online learners, the threaded discussion is considered to be a key tool in enabling e-learners to develop such skills. Using Newman, Webb, and Cochrane's (1995) content analysis framework, Tan and Ng (2014) assessed how well postgraduate students demonstrated critical thinking skills in threaded discussions. They found that while participants could not critically evaluate their own or others' postings, their personal experience and knowledge had a bearing on critical-thinking performance.

Clarke and Kinne (2012), noting that the use of threaded discussion in creating online learning communities has been validated, also point out that there have been studies critically examining the practice. For example, Dollisso and Koundinya (2011) determined that the use of a two-stage discussion model could help keep threaded discussions on track while maintaining the interactive features of the discussion. Clarke and Kinne wanted to understand the effect that altering the discussion format would have on students' learning experience. In their study, the authors used discussion boards with one group and blogs with another for group discussion. They found that the learning community built from the group discussion in the discussion board was both more academic and more collaborative than that built using a blog.

However, as Lee, Yang, and Rim (2014) observed, not all threaded discussions are created equal. They found that how a threaded discussion was structured outweighed time constraints, the participant profile or who initiated the thread.

In this study, researchers looked at format, as well as students' perceptions of the value and usefulness of threaded discussions to learning in order to determine the role that threaded discussion plays in enhancing student learning in the online environment. The study combines the results of surveys conducted over a three and one-half year period.

RESEARCH QUESTIONS

1. From the student's perspective, is one format preferable to another in threaded discussions?
2. From the student's perspective, do threaded discussions add to or enhance learning?
3. From the student's perspective, do threaded discussions assess learning better than written assignments?
4. From the student's perspective, are threaded discussions useful for learning course material?
5. From the student's perspective, which learning environment, online or face-to-face, is preferable?

METHODOLOGY

Researchers developed a fourteen-question survey instrument modeled on one designed by Shelley and Best (2014) to determine student perceptions of the value of threaded discussions in fully online and in blended learning courses. The survey was first administered to graduate and undergraduate students in business and education courses in 2013-2014. Surveys were administered again in 2015-2017 to students in graduate and undergraduate business and education courses. The survey had been modified for the second study to include two additional questions on the use of rubrics in scoring threaded discussions. The additional questions were deleted when the results from both studies were combined for analysis in SPSS.

The first four questions were demographic in nature and included gender, enrollment status, academic level, and experience with online courses. Seven questions focused on the respondents' view of selected elements of threaded discussions, including value and usefulness, format, assessment methods and weighting, and time commitment. One question asked for the student's preference for online or face-to-face instruction. Another asked if the student "enjoyed" threaded discussions. There were two open-ended questions asking for additional comments. These last two were optional. Students were given extra credit to complete the survey. The survey instrument was developed in Question Pro, the web-based survey software used at the University. Results were transferred into SPSS for analysis.

Independent samples T-tests were run on each of the five research questions comparing results from each of the earlier studies. Independent Samples T-tests were also run on the combined sample for each of the five research questions based on enrollment status and gender.

Sample and Participant Selection

Students in the undergraduate and graduate business law classes, graduate students in the educational technology and education research courses, and graduate students in the MS in Human Resource Management program over the three year and one-half period were asked to participate.

In the first study, 440 students started the survey, of those, 402 completed it, for a completion rate of 91.36%. Undergraduate students made up 65.24% of the sample. Females represented 77.30% of the respondents. Full-time students made up 77.36% of the sample. More than 36% of the students had previously taken between one and three online courses, followed by 28.24% for whom this was their first online course. Approximately 21% had taken between four and seven online courses. Respondents who had taken between eight and ten online courses represented 6.35% of the sample. Those who reported having taken more than ten online courses made up 7.76% of the sample.

In the second study, 524 students began the survey. Five hundred twelve completed it for a response rate of 97.71%. Graduate students composed 53.33% of the sample. The response rate between females and males was more evenly split in the second study (50.79% - 49.21%). Full-time students represented 63.73% of the sample. More than 34% of the students had previously taken between one and three online courses, followed by 22.40% who had taken between four and seven online courses. There were 19.45% for whom this was their first online course. Approximately 12% had taken between eight and ten online courses. Those who reported having taken more than ten online courses made up 11.59% of the sample.

Together, 964 students began the survey, of these, 914 completed it for a completion rate of 94.81%. Undergraduate students made up 55% of the sample. Females represented 62.8% of the respondents. Full-time students made up 69.8% of the sample. Approximately 35% of the students had previously taken between one and three online courses, followed by 23.44% who said that they had not taken any online courses prior to the current one. Almost 22% had taken between four and seven online courses. Almost 10% of the respondents had taken between eight and ten online courses. The same percentage reported having taken more than ten online courses.

In both studies, "online" was defined to include courses with an online component as well as courses delivered in the fully online mode.

RESULTS

Research Question 1

The first research question asked students whether they preferred one question format over another in a threaded discussion to learn course material. When survey results from both studies were combined, 27.25% said that they preferred questions asking the student for their opinions on an instructor's example or scenario, followed by responding to controversial issues (23.87%).

There were differences between the two studies on the first research question. In each of the surveys in both studies, students were asked to choose which of the four formats for threaded discussions they preferred. These were "specific answer," "opinion on an example or scenario presented," "response to controversial issues," or "role-playing scenarios." Students could also answer that they liked all "about the same" or did not like any of the formats for threaded discussions.

In the 2013-2014 study, 26.36% of the students said they liked all "about the same." Approximately a fifth of the participants in the first study chose "specific answer" (20.93%), "opinion on an example or scenario presented" (20.16%), or "response to controversial issues" (19.38%). Slightly more than 10% chose "role-playing scenarios."

In the 2015-2017 study, 29.53% of the students said they preferred discussion formats that presented a scenario or an example on which they could express an opinion. Approximately one quarter of the students preferred responding to controversial issues (25.31%). More than 20% of the respondents in the second study said they liked all "about the same" (20.35%). In contrast to the respondents in the first study, only 12.16% chose "specific answer" as their preferred format for threaded discussions. Role-playing scenarios was identified by 9.93% of the participants as a preferred format for learning course material imbedded in threaded discussions. In both studies, approximately 3% elected "I really don't like any of these formats."

Independent Samples T-tests were run on Research Question 1. There were no statistically significant differences between the two studies, 2013-2014 and 2015-2017, on the preference for format of threaded discussions. There were no statistically significant differences on the preference for format of threaded discussions based on enrollment status or gender. The differences between the two studies with regard to the first research question are represented in Table 1.

Research Question 2

The second research question asked if students found threaded discussions added to or enhanced learning. When survey results from both studies were combined, 40.11% said that they found threaded discussions to be "somewhat helpful" to learning course material, followed by 28.24% who said that threaded discussions "helped a little." Approximately 19% found threaded discussions to be "very useful" for learning course material.

Again, there were differences between the two studies with regard to Research Question 2. In the 2013-2014 study, 42.19% of the students rated threaded discussions as "somewhat helpful," followed by 23.44% who rated threaded discussions as "very useful." Respondents who said threaded discussions "helped a little" represented 19.53% of the sample, followed by 10.16% who responded, "very little," and 4.69% who had "no opinion."

In the 2015-2017 study, 39.45% of the students rated threaded discussions as "somewhat helpful," followed by 31.02% who said threaded discussions "helped a little." Those who rated threaded discussions as "very useful" represented 17.87%, followed by 9.68% of the sample who responded, "very little," and 1.99% who had "no opinion."

Independent Samples T-tests were run on Research Question 2. There were no statistically significant differences between the two studies, 2013-2014 and 2015-2017, on the perceived value of threaded discussions to enhanced learning. There were statistically significant differences on the perceived value of threaded discussions to enhanced learning based on gender at the .05 level (.017, equal variances not assumed). There were no statistically significant differences on the perceived

Table 1. Question format preference

Format	2013-2014 Study Count/*Percent*	2015-2017 Study Count/*Percent*	Combined Results Count/*Percent*
Specific Answer	27 / *20.93%*	49 / *12.16%*	76 / *14.28%*
Your opinion on an instructor's example or scenario	26 / *20.16%*	119 / *29.53%*	145 / *27.25%*
Your response to controversial issues	25 / *19.38%*	102/ *25.31%*	127 / *23.87%*
Role-playing scenario, puts you in a decision making position	13 / *10.08%*	40 / *9.93%*	53 / *9.96%*
I like all of them about the same	34 / *26.36%*	82 / *20.35%*	116 / *21.80%*
I really don't like any of these formats	4 / *3.10%*	11 / *2.73%*	15 / *2.81%*

value of threaded discussions to enhanced learning based on enrollment status. Table 2 illustrates the differences between the two studies with regard to students' perceptions of the value of threaded discussions to their learning course material.

Research Question 3

The third research question asked whether students preferred threaded discussions or written assignments as the means to assess learning. When survey results from both studies were combined, 41.50% said that they preferred the threaded discussion. Those who preferred the written assignment represented 30.56% of the sample. Almost 22% rated the choices equally.

Those who had no opinion represented 3.96% of the sample followed by 2.07% who did not like either form of assessment.

In the 2013-2014 study, 40.94% preferred the threaded discussion as a means of assessment, 34.65% chose the written assignment as the preferred method of assessment of learning. Those who thought both methods were "about the same" represented 22.05% of the sample. Those who responded that they did not like either form of assessment represented 2.36% of the sample. There were no respondents who selected "no opinion."

In the 2015-2017 study, 41.69% chose threaded discussions as the preferred method of assessment, while 29.28% selected the written assignment. Those who thought both methods of assessment were "about the same" represented 21.84% of the sample. More than five percent had no opinion, while 1.98% said they did not like either.

Table 2. Threaded discussion value

Value	2013-2014 Study Count/*Percent*	2015-2017 Study Count/*Percent*	Combined Results Count/*Percent*
Very little	13 / *10.16%*	39 / *9.68%*	52 / *9.79%*
Somewhat, they help a little	25 / *19.53%*	125 / *31.02%*	150 / *28.24%*
No opinion	6 / *4.68%*	8/ *1.98%*	14 / *2.63%*
To some degree, somewhat helpful	54 / *42.19%*	159 / *39.45%*	213 / *40.11%*
Very useful	30 / *23.44%*	72 / *17.86%*	102 / *19.21%*

Independent Samples T-tests were run on Research Question 3. There were no statistically significant differences between the two studies, 2013-2014 and 2015-2017, on the preferred method of assessment, threaded discussion or written assignment. There were no statistically significant differences on the preferred method of assessment, threaded discussion or written assignment based on enrollment status or gender. Student attitudes toward the preferred method of learning assessment, threaded discussions or written assignments, are represented in Table 3.

Research Question 4

The fourth research question asked students if they thought that threaded discussions were useful for learning course material. When survey results from both studies were combined, 42.61% said threaded discussions were "somewhat useful" followed by 32% who said that threaded discussions were "an important part of the course." Almost 11% said threaded discussions were "critical and important learning," followed by 9% who felt that they were a "waste of time" and 5.49% who had no opinion.

In the 2013-2014 study, 39.37% found threaded discussions to be important, followed by 25.98% who said they were "somewhat useful." Those who thought that threaded discussions were "critical and important learning" represented 17.32% of the sample. Almost 12% felt them to be a waste of time. Those with "no opinion" represented 5.51% of the sample.

Independent Samples T-tests were run on Research Question 4. There were statistically significant differences between the two studies, 2013- 2014 and 2015-2017, on the usefulness of threaded discussions to learning course material at the .01 level (.002, equal variances not assumed). There were no statistically significant differences on the usefulness of threaded discussions to learning course material based on enrollment status or gender. Table 4 reflects student responses to Research Question 4 on the usefulness of threaded discussions to learning.

Research Question 5

The fifth research question asked students which learning environment, online or face-to-face, they preferred for learning course material. When survey results from both studies were combined, 38.21% chose face-to-face over online instruction (29.84%) for learning course material. Almost 30% said "either one is fine." Those with no opinion represented 2.28%.

Table 3. Preferred learning assessment

Assessment	2013-2014 Study Count/*Percent*	2015-2017 Study Count/*Percent*	Combined Results Count/*Percent*
Do not like either form of assessment	3 / *2.36%*	8 / *1.98%*	11/ *2.07%*
They are about the same	28 / *22.04%*	*88 / 21.84%*	116 / *21.88%*
No opinion	0 / %	21/ *5.21%*	21/ *3.96%*
I prefer the Written Assignment	44 / *34.64%*	118/ *29.28%*	162 / *30.56%*
I prefer the Threaded discussion	52 / *40.94%*	168/ *41.69%*	220 / *41.50%*

Table 4. Threaded discussion usefulness

Usefulness	2013-2014 Study Count/*Percent*	2015-2017 Study Count/*Percent*	Combined Results Count/*Percent*
A waste of time	15/ *11.81%*	33/ *8.23%*	48/ *9.0%*
Somewhat useful	33 / *25.98%*	192 / *47.89%*	225 / *42.61%*
No opinion	7 / *5.51%*	22/ *5.49%*	29/ *5.49%*
Usually an important part of the course	50 / *39.37%*	119/ *29.67%*	169/ *32.0%*
A critical & important learning activity in the course	22 / *17.32%*	35/ *8.73%*	57 / *10.79%*

In the 2013-2014 study, 53.28% preferred face-to-face instruction for learning course material as opposed to 27.05% who preferred online instruction. Almost 19% said “either one is fine.” Those with no opinion represented 0.82% of the sample.

In the 2015-2017 study, 33.66% preferred face-to-face instruction for learning course material as opposed to 30.69% who preferred online instruction. Those who responded “either one is fine” represented 32.92% of the sample. Those with no opinion represented 2.72% of the sample.

Independent Samples T-tests were run on Research Question 5. There were statistically significant differences between the two studies, 2013-2014 and 2015-2017, on students' preference for face-to-face versus online instruction for learning course material at the .05 level (.024, equal variances assumed). There were statistically significant differences on students' preference for face-to-face versus online instruction for learning course material based on enrollment status at the .01 level (.000, equal variances not assumed). There were no statistically significant differences on students' preference for face-to-face versus online instruction for learning course material based on gender. Student preference for the online versus face-to-face learning environment is reported in Table 5.

CONCLUSION

Over several years, with the use of student surveys on different aspects of online instruction and student learning, beginning with a comparison of student learning in the online environment with learning in the traditional classroom setting, researchers have attempted to broaden the scope of the investigation into the role that threaded discussion plays in e-learning. Several themes emerged, among them the importance of student-to-student and student-to-instructor interaction as critical to student satisfaction with their e-learning experience (Cole, Shelley, & Swartz, 2014), and to some degree, to student understanding of and adherence to the precepts of academic integrity in the online environment (Cole, Shelley, & Swartz, 2013).

As several prior studies have demonstrated, the threaded discussion has proven to be an effective instructional tool for facilitating participant interaction in online courses (Joyner, 2012, Andresen, 2009, Rizopoulos & McCarthy, 2009, Mandernach, Dailey-Hebert, & Donnelli-Sallee, 2007, Edelstein and Edwards, 2002). Others consider the threaded discussion as a means to influence critical thinking (Arend, 2009; Meyer, 2003); and, as a way to facilitate the assessment of learning (Vonderwell, Liang, & Alderman, 2007). Loncar, Barrett, & Liu (2014) noted that with technological advances have come significant changes in how course material is developed and delivered. Students are expected to interact with peers as well as with the course material.

Andresen studied the impact of asynchronous discussion on student learning, comparing it with student learning in the classroom environment. He found, given certain limitations, the threaded discussion - asynchronous discussion formats - could provide "the critical dimensions of learning" found in the more traditional classroom setting. Focusing on enhancing student interaction, but acknowledging the challenges in presenting course material in a way that promoted critical thinking, Joyner found that inserting images and examples into asynchronous discussions enhanced interaction and resulted in a level of critical thinking.

This study looked at students' attitudes toward four aspects of threaded discussion: preferred discussion format, perception of their value to learning, perception of their effectiveness as a learning assessment method, and their usefulness as an instructional tool. Researchers also asked students which instructional environment was more conducive to learning. Results from this study were consistent with the authors' earlier studies on preferred discussion format (Cole, Shelley & Swartz, 2017), student perceptions of the value and usefulness of threaded discussions for learning, and preferred assessment tool (Cole, Shelly, & Swartz, 2016), and learning environment (Shelley, Swartz, & Cole, 2008).

Findings point to choosing scenarios, case studies and examples, followed by presenting controversial issues as best practice for formatting threaded discussions. Perhaps with a stronger emphasis on more challenging interactive discussions, students will find the threaded discussion to be "very useful" for learning course material as opposed to only "somewhat helpful," as this study found. In both studies, students preferred the threaded discussion over a written assignment as a means of assessment. Student preference for online instruction over face-to-face is growing, as this study illustrates. The change may be due to students gaining familiarity with online instruction. Its popularity might also be due to the evolution of online pedagogy.

Table 5. Learning environment

Environment	2013-2014 Study Count/*Percent*	2015-2017 Study Count/*Percent*	Combined Results Count/*Percent*
Traditional face-to-face	65/ *53.28%*	136/ *33.66%*	201/ *38.21%*
Either one is fine w/me	23 / *18.85%*	133 / 32.92%	156 / *29.65%*
No opinion	1 / *.82%*	11/ *2.72%*	12/ *2.28%*
I would prefer the Fully Online course	33 / *27.05%*	124/ *30.69%*	157/ *29.84%*

An in depth examination and investigation should be conducted of instructors' perceptions of the value of threaded discussions, particularly with regard to the development of critical thinking skills. In their case study involving 36 instructors teaching online, Maurino, Federman, and Greenwald (2007) examined the purposes, goals, and objectives of threaded discussions set by the instructors. They found that instructors used threaded discussion to develop both cognitive and social skills. The hope was that the threaded discussions would enhance e-learning, open students' minds to different ideas and perspectives and facilitate more in-depth learning leading to higher-level critical thinking skills. The finding was that older, more experienced students could achieve "deep learning." Instructors stated that they did not observe higher-level critical thinking skills in younger students.

Belcher, Hall, Kelley, and Pressey (2015) examined the role that faculty behaviors play in creating threaded discussions that facilitate the development of critical thinking skills. Their study was inconclusive with regard to the correlation between faculty behaviors and students' scores on the tool used to assess peer interaction (IAM). Interestingly, they noted that when the instructor was less engaged in the discussion, students seemed to increase their cognitive engagement with other students.

While researchers in this study did not attempt to determine a relationship between instructors' behaviors and student perceptions of the value of threaded discussions as a tool for learning course material, many of the responses to the open-ended questions asking for students' thoughts on their experience with threaded discussions did touch on the issue. The authors have italicized key phrases in the following examples of verbatim student responses:

Several students commented on the importance of timely feedback.

- I appreciate when instructors take the time read and make a comment on the discussion grade (2015-2017 Study).
- Feedback is important with threaded discussions. If it is being graded, the instructor needs to provide feedback and direction to facilitate improvement (2015-2017 Study).
- Timely feedback from the professor is greatly helpful and appreciated (2015-2017 Study).
- I like when professors provide feedback on a timely manner. Some courses I have not received feedback or the feedback was given several weeks later. It is helpful for students to get immediate feedback in order to ensure students are on the right track and meeting expectations (2015-2017 Study).
- The best online discussions that I have experienced have required the professor to give feedback fairly soon after the thread is closed. I put a great deal of time into my responses and threads, so it is nice to be rewarded differently than those who "seemingly" do not. Gradation is key.

For some of the best thread discussions and a framework for the future, I would suggest to look at Professor X's style and Professor Y's style. Both give immediate feedback and also give professional opinions and real outcomes of the topics (2015-2017 Study).

- My only concern is that the threaded discussions are not looked at by the professor. There are around 30 original posts and then any number of replies, so it might take the professor a long time and the professor might be checking for completion instead of content (2015-2017 Study).
- The main reason I enjoyed Threaded Discussions was because of the feedback I received from both the instructor and the students in my class. This provided me with more insight for the topics we were discussing (2015-2017 Study).
- Most professors do not share an answer to the threaded discussions, particularly the opinion or role play ones. Even though many answers could be correct, it would still be helpful to hear what the best solution is so I can determine if my answer was close (2015-2017 Study).
- I think threaded discussions are a useful tool whenever the students are given feedback, when there is nothing said or no critique given then I think they can be a waste of time (2015-2017 Study).
- It would be helpful if the overall "right" answer is posted in the threaded discussions (2015-2017 Study).
- I prefer threaded discussions where you get feedback from the professor. This allows a better understanding of the content and points that might have been missed by myself or other students (2015-2017 Study).
- I took an online international business course that I thought made use of threaded discussions very well because both students and instructors responded many times throughout the week on the discussion and valuable feedback was given (2015-2017 Study).
- Threaded discussions are helpful because one receives feedback quickly from their peers. While this isn't always at the level of an instructor, it does give more feedback from more sources and helps to offer possible different perspectives about the same issues (2015-2017 Study).

Some students focused on the instructor's approach to the course.

- I find online courses, hybrid or fully, to be a huge disconnect from the instructor, my peers, and the content. It feels like I am simply paying thousands of dollars to be told which book the questions come from. I need face to face interaction and classroom structure to learn at my fullest capability. A thoughtful and helpful instructor is always a good thing as well (2013-2014 Study).
- My first fully online course was during the Summer 2013 semester and I absolutely enjoyed every aspect of it. I feel that having daily/weekly threaded posts really engages you in the learning and promotes critical thinking on behalf of the student. It was different than the typical "lecture - exam" style that many use in face-to-face instruction and I felt more of a connection with my professor and I learned more by participating in the online discussions of the material. I would recommend to any student to at least try an online course at least once. I also enjoy professors who use the hybrid format as well (2013-2014 Study).
- Online courses can be intimidating at first and vary with each professor. Since I have had the same professor for the majority of my online courses it makes sense that I have developed a comfort level. I like online courses for the ease of restriction but face to face offers a better comprehension (at least in Grad classes...for a lecture class I would certainly prefer online with threaded discussions for the class interaction and insight) (2013-2014 Study).
- I enjoy when the instructor participates in the threaded discussions as well (2015-2017 Study).

Others noted that the instructor needed to be clear about expectations in threaded discussions.

- I think having a clear an [sic] concise rubric for discussion posts are critical. All of my classes thus far have had one. This makes achieving expectations much simpler (2015-2017 Study).
- In my experience, threaded discussions work best when the professor lays out the specific guidelines of what he/she expects us to do for each threaded discussion. For example, they should specifically indicate how many times we should post in the discussion, whether we need to use cited sources, or how long each post should be in the discussion. The professor should also have a good understanding of how threaded discussions work. Otherwise, it can become very confusing (2013-2014 Study).
- In my experience, when an instructor puts too many requirements in the rubric (such as minimum word count), it takes away from the flow of the threaded discussion. I find the best discussions are those in which the instructor encourages students to write as though they were talking with other students in a classroom setting (2015-2017 Study).
- I have found that professors vary significantly in their formatting and expectations for online discussions. For some courses, these discussions are extremely useful and relevant where in other courses they do not add to understanding of the material or ignite meaningful discussion (2015-2017 Study).
- When starting out the professor needs to let the class know the preferred method of posting to the thread. i.e. To create a new thread or utilize replies to the posted thread question. As a new student to threaded discussions this could be confusing as the classes I have taken have all had a different requirement (2015-2017 Study).

Some commented on the instructor's use of and participation in threaded discussions.

- Some of my online courses have had multiple discussions each week with replies to more than one student. In one of my online courses there are three discussions each week with reply to multiply [sic] students, with very little guidance from the professor. This has left a bad impression about threaded discussions for me. One threaded discussion every other week usually seems to be the best (2015-2017 Study).
- I do not like answering questions that are setup [sic] like an essay prompt. Once again, an online discussion is designed to supplement in-class discussions. However, some professors use it as an opportunity to assign an essay assignment each week, then expect students to respond via essay to others' posts. I believe there is certain type of informality that should follow online discussions; some educators are not even in the same ballpark with this train of thought (2015-2017 Study).
- One instructor required that you include a question to help progress the dialogue (2015-2017 Study).
- the only downside of threaded discussions is that professors typically want those closely monitored and updated which is difficult for me during the work week (2015-2017 Study).
- I think threaded discussions are useful, but prefer face to face discussions or more hands-on discussion moderated by the professor (2015-2017 Study).
- It really depends on the professor and what kind of questions or prompts he/she is providing for the discussions. It also depends on the content being discussed - some things are more able to actually discuss whereas some things are just straight forward and there isn't much discussion in it. It also is largely based on the work ethic of the people enrolled (2015-2017 Study).
- Depends on the professor and my knowledge of their courses (2015-2017 Study).
- I believe that the relevant use of threaded discussions really depends on the quality of the prompts the professors assign and the quality of the discussion that ensues. Therefore, it is up to the professors to develop good prompts and up to the students to help each other out by contributing meaningful conversation (2015-2017 Study).
- As a graduate student who only takes fully online courses, I think the threaded discussions are crucial! They provide each student a chance to answer the question then respond to other students.

It's a great tool to use for the online programs. I also enjoy the professors that give us time to complete our initial post and then additional time to complete our responses to other students! (2015-2017 Study).

- I appreciate the professor participating in the threaded discussion, most of the courses I've taken they do not do this. Or the professor is too involved, being the first to answer and takes away the students [sic] opportunity to say it first (2015-2017 Study).
- Instructors need to guide students from telling each other "good job." In my experience, too many students avoid challenging the ideas of their classmates and simply agree to get their points for participation. Even when I bait others into my thread, I usually get very little to work with (2015-2017 Study).
- Overall I think the quality of the threaded discussion is up to what the professor makes of it. Some professors put time into creating the situations for the discussions, which in turn make the discussion more meaningful and generate better discussion (2015-2017 Study).
- I think professors need to consider the amount of time it takes students to complete threaded discussions and respond to other students. I value the learning and reading that takes place when I am looking for other resources to contribute to the learning. However, it is hard to complete threaded discussions, take on line quizzes, complete research papers. Its hard to do all of those well in an 8 week course and work full time (2015-2017 Study).
- I've only been involved in one threaded discussion thus far. I think it would be interesting to see the Professor get involved with some of the discussions. It may help guide the [sic] into a more constructive learning experience (2015-2017 Study).
- Most of the time, it seems like professors use threaded discussions as way to spark controversy in the class, however it is hard to do that effectively when everyone is taking the course online. Most of us students see them as an easy way to get points and boost our grades (2015-2017 Study).

Future studies of students' perceptions of the value of online education might focus on instructor's role in the interactive features of the course, specifically, the threaded discussion to identify best practices. In place of optional open-ended questions asking for comments, researchers might develop a set of specific answer questions directly related to the instructor's involvement and participation in the course.

This study points to the continuing need for well-designed and executed threaded discussions that engage students, as well as instructors in the learning process.

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Integration of Examination Strategies in E-Learning Platform for Assessment of Collaborative Activities

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ABSTRACT

In this article, the authors propose a set of examination strategies for distributing tasks of collaborative activities. The first purpose behind this proposal is to assess fairly the learners who are involved in group or team work at the e-learning platform. Indeed, in the literature, few methods are used to assess the learners' individual contributions to the collective or collaborative work. Therefore, the proposal of this article is based mainly around this issue. This will lead to an approach to assess individuals within the learning group (or team), which in turn, will allow to assess the group (or team) as a learning entity.

KEYWORDS

Assessment Process, Cap-Platform, Distribution Strategies, Division Of Labor, Team Working, Work Item

INTRODUCTION

Collective work, teamwork or networking learners' skills have become the key elements in all educational and professional organizations. Indeed, they increasingly use methods of work organization to better enable collaboration between learners working around the same activity. In such conditions, coordinating task assessment of learners working together may prove difficult, due to several factors such as, the difficulty of assessing the scenario to be played by learners, and the difficulty of finding a consensus for a fair work dispatch, etc. That is why, it is necessary to adapt the division of labor (between learners) befitting such activity or process.

Therefore, these new forms of work organization have widely spread through the usage of new Information and Communication Technologies (ICT). This later has favored the birth of Computer Supported Cooperative Work (CSCW) that studies the individual and collective mechanisms of group working, and then investigates how actors with various skills and different prerequisites can cooperate.

However, if one admits that these technologies offer a set of tools to communicate, coordinate and collaborate, the question is: "what would be the individual and collective performance criteria to be considered for an assessment of collaborative activities". Therefore, it is needed to evaluate and even measure the effectiveness and the added value of these activities in a professional setting. Furthermore, several important issues might arise: "how to reduce the subjectivity in the assessment and how to fairly assess learners involved in the group", and "how to ensure the assessment of learners' individual contributions in group, or the assessment of the group or the team itself?" However, among the six principles of group work assessment established in Galton (2010), "a fair system should be used that rewards both individual effort and group collaboration."

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This paper focuses on the problem of assessing teams or groups, taking into account the individual assessment of each member in the team (or the group). In fact, some authors like Saadoun and Levan (1996) distinguish between the concepts of group and team based on some parameters such as the adhesion (feeling of membership that is strong in teams) and the cohesion (harmony sought to lead without conflicts at work). Generally, in the team context, the examiner must have knowledge of the individual profile of each team members such as, his level, his competence, and background, etc. However, in the group, only the prerequisites are necessary to consider.

In fact, in a teaching context, assess a product resulting from examination of collaborative work does not necessarily reflect the quality of each member of the team, because the efforts of one could cover the shortcomings of others. For example, in a programming project, the skillful of the two programmers monopolizes the task to the point that the other cannot contribute.

Therefore, to achieve the set objective, this paper proposes a set of examination strategies that will be applied for the distribution of tasks between learners who are involved in a group or team working in order to achieve collaborative activities. For that, the authors are particularly interested to exploit the tools provided by CSCW field, particularly Workflow Technology (Van Der Aalst & Van Hee, 2002), that is considered the favorite coordination tool in this field. Then, they propose to take charge of all strategies envisaged through the implementation of a combined system: a Learning Management System (LMS) and a Workflow Management System (WfMS), for purposes of assessment of collaborative activities in e-learning. This paper includes: in section 2, a brief background related to this research. In section 3, an illustrative example that explains the problematic. In section 4, the concept "Activity" on which this research is based. Then, in section 5: a set of examination strategies have been proposed for the distribution of tasks of collaborative activities. In section 6: the e-learning platform in which the proposed strategies have been integrated and implemented. Finally, in section 7: an example to show the step implementation of one of proposed strategies in the platform which was performed for this purpose.

BACKGROUND

Collaborative learning is a teaching strategy by which learners can build their knowledge with their peers who work together in teams or groups. Nowadays, it is one of the most recommended in education. In this learning mode, learners can perform several types of activities such as: solving problems, carrying out projects or mini-projects, collective drafting of documents, etc. However, in this activity, the division of labor has a great interest for the organization and coordination of collaborative activities in which each group member performs a part of the overall activity.

Furthermore, project-based learning (Kilpatrick, 1918; Dougherty, 2018) is a teaching practice that includes collective working in a learning or even a professional environment. This practice places the project as a realization in group by the division of labor. In this case, the most important question is: "how to appropriately distribute tasks". In this context and in the professional middle, the project manager is responsible for attributing the missions or tasks to the various actors using project planning tools. Particularly, Gantt chart adapted by the American Henry Gantt is one the tools. This effective tool is a connected, oriented and valued graph which is used to show the distribution of tasks and graphically shows the project progress through the visualization of different tasks that constitute the project. In addition, this diagram is often a complement of Pert tool[1], that is another conventional method used in project management (developed in the United States in 1950). It provides a methodology and practical means for visualizing the dependence of tasks and proceeds to their scheduling. In addition, brainstorming[2] (Osborn, 1948) is another formalized and technical problem-solving tool, with the guidance of a facilitator. This formula can be useful for find a compromise to distribute tasks between the participants in collaborative activities.

On the other hand, the language for describing teaching contents (Koper, 2001) as the IMS-Learning Design (IMS Global Learning Consortium, 2003) greatly facilitates the construction of

teaching contents (Hermans, Janssen & Koper, 2016). However, they do not offer all the flexibility needed to treat problems as those for tracking and assessing, particularly, the assessment of collaborative activities. In addition, this type of language does not cover the needs in terms of possibilities of task distribution between learners. They are intended to describe the possible variations or scenarios in a training program within contents and not teaching activity. In the case of IMS-LD the description of content has been made through a markup language. This one contains some elements to control the execution of scenarios such as, the sequence, the selection, etc. Also, to support collaborative learning, IMS-LD enables the attribution of several persons and/or roles to the same learning activity, because any distribution strategy was defined in this language.

In addition, the current e-learning platforms try to provide tools to facilitate the exchange and sharing of knowledge between learners through the integration of sharing spaces such as, discussion forums, wikis, sharing spaces of documents, etc. These are designed to support collaborative learning and group working. However, they offer no means to structure, monitor and control the activities performed by learners in these spaces. From this point of view, authors think it is appropriate to exploit the technologies provided by the CSCW field, particularly the Workflow that represents a solution to better structure and coordinate collaborative activities. In the case of Sadiq (Sadiq & Orlowska, 2002), it is recommended to use workflow in education, in order, to manage teaching staff and editorial contents. In addition, VanTroys and Peter (2002) propose a workflow-based environment for running and tracking individual learning works. Also, Cesarini, Monga and Tedesco (2004) present a workflow engine supporting the learning processes. Finally, Yong, Yan and Huang (2006) propose to use workflow technology to implement data integration for e-learning. Aprilinda, Sukoco and Cucus (2016) use the WfMS in the development of e-learning platforms to ensure a better efficiency and coordination of distance learning. Regarding assessment in e-learning, Hajjej, Bendaly Hlaoui and Ben Ayed (2013; 2014) propose a generic specification and a design approach based on the workflow technology for creating e-learning processes and particularly of e-assessment adapted for each learner. Consequently, according to the various studies presented above, we conclude that there is again a great lack in methods and adequate tools for monitoring, managing and assessing learning activities, particularly, those of collaborative type. To respond, the present study proposes a set of distribution strategies of collaborative work to fill one of shortcomings of current systems, to ensure a better coordination and development of assessment processes and make assessing the learners who are working around these processes more objective.

In fact, a collaborative process of teaching or assessment represents a set of activities that are organized around a certain project type (mini-projects, projects for collective drafting of documents, practical works, etc.). These collaborative activities may be yielded with one or more distribution strategies to carry out the collaborative learning project. Therefore, to make a dispatch of learning activities in a collaborative context, (Mahdaoui, 2008) proposed two ways. The first approach proposes an equitable sharing of activities between the team members. The second approach proposes to give more freedom to learners in choose and dispatch labor between them. The activities are not shared in advance so as to give more freedom to learners in the choice and distribution of labor. In the following, the problematic is explained through an illustrative example.

ILLUSTRATIVE EXAMPLE AND PROBLEMATIC

Illustrative Example

Suppose a set of learners who are organized into a group or team and which have a set of activities to do in order to accomplish the collaborative process of drafting a document, these activities can be for example: conduct research on the subject, describe the document sections, draft the document sections, organize the different parts and structure the final document.

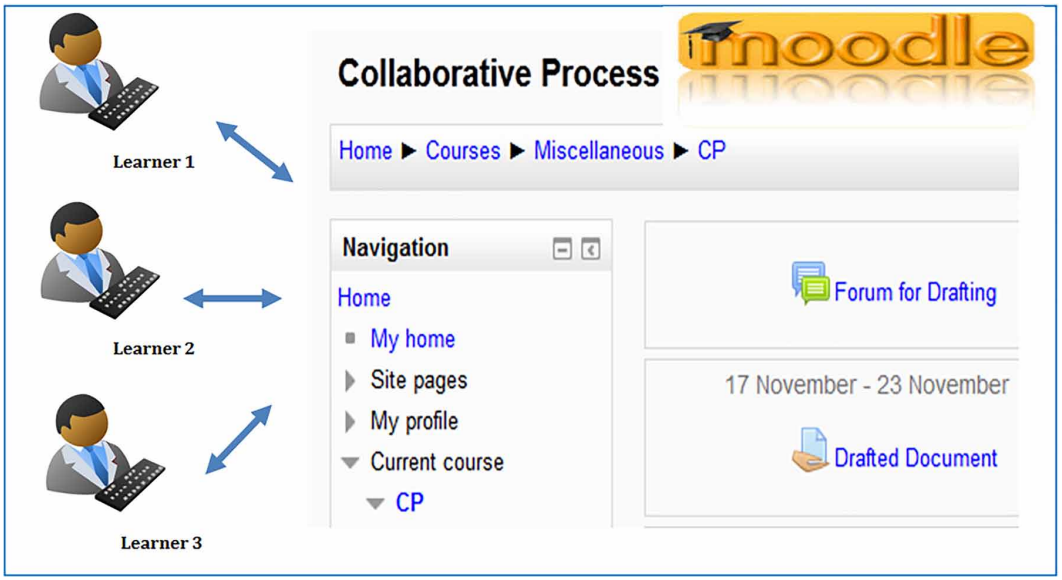
If we use an LMS as the platform “Moodle” (Moodle) to describe this collaborative process and to assess these learners, we will insert the activities that produce the document, which are in

this case the two activities "Forum and Assignment" (Figure 1). Therefore, learners must work together around these two activities to produce the final document and load it in the platform. In this situation, we cannot know how this document has been actually achieved neither assess the contribution of individual effort in this collaborative process. In fact, the assessor may assess only the final document assumed to be collectively produced by learners and assess exchanges between learners in the discussion forum. Indeed, an activity like forum can give some exchanges without necessarily detailing individual contributions.

However, to assess collaborative activities, it is necessary to assess the final individual and collective production of learners and the collaborative process or the approach followed by learners to achieve this production. In the second case, the assessment is based on measurement indicators specified by assessor, in order to estimate learners' individual and collective efforts through exchanges analysis, produced by participants in shared spaces like discussion forums, wikis, etc. Indeed, these tools are integrated into the existing e-learning platforms to facilitate exchange within the learners' community. These two complementary approaches of assessment can cover all aspects to carry out a more comprehensive and objective assessment.

Furthermore, in previously mentioned and used platform i.e., Moodle, one can make a direct individual assignment of activities, but one cannot know the execution traces of tasks to track the progress of overall activity. In other terms, with the use of this training device, one can do some structuring, but it remains informal. In addition, such platforms do not offer methods or strategies to distribute tasks between learners who are working together around collaborative processes. On the other hand, the LMS are based on what is called the language of description of pedagogic contents that offers a great ease for the construction of teaching contents. But they do not offer all the flexibility wanted to treat problems like those of monitoring and assessment, particularly the assessment of collaborative activities. In the next sub-section, a comparison between the LMS and WfMS was made to identify the problematic addressed in this paper.

Figure 1. Collaborative process "drafting a document" in Moodle platform



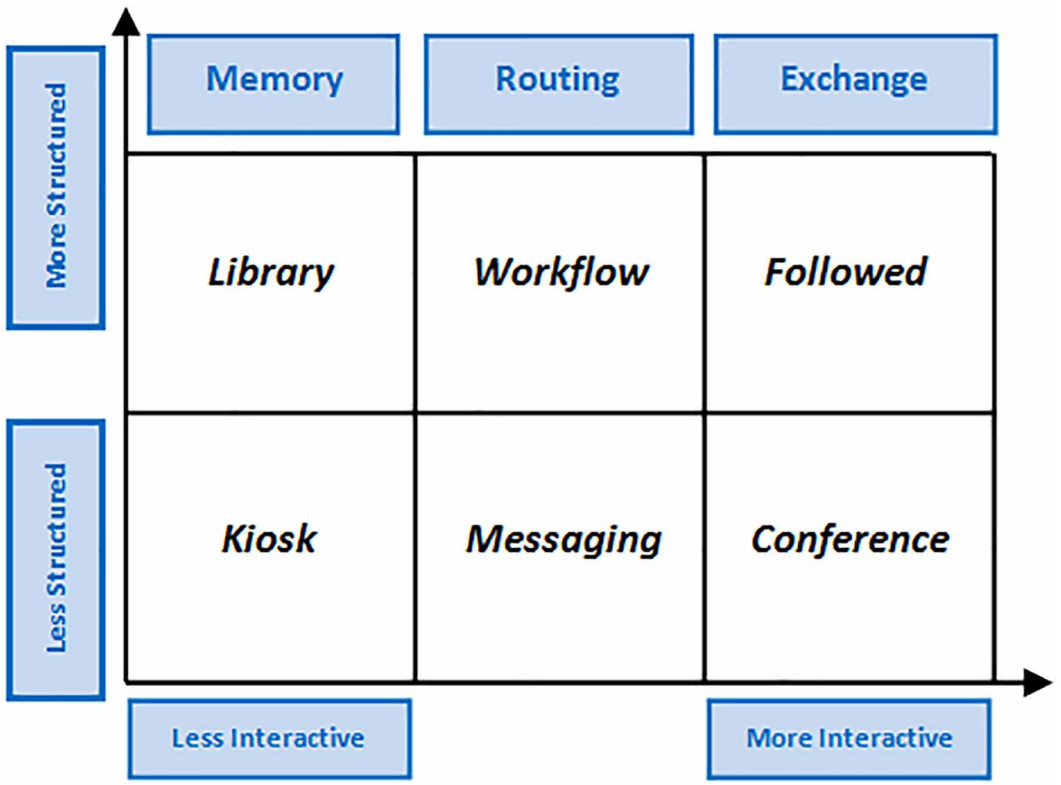
Discussion

The LMS are a category of groupware tools that specifically provides communication and collaboration features to various participants. Figure 2 presents a fairly common classification of applications and tools related to the groupware field.

From Figure 2, the LMS are considered as exchange groupware applications with less structured routing, and therefore, the coordination and structuration aspects of teaching activities in such systems are very limited (Lonchamp, 2003; Levan, 2000). The WfMS is another groupware category which represents systems intended mainly for the coordination and structuring of business activities. In the following, few points have been mentioned that detail the difference between the two categories of systems; to show the limitations of an LMS compared with the coordination aspect considered interesting for structuring learning or assessment activities, particularly of collaborative type. Recall some basic definitions commonly known in groupware tools, particularly workflow:

- **The instantiation of a process:** it is the execution of a workflow on a specific situation.
- **A work item:** describes the representation of the work to be performed by an actor as part of an instance of a collaborative process that will then be executed by workflow engine.
- **A Workflow Engine (MWF):** is a tool that can interpret the definition of a process, manage the participants' coordination and call external applications.
- **Expression of activities:** this aspect represents the manner to envisage the activities in both types of systems. In fact, in an LMS, a training program is defined by a set of themes. Each of them is composed in turn by a set of non-decomposable activities. In addition, the definition

Figure 2. Groupware applications (Morand, 2001)



of these activities is limited by repositories concepts proposed by the LMS itself such as the activity: Wiki, Quiz, Survey, etc., in Moodle. In contrast, in a WfMS, a process is composed of a recursive manner by a set of sub-processes, activities and tasks. These will consist of a set of executable operations or primitives by workflow engine. This decomposition is detailed in the workflow modeling functional aspect (Aouine & Mahdaoui, 2013; Saikali, 2001; WfMC, 1996). On the other hand, contrary to WfMS, the LMS does not have their own graphical tools to simplify the creation of scenarios and ensure a good schematic visualization. Nevertheless, it is still possible to interface a LMS with an author tool to describe graphically the contents (Paquette, Léonard, Lundgren-Cayrol, Mihaila & Gareau, 2006; OMG, 2004; Dalziel, 2003), and ensure their interpretation using languages such as SCORM, IMS-LD, etc. However, it is important to note that an author tool is focused on the content and not the learner's activity and even less for a learners' group/team. And as stated previously in this work, there is no clearly defined flow control operators for the distribution of work items in pedagogic languages and consequently in the LMS.

- **Expression of flow control:** this aspect represents the execution logic of activities related to the overall scenario. Indeed, the LMS impose a sequential description of activities, in addition to some other form of flow operators, that can be used implicitly (they are not clearly defined), such as the parallelism that can be defined with setting of start and end dates of activities. However, this expression of flow is described in terms of accessing activities, but not in terms of work performed by learners. By this we mean, the possibilities of separate assignment of activities to different learners at the same time, due to the absence of instance concept materialized by a work item in the WfMS. Indeed, the WfMS provide a set of flow control operators (sequence, alignment, joint, selection, etc.) that are clearly defined and whose semantics are precise. These operators allow splitting or merging different parts of work, which is interpreted by a set of tasks that will then be performed by actors, who in turn are assigned work items.
- **Assignment of activities to actors:** this aspect is important because it allows specifying actor who will play a predefined role. In the LMS, one can only make an assignment of activities to predefined roles in the platform (tutor, learner, etc.), without being able to clearly associate the actor instance because of the lack of work item. The same principle is used in WfMS, except that at the instantiation of a process, one can have a static or dynamic assignment of work items, and so can identify the actor who will play the role associated with the specific task. Indeed, the static assignment is to assign tasks to roles in the design phase of the process; also called "Build-time", while a dynamic assignment will be made during the execution of process i.e. during the "Run-time" phase.
- **Instantiation of activities:** this aspect describes the execution phase of processes models or training scenarios (programs). In fact, the LMS is limited to the management of activities instances to be performed by learners; but, no way of tracking or monitoring the execution of these instances, is proposed in these systems. In contrast, in the WfMS, the instantiation function is to follow the progress of process and the different tasks associated with this process. More about management of users, groups and roles, in which, the workflow engine must specify every moment at what group a user is assigned and the role entrusted to him.

The Problematic

In light of the previous discussion, the lack of structuring in LMS in terms of the possibility of distributing work items and therefore the coordination of collaborative activities, appears clearly. Indeed, in a collaborative work setting, one can distinguish several problematic situations resulting from the impossibility to better distribute the work by a teacher and the inability usually observed in learners to distribute work among themselves in certain activity types. So, if one takes the case of two learners working together to jointly achieve their objective, one can fall into a situation where

these learners are able to properly coordinate their activities. One can say then that they are able to define their own distribution strategy of work. In a reverse situation, learners may not be able to reach consensus among them to conduct their cooperation (achieving the common objective). In other words, they are struggling to adopt an appropriate strategy for equitable dispatch of work. This problem may be due to several reasons such as: the lack of harmony between members of the group or the team, one or more learners who dominate the other(s) negatively, etc. In this case, it would be better to impose a distribution strategy by the leader to ensure the smooth progress of the learning process, specifically the assessment, and thus ensure a good estimate of each learner's contribution in relation to the other.

Finally, for better performance of some collaborative activities by involved members (particularly the structured activities), it is often more appropriate to assign the tasks of these activities to learners in a certain way to ensure better efficiency and smooth progress of assessment process, from the moment one is interested in this process type. Furthermore, in reality, the members who work together try to always set a fair distribution of tasks for the achievement of their collaborative activities. Therefore, this paper proposes a set of distribution strategies of tasks for the purpose of collective examination. Before detailing all of these strategies in the fifth section, it is important to address the "activity" concept around which it focuses this study.

TOWARDS A MODEL CONSIDERING THE EXAMINATION STRATEGIES

The Concept "Activity" in the Activity Theory

The activity theory is a reference for all approaches based on the "activity" concept including that of CSCW and its variant CSCL (Computer Supported Collaborative Learning), which highlights the main elements and means in collaboration with the actors to achieve the common objectives of a distributed community as that of e-learning.

This theory emanates from Soviet psychology and was first introduced by the famous Russian psychologist Vygotsky (1978), and then developed by his student Leontiev (Leontiev & Englewood Cliffs, 1978). This theory provides a general conceptual framework for understanding and analyzing human activities (Lonchamp, 2003), in which each activity is performed by a "Subject" and directed by an "Object" (actor). The existing mediation between subject and object is represented by the support "Tool". Moreover, the subject or the actor is not isolated, and he is part of a "Community". The community represents the set of subjects that share the same object of activity. The community-object relationship is defined by the "division of labor" while the community-subject relationship is defined by a set of "rules" (see Figure 3).

On the other hand, the tools provided by CSCL field as the LMS do not offer the coordination feature, and task distribution for learners working together, and cover only two triads shown in Figure 3.

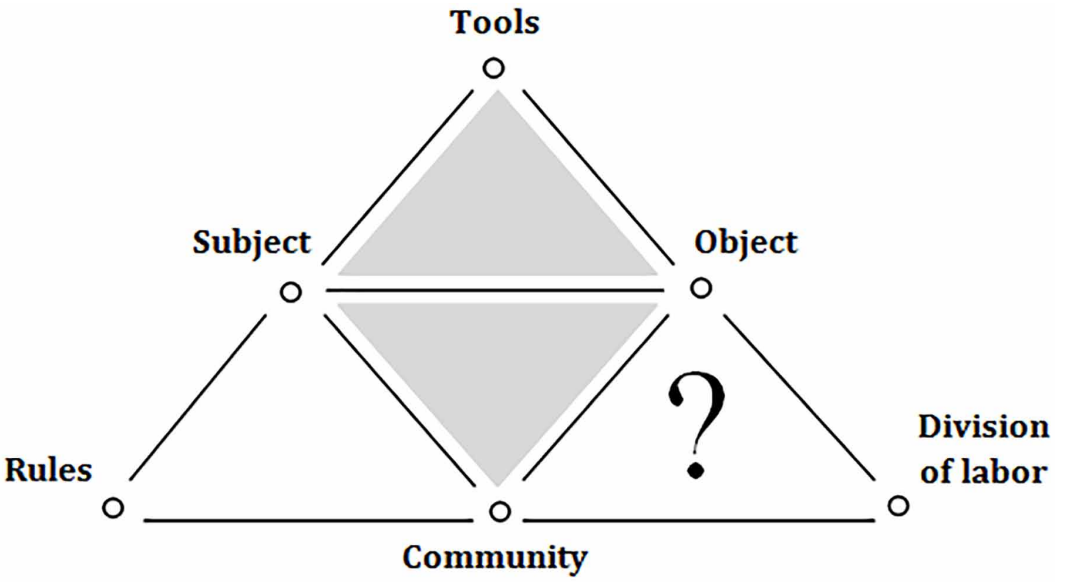
In accordance with the foundations provided by the activity theory, in an e-learning community, the learners perform their activities of learning or assessment to achieve one or more pedagogic objectives predetermined by examiners, using tools which in this case represent the execution environment of the assessment processes. The "staff examiners" community brings people (author, tutor, and assessor) who intervene through this environment to create, monitor and assess the examination processes and help learners to complete these processes.

In the following, one reminds the meta-model of Educational Modeling Language IMS-LD. The starting point was first to study what offers this meta-model, then extending it so that it meets the requirements of the coordination and distribution of tasks of collaborative activities.

The Concept "Activity" in the Educational Modeling Language IMS-LD

IMS-LD represents the most widely accepted specification by the educational community (Cuevas, Muñoz-Merino, Fernandez-Panadero & Kloos, 2010). It offers an educational language that puts the

Figure 3. The Activity Theory (Engeström, 1987)



activity in center of the pedagogic process and allows specifying the learning unit's progress and the description of pedagogic scenarios (Figure 4).

Indeed, the choice of IMS-LD meta-model is motivated by the fact that this latter is intended for pedagogic engineering field, and it allows to support concepts from the CSCW field with a vast possibility to make comparisons and analogies while remaining in the pedagogic field (Aouine & Mahdaoui, 2013). Also, the activity theory is the shared base between collaborative working and collaborative learning. Indeed, work/learn are twin activities and therefore can be considered as two sides of the same piece.

In Aouine & Mahdaoui (2013), the authors have proposed an extension of IMS-LD meta-model based on the workflow technology for assessment purposes, in particular, the assessment of collaborative activities i.e. the group/team work. This extension covers four aspects: organizational, functional, behavioral and informational. Figure 5 represents a part of this extension that shows the static aspect related to distribution strategies since this is the objective of this study.

The assessment activity is the most important concept in the context of the assessment processes modeling. While, one can describe an assessment process in terms of sub-processes or eventually of activities[3]. A sub-process corresponds to an individual assessment plan (IAP) or collective assessment plan (CAP). An IAP is described by a set of individual activities while a CAP is described by a set of activities with at least one collective. We show these different levels of granularity and different types and links between them through Figure 5. Also, a collective assessment activity can be either structured or non-structured. A collective assessment activity non-structured or non-coordinated supported by computer is an activity not modeled by a workflow because the order of interventions is not pre-determined in advance. This activity type is supported by systems that offer primarily shared workspaces with communication and collaboration features as in the LMS. In contrast, a structured collective assessment activity can be supported by systems that generally monitor the progress of processes and information exchange (Lonchamp, 2003). In general, a structured activity is decomposed into a series of tasks. This decomposition may give rise to a sequence of tasks executed one after another, just as it is possible to organize the tasks according to a distribution strategy by exploiting the flow control operators.

Figure 4. IMS-LD meta-model (IMS Global Learning Consortium, 2003)

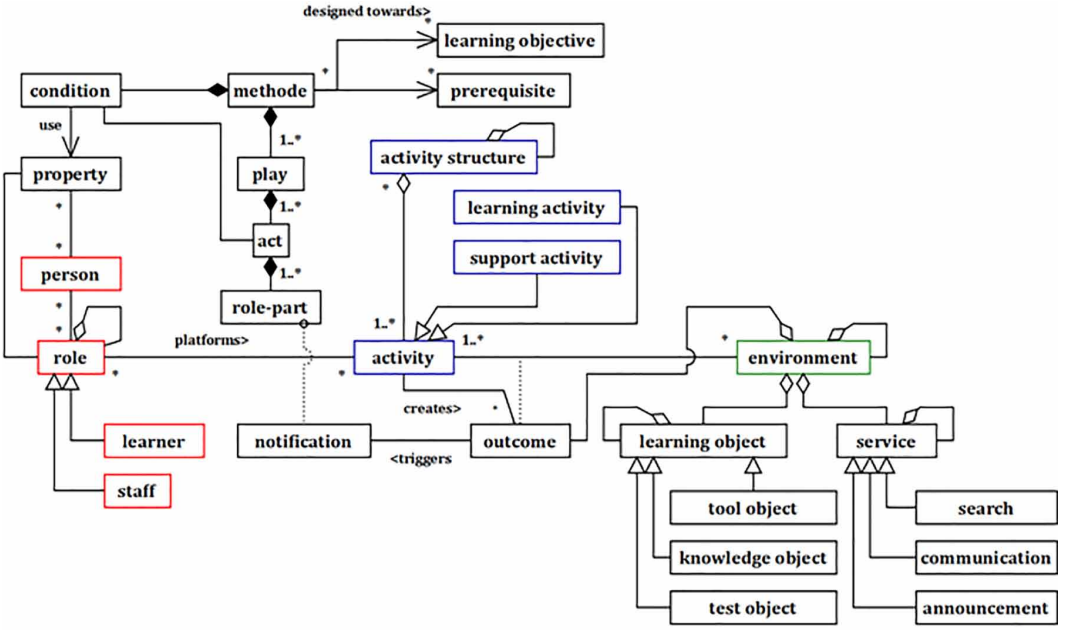
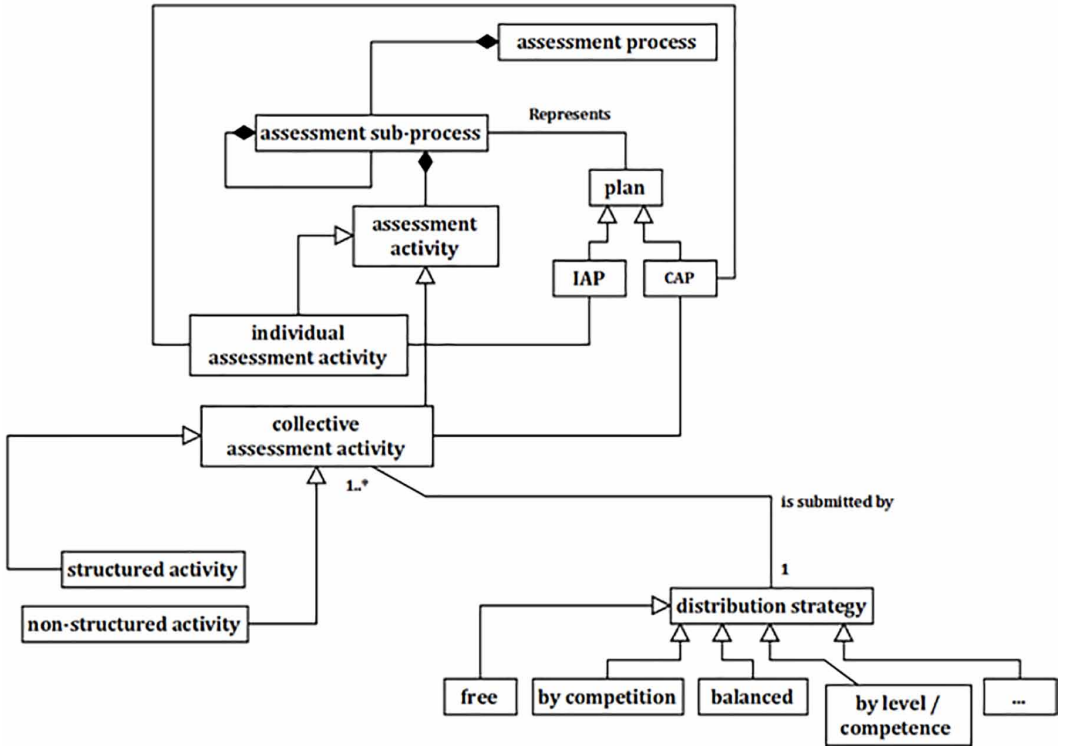


Figure 5. Extension of IMS-LD meta-model (part of functional aspect) (Aouine & Mahdaoui, 2013)



In summary and after the presentation of two previous subsections, the existing methods and tools do not take into account the collaborative aspect in assessment and particularly the one related to the division of labor between learners. Following this, the next section details a set of distribution strategies called "examination strategies", that allows covering this important aspect related to the assessment of collaborative activities.

Detailed Description of Some Proposed Examination Strategies

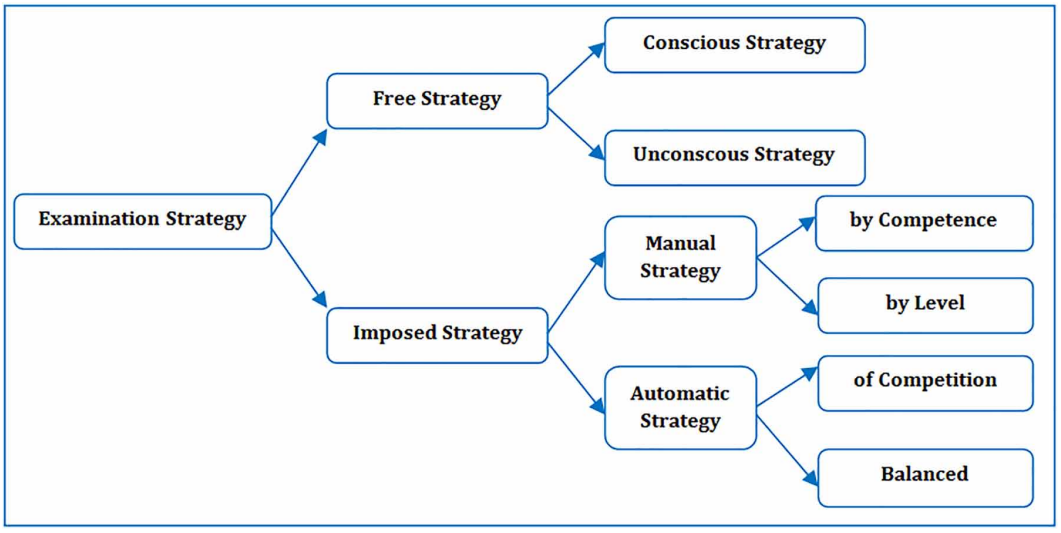
The analysis of different learning and assessment situations of collaborative activities of learners, allow identifying a set of variations in terms of possibility of division of labor between learners. These different situations are presented in the following figure. For reason of paper space, this work details only some proposed strategies.

Summary of Different Situations of Application of Some Examination Strategies

When speaking of distribution strategies of tasks of collaborative activities, the first question that arises is: "In what situation should we apply such and such strategy?" In general, in a given situation, the examiner can detect the non-feasibility of applying a free distribution strategy, either because of non-compatibility between nature of assessment activity and this type of strategy, or because the learners may have a difficulty in determining a favorable dispatching of work. In this case, the examiner must replace this strategy by another strategy that it will have to be imposed.

1. **The free strategies:** The free strategies are inspired by "brainstorming" technique that is known in project management. In this type of strategies, the learners will have the possibility to organize and divide tasks between themselves to perform the activities designated by the staff examiner. The free strategies are performed according to a consensus between examined. It aims to implement and promote cooperation, coordination and communication within the group or team. It offers some advantages so that to give to the examined the responsibility to find a consensus for a fair dispatch of labor. It will depend on the degree of understanding and agreement between them, besides increasing the competitive spirit between learners. However, let's note that conflicts are an exception, which will involve the tutor to trying to solve the problem first, if not, to eventually

Figure 6. Forms of examination strategies



apply an imposed strategy. In this type of strategies, one distinguishes two forms: conscious and unconscious.

2. **The imposed strategies:** In this type of strategies, the tutor plans tasks execution and the learners just have to follow the instructions assigned to them. These strategies can operate in two possible ways (manual or automatic) shown in the following two subsections:
   a. The manual strategies: In terms of their level or competence, the tutor assigns manually the various tasks to learners according to a manual strategy by level or by competence.
   b. The automatic strategies: When the tutor selects one of strategies (balanced or competition), the assignment of tasks to learners will be ensured in an automatic manner by the software system that manages the monitoring of examination plans.
      i. Balanced strategy: In this strategy, the assignment of assessment tasks to learners is done automatically by the software system and in a balanced way. So, the objective of the assessor behind the application of this strategy is to ensure a balance in the division of tasks that will be assigned to learners.
      ii. Strategy by competition: In this strategy, the responsible launches a list of assessment tasks according to the dynamic roles[4] that learners will play. Then, the learner who connects the first may take a task and so one. The main purpose of this strategy is to increase the competitive spirit between learners of the same team or group, from where it is called competition strategy.
      iii. According to the criteria explained above, we identify a set of typical scenarios representing situations where the proposed strategies could be implemented. The following table summarizes one category of strategies (imposed- automatic) by explaining the objectives behind the application of each associated scenario (Table 1).

It is recalled that in the third section, we had discussed and compared between two types of groupware applications that are the LMS and WfMS. In fact, this comparison was aimed to demonstrate the lack of coordination in LMS and show the ability of WfMS in this aspect (coordination) and distribution of tasks of collaborative activities.

In order to implement the different proposed strategies, we propose to use the workflow technologies that we will combine with classic LMS. In this technology, a distribution strategy represents the manner to divide and assign work items to different users. Remember that a work item describes the representation of work to be performed by an actor in the context of an instance of a collaborative process, which will then be executed by the workflow engine. In the following, we have implemented a subset of examination strategies among the proposed series by integrating them into a platform dedicated to the execution of collaborative assessment processes.

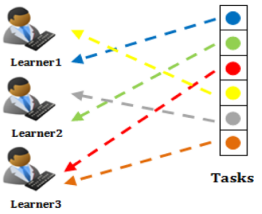
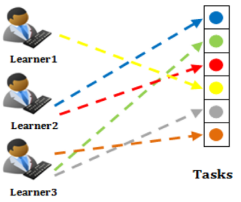
THE CAP-PLATFORM

The CAP-platform is an e-learning platform (Aouine & Mahdaoui, 2014) for assessing collaborative activities. Its main purpose is to assess individuals in the team/group. The functioning of this platform depends on the use of a WfMS for the management of structured activities and an LMS for the management of unstructured activities, using "web service" technology. The following figure illustrates the general operation of this platform as well as the exchanges between users and used systems.

In addition, in the following figure, we present a code portion related to the implementation of the balanced strategy in CAP-platform, in which we invoked the two web services "New Case" and "Reassign Case" (ProcessMaker WSDL Web Services) offered by the WfMS "ProcessMaker" to assign tasks to learners.

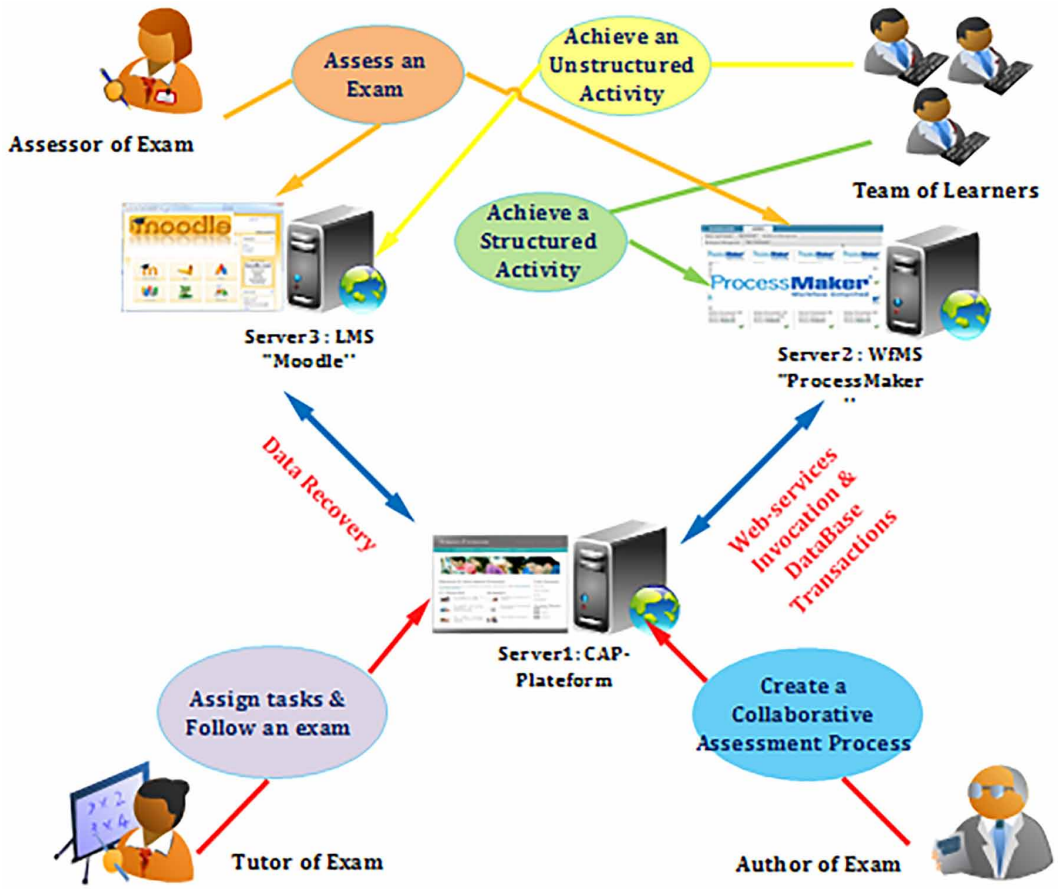
In fact, "ProcessMaker" provides a set of policies for assigning tasks to users and a set of flow control operators to ensure the flow and routing of tasks in a business process. Note, however, that some policies provided by this WfMS fit very well with some of the proposed strategies in this research.

Table 1. Description of imposed-automatic examination strategies

Imposed-Automatic Strategy	Situation of application	Implementation mechanism
Balanced Strategy	In this strategy, the examiner wants to ensure a balance in the distribution of tasks, i.e. the tasks number to assign by the learner in the group without taking in consideration other factors such as the level, the learner's prerequisites, etc. The staff who prepares the exam will ensure that tasks are of the same level of difficulty and require almost the same time to their execution.	The set of work items will be assigned automatically to learners respecting the balance of work of each one. An automatic assignment program will handle the distribution of tasks (Ratio = total number of tasks to assign/ number of learners).  *Blanced Strategy*
Strategy by competition	In this strategy, the examiner wants to increase the competitive spirit between the members of team or group. So, he will launch a set of tasks and let the learners work in competition to achieve the maximum of tasks of a given examination process. In this strategy, no members will be assigned to divide the work internally. Each will proceed according to his advancement degree. This strategy may be useful for judging differences in levels between learners for a newly formed group.	The interface provides to learners a set of work items, in which each learner can assign an available work item to himself and perform the corresponding task and so on until all tasks are consumed. It will be assumed that conflict situations will have little chance of occurring (two learners with the same level of advancement and trying to access the same task at the same time).  *Strategy by competition*

However, assignment policies of work items and flow control operators of WfMS are usually used in a framework, i.e., professional. In this case, the organizational aspect is important for defining and assigning business roles. In this study, we suggest using this technology for collaborative learning field, particularly the assessment. A particular interest is given to the assessment in an e-learning context. Some of the proposed strategies are simple enough to run and support with a WfMS. For example, automatic strategies will obey predefined rules that the engine will execute. While for other strategies, human intervention is necessary for a good progress such as, the strategy by competence which requires other data and parameters that only the teacher/examiner can know and estimate. In the following, we will present a case study in which we apply one of the proposed examination strategies.

Figure 7. General operation of CAP-platform (Aouine, Mahdaoui, & Moccozet, 2019)



CASE STUDY

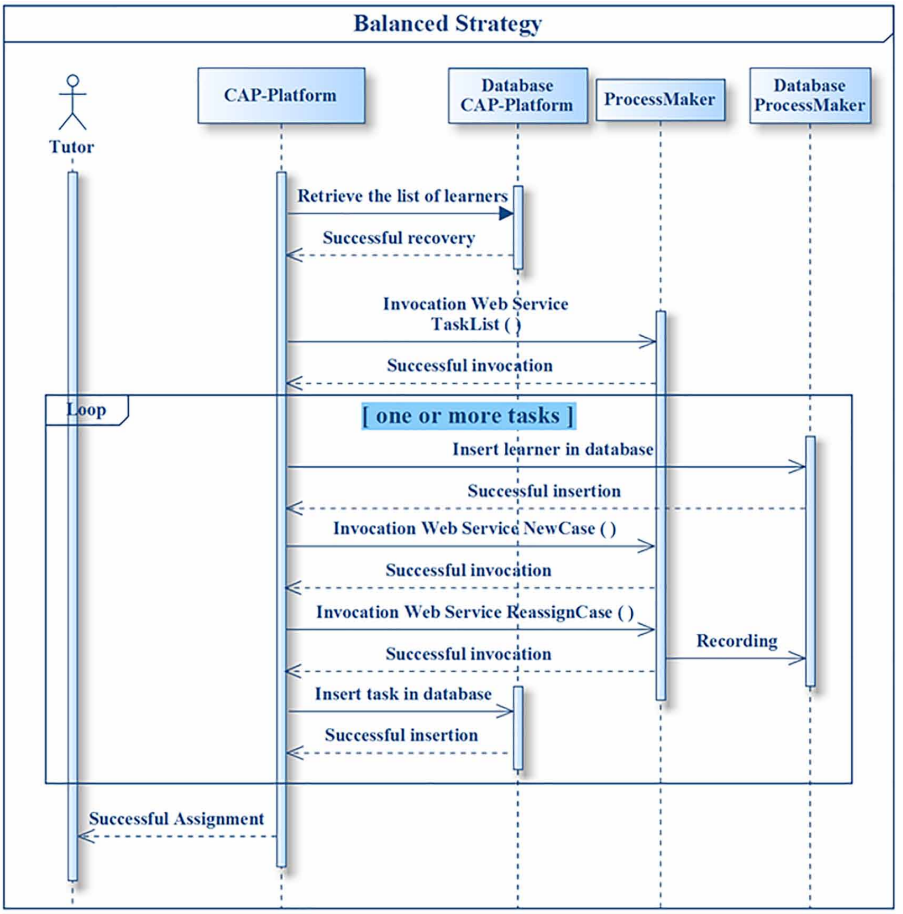
Presentation of the Case Study

In this section and to demonstrate the effectiveness of the proposed solution, we present an example that shows the application of balanced examination strategy implemented in CAP-platform. In fact, this strategy ensures equity in the assignment of tasks to learners, and therefore, improves learners' motivation to perform the tasks assigned to them.

The chosen assessment scenario describes a collective assessment situation. It will be for learners to carry out a work of collective drafting of scientific documents (research articles) within the module setting "Initiation to Research" taught in "Academic Master." Students will be organized in teams of 03 to 04 individuals who will collaborate to write their research article. For this situation, we will distinguish in the Collaborative Assessment Plan (CAP) related to this situation, three main activities (Figure 9):

1. Discussion and elaboration of document drafting plan.
2. Drafting the various parts of document.
3. Structuring the document and integrating individual contributions.

Figure 8. Sequence diagram and computer code "assign the task to a learner by balanced strategy"




```
      // code for assign the task to a learner "Balanced Strategy"
mysql_connect('localhost:3307','root','');
mysql_select_db('wf_workflow');

$sql1="select usr_uid from users where usr_username='".$utilisateurs[$j]['login']."'";
$r1=mysql_query($sql1) or die("erreur sql <br/> $sql1 <br/>".mysql_error());
$res1=mysql_fetch_assoc($r1);
$vr=mysql_query("select * from task_user where tas_uid='".$don['tas_uid']."' and usr_uid='".$res1['usr_uid']."'");
if(mysql_num_rows($vr)==0)
{
    $sql="insert into task_user values('".$don['tas_uid']."','".$res1['usr_uid']."','1','1')";
    mysql_query($sql) or die("erreur sql <br/>$sql<br/>".mysql_error());

}
$s="update task set tas_user='".$res1['usr_uid']."' where tas_uid='".$don['tas_uid']."'";
$q=mysql_query($s) or die("erreur sql <br/>$s<br/>".mysql_error());
$verif=mysql_query("select tas_start from task where tas_uid='".$don['tas_uid']."'");
$rverif=mysql_fetch_assoc($verif);
```

The first step "discussion and elaboration of the document plan" represents an unstructured activity supported by an LMS. This environment will allow us to provide a forum/chat space and assign accounts to learners to establish the document plan to be written. The tutor has the right to access this forum/chat and can therefore participate in the discussion to add clues and observations. Then, in the second step "drafting the various parts of the document", which represents a structured activity supported by the WfMS "ProcessMaker", each learner must draft one or more parts of the document and the tasks will be assigned to learners automatically according to the balanced strategy that is adopted by the tutor. Therefore, the first task will be assigned to the first learner and the second to the second learner and so on, if all learners taking tasks and there are still others, then there will be a turnstile and the first learner takes another task and so on. Finally, the third step "structuring and integration" also represents an unstructured activity that will take place in a forum/chat space to integrate the various parts and structure the final document.

Instantiation of Roles, Resources and Activities

The actors involved in the assessment process: (1) twenty learners examined are organized in four teams of three learners and two teams of four learners who will play the role of writer; (2) the examiner staff: the creation of the assessment plan and content (author of examination role), the moderation and follow-up of the assessment process (tutor role) as well as the final assessment of work (assessor role) will be the responsibility of the teacher of the course.

Services used and resources manipulated: (1) a descriptive content that specifies the different phases of the work and interprets the work required of the learners; (2) a template of article format to be drafted; (3) a common discussion forum for learners and tutor; (4) the final product produced by learners (the documents that contain the individual contributions of learners and the final version of the scientific article), then used by the assessor.

Activities and tasks handled in the assessment process are shown in Figures 10, 11 and 12.

CONCLUSION AND PERSPECTIVES

In this article, we proposed a set of examination strategies for the distribution of tasks of collaborative activities in e-learning. Then, we integrated these strategies into an e-learning platform dedicated to creating, monitoring and assessing collaborative processes. The first purpose behind this proposal is to make a fairer assessment of learners who work collectively at the group or the team. In fact, it is difficult to determine and implement all strategies exhaustively.

As prospects, we plan to automate manual-type strategies. However, to automate some proposed strategies, such as competency-based strategy and strategy by level, we need to know and have indicators and measures on the profile of the team/group members. In addition, we would like to go further in testing of each proposed strategy in order to analyze deeply the findings obtained under a massive usage. Besides, we plan to use a survey to collect users' opinions for knowing effectiveness of our proposal in terms of fairness in assessment of collaborative activities in an online community.

Figure 9. The overall process "collective drafting of documents"

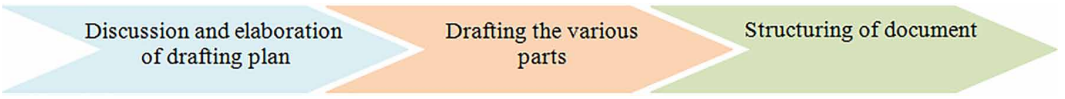


Figure 10. The activities of collaborative process "draft a document" in the CAP-platform

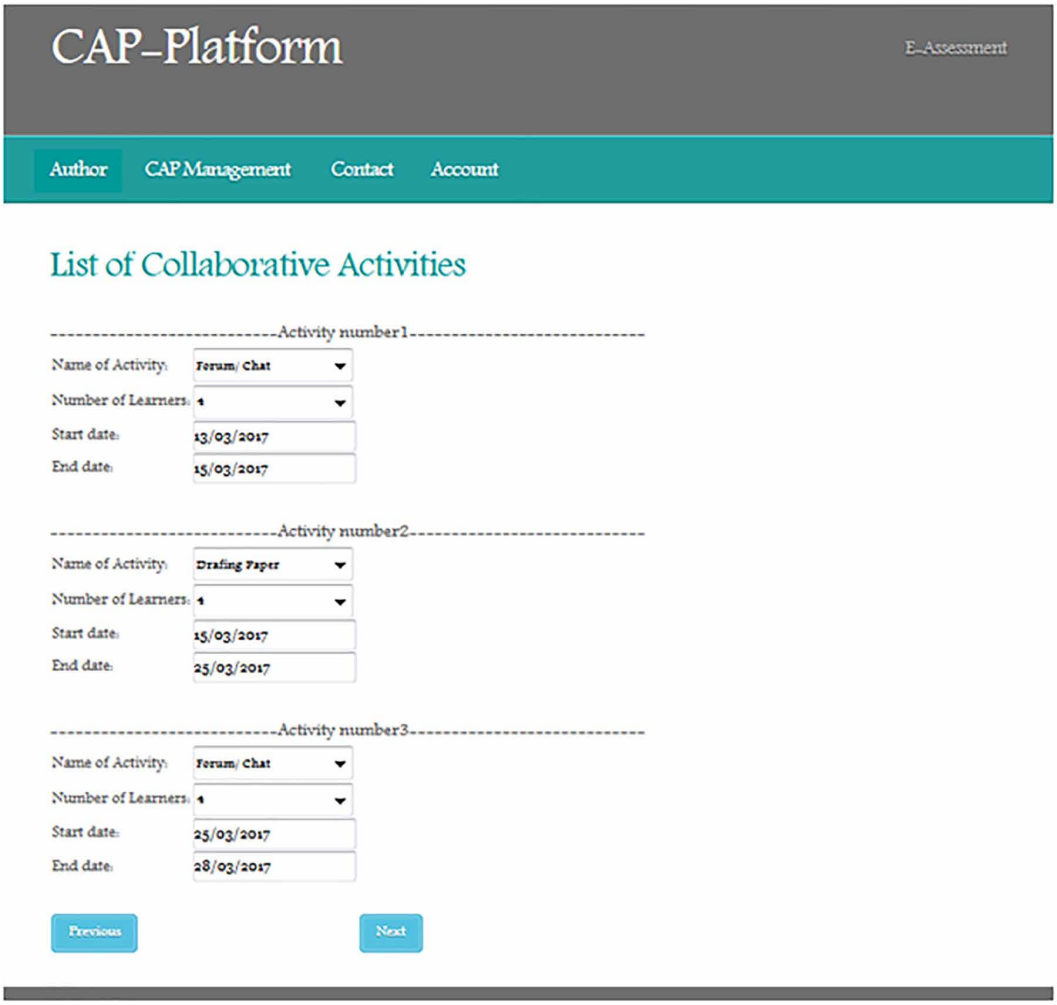


Figure 11. Execution of the activity "drafting parts of the document" in "ProcessMaker" by learners

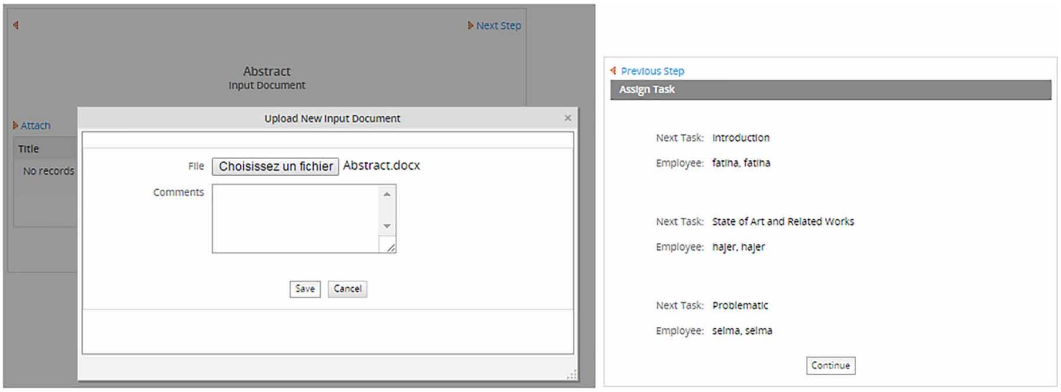
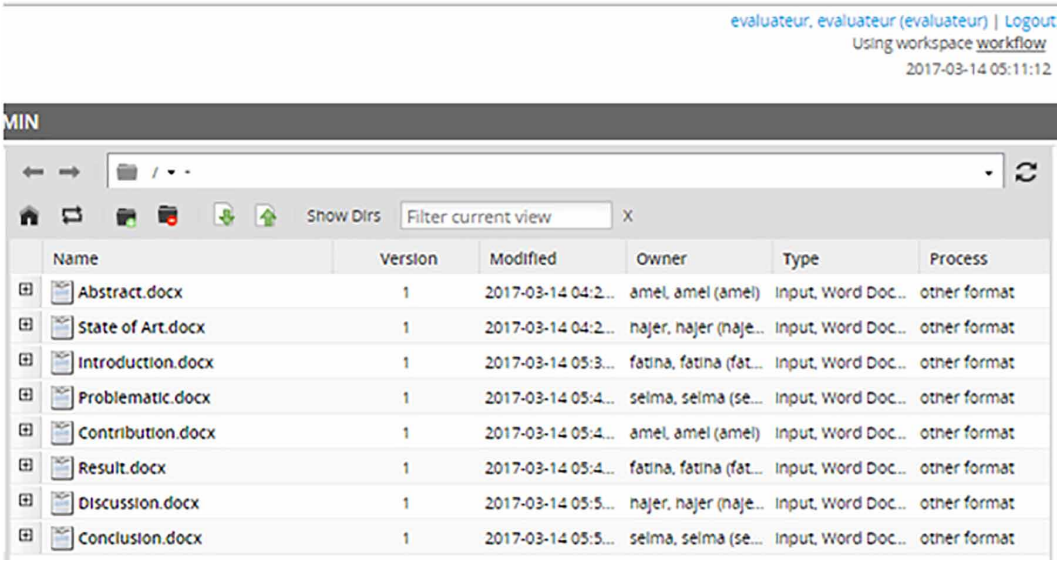


Figure 12. Recovery of learners' individual contributions by assessor



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ENDNOTES

1 Pert: Program Evaluation and Review Technique
2 Brainstorming: (to storm) a problem with the (brain)
3 It depends on the complexity of the assessment plan to elaborate.
4 The dynamic role represents the role played by learner during an examination process.

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Factors Affecting the Use of ICT Services in Ethiopia:
The Case of Illubabor Zone - Oromia Regional State

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ABSTRACT

ICT is used to enhance the overall activities of individuals, administrative processes of businesses and various governmental and non-governmental organizations. Despite its advantage in all aspects of development, it has drawn low attention in expanding the services in general and utilizing the technology in particular. Therefore, this study was aimed to explore the main factors that affected the usage of ICT in Illubabor zone, Ethiopia. A descriptive cross-sectional study design with quantitative and qualitative data collection method was carried out. The data was collected from 195 samples by using structured questionnaires and observations by employing simple random and purposive sampling techniques. SPSS version 16 was used for data analysis. The study confirmed that lack of computer skill training for staff and lack of sufficient budget for the provision of ICT are the major bottlenecks in expanding ICT service in the zone. Major emphasis should be given in enhancing the awareness of government employees to make use of ICT services in their daily official work.

KEYWORDS

Barriers, Expansion, Governmental Offices, ICT, Utilization

INTRODUCTION

Information Communication Technology (ICT) is basically about using technology for information process and communication business. Its application ranges from collecting to disseminating or receiving information from one place to another electronically. The gathered information will be stored, retrieved, processed, and analyzed before it is communicated using ICT devices (Adigwe, 2012). In this study, ICT is considered as an electronic device that can be utilized by people to enhance or improve the administrative or overall office activities.

Nowadays, the prospective of ICT to promote overwhelming growth in the economy and reduction of poverty has got the attention of developing countries. The state of ICT access and usage in a particular country or region show both its social and economic development (Morrar, Abdeljawad, Jabr, Kisa, & Younis, 2019). As long as ICT presents opportunities for economic and social development, devising ICT policy and strategies, allocating the proper amount of budget and resource, creating a partnership with stakeholders and establishing suitable environment should be a primary duty and responsibility of a state. Governments especially the developing ones are often cash-strapped or have a multitude of other shortfalls which impact ICT development. In this case, establishing a network or partnership with private industry where some of the costs are shared along with the risks in improving the situation will be the best alternative solution. In this regard, it is essential to consider the role and contribution of NGOs in promoting ICT services (Shava & Maramura, 2016).

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In Ethiopia, ICT development has become one of the priorities and key driver of the government for the socio-economic growth and transformation since the last decade (Report from Ethiopian Ministry). According to the report from the ministry of communication and information technology, the statistics about Ethiopian communication sector until June 2017 are shown in Table 1. The estimated population of the country in the same year was about 105.0 million.

Though the overall statistics seem promising, different regions, zones, and districts have unequal ICT coverage, and utilization rate due to unknown reasons and little is known figuratively. Thus studies aiming at finding the proper statistics of the accessibility and utilization of ICT in every corner of the country will help the government bodies to early identify the main factors those are affecting the expansion of ICT and to prevail over their impediments (Akther, 2015). Moreover, it also helps the policy makers and management authority in the process of policy making and development of effective ICT expansion. In general, policies, strategies, and investments that enable to seize the benefits of ICT are better based on statistical evidence (Adam, 2012). Therefore, this paper assesses the utilization and factors affecting the expansion rate of ICT in all governmental offices within the zone and all districts of Illubabor.

LITERATURE REVIEW

ICT has become one of indicator of economic growth and transformation of society. Those countries ranked at the lower position in the world ICT index are the third world countries. The gap between the development of a society and their ICT usage rate has a direct implication in categorizing whether they are underdeveloped or developing ones. Compared to the economically advanced countries, the opportunity of enjoying life and improving economic growth is much less in the developing ones due to limited internet connectivity and shortage of ICT accessibility. Those countries like Malaysia and Singapore those heavily invested in ICT have scored remarkable achievement in their economic development.

Many scholars agree that ICT infrastructure is important in enabling fast growth in emerging economies (Karimi, 2012; Ngwenyama, & Morawczynski, 2009; Kramer, Jenkis, & Khaz, 2007; Houghton, 2010). On the contrary, other researchers argue that less attention is given to civil infrastructure (electricity, roads, clean water, etc), human capital, and health. (Zhang, Wang, & Duan, 2016).

In Nwagwu (2005), the authors described their study participants agreed that 97% of them use a computer and other ICT devices for their administrative activities in the office. In general, many people are increasingly becoming dependent on computer and other ICT equipment to carry out their work, entertainment and contact people on social media. Hence, the availability of ICT infrastructure in schools, offices, etc., improves work performance efficiency and life satisfaction (Vijaykumar, 2011).

Table 1. Ethiopia's communication sector statistics – until June 2017

Number of customers	June 2017
Mobile telephone	58,080,626
Data and internet	16,505,225
Broadband (EVDO, WCDMA, LTE, ADSL)	6,902,902
Narrow band (1x, ADSL<256K)	276,294
GPRS	9,326,029
Fixed line telephone	1,169,625
Total customer	59,899,089

From the finding of the study conducted in Kiambu Sub-County Kenya (Adam, 2012), it was verified that ICT plays a great role for school administrators in carrying out administrative tasks. Nevertheless, the rate of using the available computers and important equipment was very slow. Furthermore, the study outlined that literacy towards the use of computer within the school staffs was very poor. Thus it was required to offer basic computer training to improve their skill to make use of the technology efficiently.

In Shava and Maramura (2016), the authors presented the challenges faced by NGOs in the development and expansion of ICT in Zimbabwe. They tried to address the role of ICT in rural communities of Zimbabwe towards achieving sustainable development, the challenges facing NGOs in implementing ICT for sustainable rural development and to what extent have NGOs implementation of ICT in most vulnerable rural communities of Zimbabwe increase the technological literacy of rural people. The study concluded that poor civil and ICT infrastructure financial problem, the effect of HIV/AIDS and less number of ICT expertise were some of the impediments for NGOs to accomplish sustainable development in terms of economy and culture.

According to a qualitative study conducted in Pakistan (Nyang'au, n.d.), a gap is obtained between the ICT policy and the actual problem on the ground to be addressed. There are several reasons for the existence of gaps between policy design and actuality. Lack of citizens' involvement in policy design, inter-agency coordination, and inconsistent policies, and political instability, i.e., changes in government interests are some of the outlined reasons for the design-actuality gaps in Pakistan.

In Palvia, Baqir, and Nemati (2015), the author outlined the significance of ICT in alleviating poverty and increasing local economic growth in Zimbabwe. The study also explained how to set up a feasible ICT industry which can sustain for longer period with the same or better performance. Moreover, it also briefed about what ICT can provide in alleviating the hindering factors that most Africans face while putting their full effort to be part of the global information society and knowledge economy.

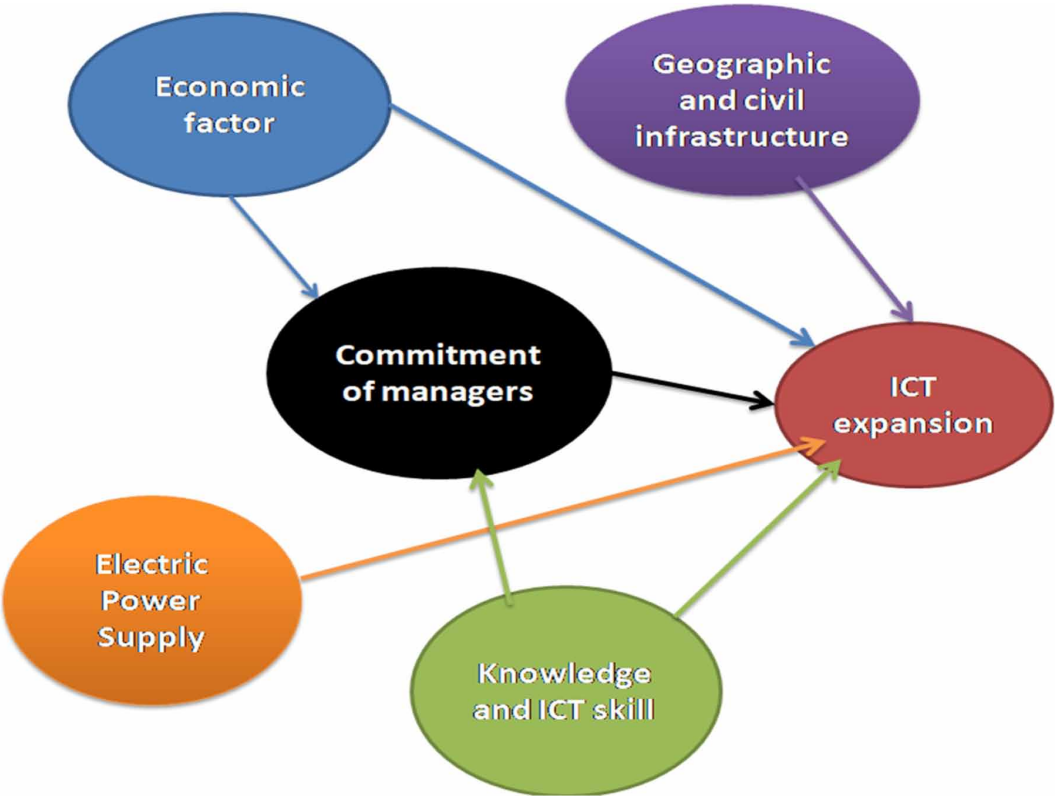
As outlined in Kundishora (2014) and Manochehri, Al-Esmail, and Ashrafi (2012), the adoption and expansion rate of ICT services in various governmental institutions will be affected by factors like GDP per capita of a particular society. In addition to this, separating ICT infrastructure from civil infrastructure is the key drawbacks and severe problem of many governments (Roberto Evaristo, 1998).

In Minges (2015), Peña-López (2016), and Olalekan (2013), the significance of academic institutions in acquiring technological competence as an economic and societal growth enabler and its necessity in the expansion of ICT services in developing countries is explained briefly. In Francophone West Africa (Shakeel, Khan, & Malik, 2012), the main reason for ICT infrastructure expansion was found to be human capital. According to Yoon and Na (2013), the rate of ICT expansion increases as the GDP per capita of Latin American countries increases.

From the finding of a research done in South Africa (Modimogale & Kroeze, 2011), the study participants enumerated various barriers those hindered the expansion of ICT ranging from technological to socioeconomic issues like electric power cut, high cost of ICT devices (perceived), technology intimidation, lack of money, possibility of fraud, and lack of knowledge.

Figure 1 illustrates how geographic and civil infrastructure economic factors, power line, knowledge, and skill of ICT, and commitment of managers affect the ICT expansion. According to the diagram, geographic and civil infrastructure and power line have a direct influence on ICT expansion whereas economic factors and knowledge and skill of ICT affect ICT expansion directly and indirectly through the commitment of managers. Furthermore, these two factors have a direct influence on the commitment of managers towards ICT expansion.

Figure 1. Conceptual framework



METHODS AND MATERIAL

Study Design

A descriptive cross-sectional study design with quantitative data collection method was carried out.

Study Area and Period

This study was carried out in Illubabor zone of Oromia Regional State located in the South West part of Ethiopia. Illubabor is one of the 18 zones of Oromia regional state with its capital Mettu 600 km away from Addis Ababa. The zone has 24 administrative districts.

Source Population

The source population for this study was all governmental organizations located in Illubabor zone in the year 2013 to 2014.

Study Population

The study population was all governmental organizations located in the seven selected districts from Illubabor zone.

- **Inclusion**: All governmental offices under the zonal administration.
- **Exclusion**: All governmental offices not under the zonal administration.

Sample Size Determination and Sampling Technique

All governmental organizations which are located in the selected district were included in the study. For this study, we used purposive sampling technique to select two districts from the twenty-four zonal districts purposely. The selected two districts were Mettu and Bedele. In these two districts, ICT access was comparatively higher than the others. Since the remaining districts were assumed to have a similar setup and ICT access, we employed simple random sampling technique to select five representative districts, i.e. Gore, Hurumu, Yayo, Darimu and Yanfa.

Data Collection Instrument

Data were collected using a structured questionnaire by interviewer lead administer and observation methods. The tools were adapted from different kinds of literature and modified according to the investigator concern. Observation method was employed to verify the trustworthiness of the information provided by the study participant.

Data Quality Assurance

- The questionnaire was pretested in Nopa district exclusive of the selected sample units.
- The training was given for data collectors and supervisors on how to collect the proper information
- The questionnaire was reviewed and cross-checked daily, and corrective measures were taken by the investigator.
- The questionnaire was translated to Afan Oromo language (the local language in the zone) and then back-translated to English to verify its consistency.
- Data were cleaned, edited and checked for the outliners and missed values or variable.

Data Analysis

Data were coded, entered, edited, cleaned and analyzed by Statistical Program for Social science (SPSS 16.0). A descriptive analysis was carried out to check missed values and outliners to verify consistency.

Ethical Clearance

Ethical clearance letter was taken from Mettu University Research and Community service Directorate, and oral informed consent was also taken from the study subjects and confidentiality was secured after introducing the purpose of the research.

RESULT AND DISCUSSION

Description of ICT Utilization

All governmental sectors which were located in all selected seven districts were included in the study. The total size of the study units were 195 and making the response rate 100%. In the analysis below, all the collected data from the study participants were supported by observation for their presence and functionality of ICT devices in the respective offices.

Desktop Computer, Laptop, and Printer

In all selected districts 190 (97.4%) governmental offices have desktop computer ranging from 0 to 32. The mean desktop distribution among the study subjects was found to be 2.86 with a standard error of 0.25. The total number of desktop computers was 558, but the total required amount is 1203 with a mean of 6.17 and the standard error of 0.48. Of the total computers available, 472 (84.59%) were functional during the study time.

In the case of a laptop, 76 (39%) of the study subjects have laptops ranging from 0 to 13. The mean laptop distribution was 0.9487. The total number of laptops was found to be 185 (182 are functional), but the required amount is 835 (4.58 times the number of the existing laptop).

One hundred and eighty-nine (96.9%) of the offices have printer out of which 382 (77.37%) are functional. However, the number of required printers is 773. The mean distribution of printer among the offices is 1.95 with a standard error of 0.115.

Scanner, Photocopy Machine, and LCD

Thirty scanners from all the study subjects were available, and only 18 (60%) are functional. Among the study subjects, 51 (26.2%) have a photocopy machine with mean distribution 0.159 and standard error of 0.029. Out of the currently existing 67photocopy machines, only 31 are functional. However, the number of a required photocopy machine is 257. Out of the 20 liquid crystal displays (LCDs) currently available 4 (20%) are non-functional. The mean distribution was found to be 0.082 with a standard error of 0.022. The required number of LCDs is 227.

TV, Fixed Line Telephone, Internet

There are 73 televisions available, and 4 (0.05%) of them are non-functional. However, the number of televisions required is 302. Out of the total respondents, 72.8% of the zonal offices have fixed line telephone, and 92.05% of them are only functional with the mean distribution of 1.3 and standard error of 0.095. According to the respondents, the number of required fixed line telephone is 532. Regarding internet access, only 18 (9.2%) offices have an internet connection. Among them only seven offices use CDMA-1X, eight offices use the Broadband connection with a bandwidth of 512KB, and three offices use a dial-up connection. The available connection is even being utilized by the office managers especially for their purposes. Since the computers in the offices are not networked with the manager's system, sharing the connection is impossible. Around 8 (44.4%) offices use broadband connection, and the rest 3 (16.6%) use dial-up connection. From this, we can conclude that there is less internet coverage in the zonal and district offices. Table 2 shows the internet coverage.

This finding agrees with the study conducted in India where internet access was very poor in most governmental schools. However, it disagrees with the finding of developed countries in Europe where governments through the Ministry of Education purchase computer hardware and software and provide access to the internet (Nwagwu, 2005; Vijaykumar, 2011).

Fax, Digital Photo, and Video Camera

There are 58 faxes available in the offices during the data collection time out of which 39 (67.2%) are functional. A number of fax lines required is 218 with a mean distribution of 1.11 and standard error of 0.509. There are 82 digital cameras currently available, and 14 (17.07%) are non-functional. The mean distribution of digital camera is 0.348 with a standard error of 0.06. The amount of required digital camera is 350. The number of video camera currently found is around 15, and 6 (40%) are non-functional. The amount of required video camera is found to be 215.

The summary of the result is illustrated using Table 3 and Figure 2.

The study indicates that the required number of ICT devices in each type is much higher than the existing one. This shows there is a high demand for ICT utilization, but no adequate supply of

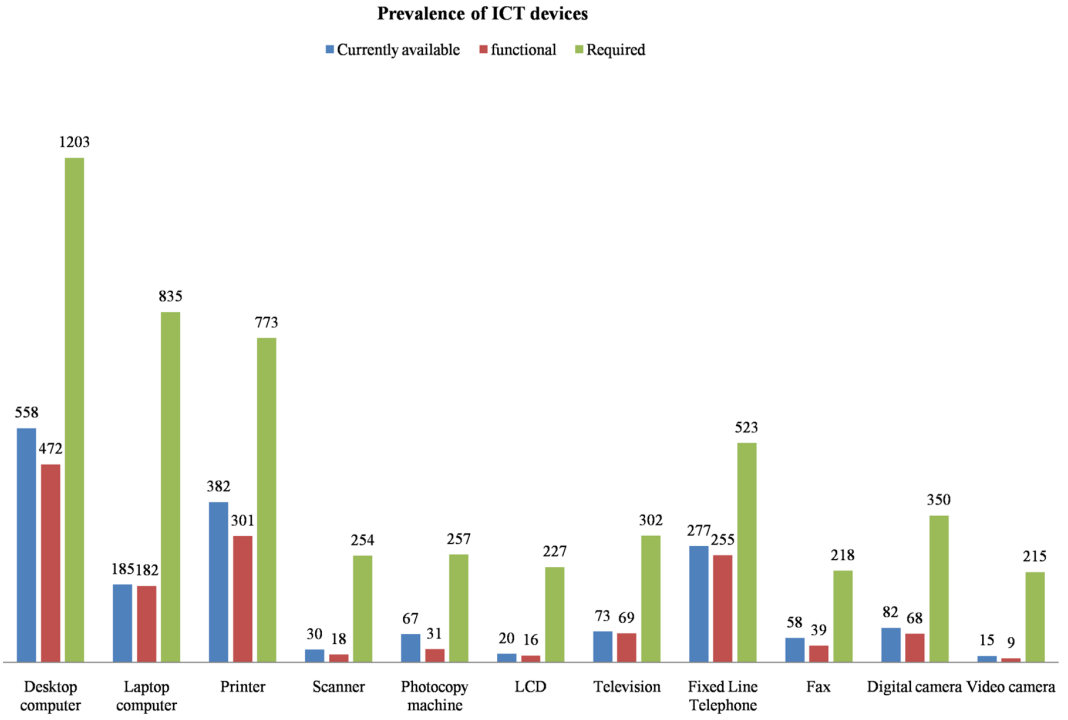
Table 2. Internet coverage

Office status	No. Of offices	Percent (%)
Offices with an internet connection	18	9.2
Offices with no internet connection	177	90.8

Table 3. Prevalence of ICT devices

Variable	Currently available		Functional		Required
	Quantity	Percent	Quantity	Percent	Quantity
Desktop computer	558	46.38	472	84.58	1203
Laptop computer	185	22.15	182	98.37	835
Printer	382	49.41	301	78.8	773
Scanner	30	11.8	18	60	254
Photocopy machine	67	26.07	31	46.26	257
LCD	20	8.81	16	80	227
Television	73	24.17	69	94.5	302
Fixed Line Telephone	277	52.96	255	92.05	523
Fax	58	26.6	39	67.34	218
Digital camera	82	23.24	68	82.9	350
Video camera	15	6.97	9	60	215

Figure 2. Prevalence of ICT devices



these devices in each office. In addition to this, among the existing devices, some of them are non-functional. Moreover, a problem like lack of ICT professional in each district has its role. Generally, this can hinder the ultimate efficiency and performance of the government regular activities.

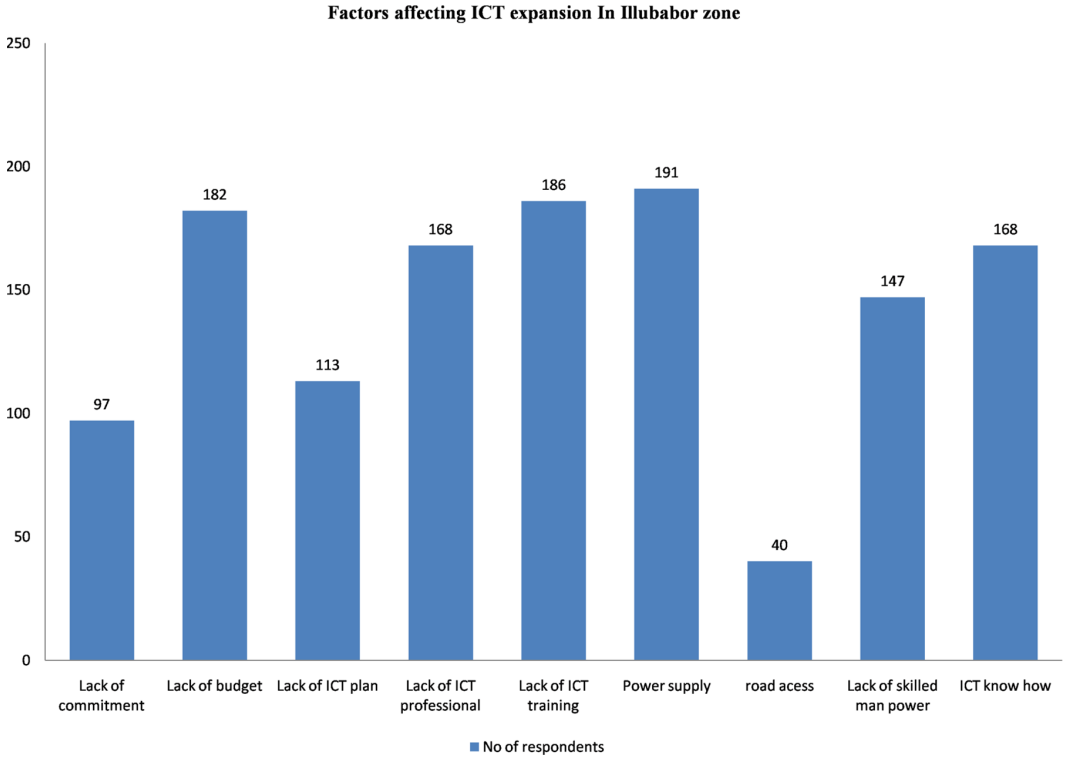
Barriers for the Expansion of ICT

Based on the analysis of the survey conducted, we obtained the following major factors that hinder ICT expansion within the zone.

- Lack of sufficient budget: is mentioned by 182 (93.3%) of respondents as factors that hinder ICT expansion in the zone. In some districts, the computers even available were donated by NGO's which indirectly confirm as a proper budget for ICT is not allocated.
- Lack of commitment by the government was also mentioned as hindering factors by 97 (49.7%) of the respondents.
- Absence of updated ICT strategy plan was the other reason explained by 113 (57.9%) of respondents as one hindering factor for ICT expansion.
- Power supply irregularity in the zone is also mentioned as the main challenge for the provision of ICT by 191 (97.9%) of respondents.
- Technical literacy was also frequently mentioned as an impediment for the growth of ICT within the districts. Moreover, 147 (75.4%) of respondents (officers) were persons with no necessary computer skill ranging from 0 to 39 with an average of 5.58 people per office. The primary reason for this is the lack of short term computer training institutes in the zone and being reluctant by office managers to coordinate a training session for the workers. The essential typical constraints are shown in the chart below.

From Figures 2 and 3, the dominant barrier for ICT expansion in the zone is found to be a lack of training for the employees and lack of adequate budget for fulfilling the required devices. Lack of ICT literacy has indirectly influenced the zone and district employees not to utilize even the already

Figure 3. Factors affecting ICT expansion in Illubabor zone



existing ICT equipment properly. All factors explained in the result of the current study were in line with the factors listed in the conceptual framework of the study. As the framework was adapted from the findings of different literatures factors like lack of knowledge and skill regarding ICT, economic factors which affect the supply of ICT materials, lack of commitment from a person on the managerial area to influence the situation, irregular power supply and problem associated with poor infrastructure were hindrance factors for the expansion of ICT in many developing countries. The findings of this study also share the same things as barriers of ICT expansion in Illubabor Zone of Ethiopia.

CONCLUSION AND RECOMMENDATIONS

This study investigated factors responsible for the reduced use of information and communication technologies in the Illubabor zone of Oromia region, Ethiopia. Literature was reviewed extensively. From the finding, it is clearly shown that lack of computer skill training for government employees accounts the significant percentage in the weak expansion of ICT. Secondly, the amount of budget that is allocated for ICT is less and irregular power supply in the districts contribute to the underutilization of the technology. The other main factors are the lack of commitment by institutional leaders; lack of ICT strategy, lack of qualified ICT professionals who will be responsible in maintaining and installing all the available ICT devices and infrastructures in the offices. The following recommendations are derived from the findings of the study. The Illubabor zone:

- Should provide adequate fund for the acquisition of appropriate ICTs.
- Must ensure that satisfactory training in the use of ICTs must be organized and given to all staffs in the zone and district level
- Must put ICT strategy in place.
- Should install a standby generator to ensure the continuity of work in the case of a power outage for districts according to their needs.
- Create a partnership with private industry where some of the costs are shared along with the risks in improving the situation in the country

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