

Technology and Task in Computer Supported Collaborative Learning Environment

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Abstract — Nowadays, more tasks are accomplished effectively and more efficiently with the advancement in information systems and communication technology. Tasks such as teaching and learning use information technology as a tool. In conducting the research on how technology can assist an individual to perform a task, task technology fit and technology to performance chain are two theories which must be considered. This paper aims to propose a model based on technology to performance chain to increase online learning performance in CSCL environment. There are tremendous opportunities and needs for distance education. However, if the appropriate technologies are not employed, the task could be challenging. So choosing the right technology for performing collaborative tasks is an important decision to make. As instance, the more demanding the task and the more challenging the learning objective, the more capabilities and sophistication a CSCL technology needs to provide. So the technology is very important in online learning. Choosing an inappropriate technology for the CSCL environment can lead the universities to the high dropout range, and this can be crucial in scenario of small collaborative groups which includes four or five students. In this research The author analyzed the findings of many quantitative, qualitative, and mixed methods studies in multicultural groups, group performance, Task Technology Fit, computer supported collaborative learning, social networks supporting collaborative learning and virtual teams. Finally authors proposed a model based on TPC which can improve the learning performance, this model contains culture, user satisfaction and social network as a platform for e-learning.

Keywords– Technology to performance chain; task technology fit; computer supported collaborative learning; group performance

1. INTRODUCTION

As online learning or e-learning system is one of the latest advances of Internet technology, universities are spending extensive funds in this field to support teaching and learning [1]; [2]. The Learning Management System (LMS) is an example of e-learning technology, which has ability to distribute courses over the internet and online co-operation. It can simplify educator-to-student communication, tracking students' progress [3]. E-learning is one of the fastest growing trends within education which is known as asynchronous distance education through the internet. Online learning has become common because of its potential to provide easy access to content and instruction which is not dependent on time and geographical limitation. Since the past decade, technology development has significantly increased the efficiency and effectiveness of information richness from the World Wide Web.

U.S. Department of Education [4] has conducted a meta-analysis on 51 independent effects, screened from more than a thousand empirical studies of online learning. After comparing the effectiveness of online learning with that of face-to-face instruction, the results of meta-analysis showed “stronger students’ learning outcomes in classes with online learning (whether taught completely online or blended) than classes with solely face-to-face instruction”. Furthermore, the results also indicated stronger learning outcomes in blended learning (supplementing face-to-face instruction with online instruction) than face-to-face instruction alone. These days, LMSs have become almost crucial tools in education. Whether focusing on distance education or classroom-based education, nowadays most universities use LMSs to support and improve learning and teaching processes . As the LMSs usually contain different features, has the ability to support both distance and traditional teaching. Previous e-learning research has focused totally on the adoption and post-adoption use of e-learning systems [2] ; [3] ; [8]; [9].

A main concern in information system research is to recognize the relationship between Information technology and individual performance [10]. With the fast development in computer software, hardware and communication technologies, IT has been adopted extensively as effective tools to achieve tasks by individuals. The learning process describes the relationship between technology and learning performance, which is known as primary mediator. A fully

understanding of the methods in which technology involves users in the learning process will help to understand how technology can contribute to a stronger theoretical foundation for CSCL research to improve learning. This paper consists of 8 sections. Section 1 describes the importance of technology. Section 2 describes the methodology of this study. Section 3 explains online learning and CSCL. Section 4 describes culture and virtual teams. Section 5 explains social network in teaching and learning. Section 6 focuses on task technology fit and technology to performance chain, section 7 describe TPC and its impact on learning and section 8 focus on result and discussion

2. METHODOLOGY

Based on previous researches, we can conclude that social networks can be a proper online learning environment for increasing performance and reduce the negative elements affecting cultural differences. The researches were conducted in order to explore the current trends in online education and more specifically to identify a proper platform for computer supported collaborative learning. This is to match the tasks where multicultural students must perform during their learning process to increase group performance. The author analyzed the findings of many:

- Quantitative studies.
- Qualitative studies.
- Mixed methods studies.
- Studies in multicultural groups.
- Group performance.
- Task Technology Fit.
- Computer supported collaborative learning.
- Social networks supporting collaborative learning and virtual teams.

The following criteria of inclusion were used in order to maximize the credibility and relevance of sources of information. They are peer-reviewed articles, books, dissertations, theses and reports published in the last ten years. Nonetheless, older research materials were also included.

3. Online Learning and Computer supported collaborative learning Environment

Using information and communication technology to facilitate group learning activities such as knowledge sharing and problem solving is called Computer-supported collaborative learning (CSCL) [11]; [12]. Distance learning offers flexibility for online learners to manage their learning time and place, but collaborative learning reduces the flexibility of online learning, because it creates interdependence between the group members. The results of the studies show that students in an asynchronous CSCL environment have less freedom, but they were quite pleased with learning this way. Using information and communication technology in a collaborative learning environment, reduces the limitation of time and space as well as helping to improve the learning outcomes [11].

Collaborative learning can generally be defined as “learning activities expressly designed for, and carried out by, pairs or small interactive groups”. Research has proved that when students works in groups, verbalize their thoughts, challenge the idea of others, learning is most effective [13].

A: Culture and Virtual Teams

Culture is certainly a basis of variation in the human behavior. Most of the virtual groups are organized by different people from different countries or different continent which all have their own cultural background. This cultural background brings different opinion about the tasks which must be performed by team members.

Culture is one of the main factors that affect a virtual team. Not knowing the cultural diversity characteristic has negative impact on virtual team's performance and effectiveness [14]. Prior literatures show that similar with traditional FTF (face to face) teams, cultural diversity has both positive and negative effects on the performance of virtual teams. Researchers find that conflict plays a pivotal role in the relationship between cultural diversity and team performance [15].

Culture in virtual teams is deeply rooted and must be analyzed to be fully understood. This is important in order to understand virtual team primarily. Bernard described the culture as an important factor where he further added that it is

important to understand that culture cannot be treated as a mere affecting virtual team, but as a pervasive concept indistinguishable from the team itself.

[16] considered culture as a phenomenon with great complexity, people tend to understand and share information based on their cultural filters and this intention may cause misinterpretation and disorientation. When there is cultural diversity in virtual teams, it is difficult to predict the time that team needs to be effective. Many scholars have indicated that culture does have an impact on virtual teams. Here is a list of recent researches about culture which shows, culture must be considered in success of learning process in online learning.

TABLE 1-Virtual teams and culture

Article	Author	Effect of culture on virtual teams
Conflict and the path to resolution in global virtual teams	A Research Project, Nicole O'Hay, 2011	Different types of culture affect the interactions on a team.
Conflict, Culture, and Performance in Virtual Teams: Results from a Cross-cultural Study	Gallenkamp et al, 2010	Process conflict is negatively related to team performance.
Cultural diversity online: Student engagement with learning technologies	Hannon and D'Netto, 2007	Analysis indicated that cultural differences do have an impact on participant performance
E-learning in India: the role of national culture and strategic implications	Pramila Rao, 2011	This research proposes that national cultural influence e-learning practices
Online collaborative learning: Cultural differences in student satisfaction and performance	Chang Zhu, 2011	Study confirms that culture is an important factor that affects student academic achievement in an e-learning environment.
The Effects of Cultural Diversity, Conflict and Conflict Management on Performance in Global Virtual Teams	Yongmei, 2008	Cultural diversity may produce more conflict and lead to different conflict management behaviors in virtual teams, which in turn affects team performance.

Therefore, the possibility of conflict in virtual teams is higher than a domestic group where all members share the same culture and opinion. Meanwhile, cultural diversity could be a barrier for member's communication coming from different cultural backgrounds. Members could misinterpret the deeds of others as sinister in intention or disrespect, and interpret the argument about content of the task as a personal attack because of the cultural difference, so as to produce more relationship conflict in groups [17]. All factors in the process of learning in an online environment must be evaluated from a cultural point of view and in design process culture is a factor that must be considered [18].

Analysis of the student behavior in online learning indicated that cultural differences do have an impact on participant performance with organizational and technological issues.

4. Social Networks in Teaching and Learning

A computer network, which is used in e-learning is encouraging the students in the learning process, to cooperate in groups by the group process, establish communication between the learners. These activities are considered as a range of social network to support collaborative learning. There are tools for knowledge sharing such as knowledge and experience sharing, which matches the real life context.

Social networks are applications that support enthusiasm in a common space around sharing interests, collaborations, resource sharing, communications and interactions. These characteristics of social networks support both

the real and virtual social worlds. From this point of view, it is recommended that social networks provide advantage by choosing the proper tools for interaction. Furthermore, the SNSs effect on interactions positively among students and lecturers by creating more friendly environments [19]. On the other hand, these sites included of multimedia based on the web distribution tools incorporating audio, video and photo.

The recent attention of students to social networks brings a privacy and safety concern in an educational environment. The appearance of social networks that are focused on teaching and learning like Ning and Elgg give an opportunity to students and lecturers to minimize the privacy and safety concerns [20]. But, social networks such as Ning and Elgg are not offered free of charge. In this situation, for large networks the cost may not be expensive, but for small networks such as small organizations the cost may obligate them to look for alternative networks. For instance, Edmodo is a free Social Network that is designed specifically for lecturer and students in an educational context.

TABLE 2- Social Network and Its Impact on Teaching and Learning

Social network and e-learning	Author	Method	Conclusion
Social network communication style and learning performance	Hiching et al 2007	31 college engineering students from two distant universities collaborated using online collaborative tools in te US.	Increase the performance of the group
Supporting Virtual Research Teams - How Social Network Sites Could Contribute	Daniel Richter, 2011	Two different case studies	SNS seem to better match the needs of virtual teams in academic contexts
Online social networks and learning	Christine Greenhow	Based on a selective review of the research literature as well as the author's explorations of young people's online social networking practices	Social network sites can serve as direct and indirect supports for learning.
The Benefits of Facebook "Friends" Social Capital and college Students' Use of Online Social Network Sites	Ellison et al, 2007	Survey of undergraduate students (N = 286)	
'Old communication, new literacies: social network sites as social learning resources'	Greenhow, C. and Robelia, 2009	Conducted interviews	Supports the idea of using social networks for e-learning
An assessment of the impact of social networks on collaborative learning at college level	Rodriguez-Tejedo, 2012	Data were collected from three sections of an intermediate Macroeconomics class at a Spanish university	The results of this experiment seem to suggest small but negative impacts for the usage of this particular SNS for group projects
Absence of sense of community in e- learning courses: can the implementation of tools used by Facebook help?	A Thesis submitted to the Graduate School, University of Arkansas, 2011	Quantitative data were gathered by performing an online survey of educators who teach online as well as students who take, or have taken, online courses.	Using social network will help students feel they are part of a community.

5. Task Technology Fit and Technology to Performance Chain

Information technology must have a positive impact on individual performance. In order to achieve this objective, the technology must be utilized and be a good fit with the task it supports. [21] Goodhue and Thomson (1995) stated that if information technology wants to have a positive impact on individual performance, it must be utilized and also it must be a good fit with the task which should be performed. Basically, task technology fit is each individual's perception of how technology supports a task. The Task-technology fit was further defined by [22] as "ideal profiles of task-technology alignment". The most important link between information systems and the performance impact is task technology fit. When

the technology provides features which are required for performing a task, and it also meets user's expectations and needs, the impact on utilization and performance will occur.

[21] Goodhue and Thomson defined TTF as "the degree to which a technology assists an individual in performing his or her portfolio of tasks". They developed three different models for linking the technology and performance: (a) utilization focus model, (b) fit focus model, and (c) combination of utilization and fit model. The last model was named Technology to Performance Chain (TPC).

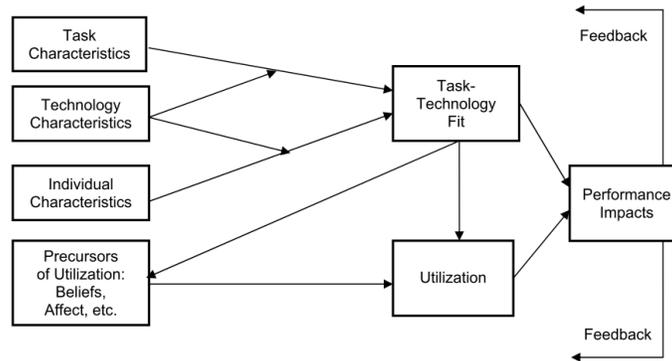


FIGURE 1. Technology to Performance Chain (Goodhue and Thompson, 1995)

TABLE 3- TPC Components

TPC model constructs	Definition
Task Characteristics	Tasks are actions taken by individuals to turn inputs into outputs. Task characteristics are those tasks that a user might use information technology to perform.
Technology Characteristics	Technologies are tools that can be used to execute tasks. Technology characteristics describe the tools, and include whether the information technology is a single system, or a set of systems, policies, or services.
Individual Characteristics	Individuals are the users of the technologies (tools) to perform their tasks. Their characteristics affect their competence in using the technology and include such things as training, computer experience, and motivation.
Task-Technology Fit	"TTF is the correspondence between task requirements, individual abilities, and the functionality of the technology"
Precursors to Utilization	Precursors to utilization represents the notion that if a system has TTF, the system will be believed to be "more useful, more important, or give more relative advantage" (p. 210). Precursors to utilization include expected consequences of utilization, affect towards using, social norms, habit, and facilitating conditions.
Utilization	Utilization represents the action of the individual using the technology to complete his or her tasks. It is important to note that in this context, utilization is a measure of whether a system is used, not a measure of duration.
Performance Impacts	Performance impact implies improved efficiency, effectiveness, or quality in the accomplishment of an individual's tasks. The Performance impact is used as a surrogate measure of information system success.
Feedback	Feedback addresses how the experience of using a system affects future-use. Feedback can increase task-technology fit via experience from learning, and it can change future utilization by changing expectations.

A: Technology to performance Chain and Its Impact on Learning

Information and communication technology starts to change education and more learning is taking place by using the newer and more advanced technologies and it has influenced the higher education [23]. Techniques such as social software practices as well as podcasting, blogging, have changed the way that we learn. Task technology fit suggests that when the technology's functionality is matched to task requirements; it has a positive impact on performance. The result of a poor fit is poor performance [21].

[23] McGill and Klobas used technology to performance chain as a framework for their study to understand the influence of task technology fit on performance in learning management systems (LMS). The result of their study determined a strong support for the importance of TTF, which had a strong influence on the impact of LMSs on learning.

8. Result and Discussion

The main use of technology in a virtual learning environment is to improve a learner performance. Studies showed that VLEs provide benefits such as increasing learner's convenience, worldwide training and all these will be provided by lower expenses. The key concern in information system research is to achieve a better understanding of relation of information system and individual performance. An appropriate technology must be chosen to support a task; organizations (mostly universities) use information technology to improve the flow of information sharing and performance. Choosing the right technology is crucial because not choosing the right technology have a negative impact on the organizations' objectives and goals (in universities the goal can be improving the teaching and learning performance). As [21] mentioned, technology has a direct influence on performance.

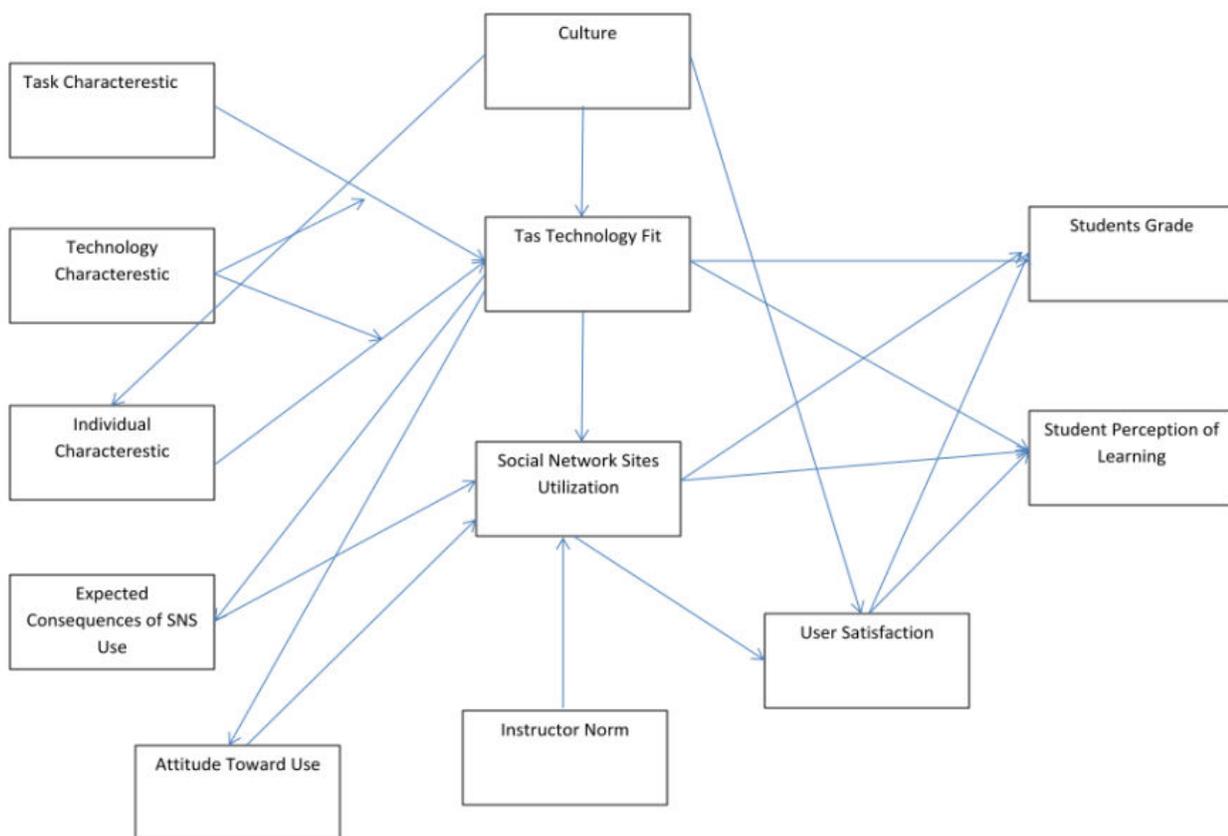


FIGURE 2: Modified technology to performance chain

As instance, the more demanding the task and the more challenging the learning objective, the more capabilities and sophistication a CSCL technology needs to provide. For example, if the learning objective is knowledge (such as memorizing a list of facts for a history class) and the task is divisible, then the technology does not need to provide many features for students and the basic features, such as communication support and collective memory is enough for performing the task. But when the learning objective is more complex, technology needs to provide more features to meet the task requirements. For example: if the learning objective is an evaluation (such as assessing against forecasted projections in an economics class) and the task is discretionary, the technology must provide not only communication support and collective memory, but also information processing, process structuring, and information modeling.

Social networks can give the students, sense of belonging and they feel that they are part of a community so work harder, this sense of belonging reduce the rate of dropout in computer supported collaborative learning, it also helps students to become more motivated. A study by [24] Smith (2009) described that what can be the possible effect of the lack of a sense of community? The result was: students' feelings of isolation, boredom, distraction and lack of involvement. " Students in e-learn-in environments enhance their skills when they interact regularly with peers who share the same interests, concerns and passions [25]. Based on the previous studies and the discussions now author can propose a model which is based on the technology to performance chain to increase the group performance in computer supported collaborative learning.

As mentioned before, the proposed model is based on Technology to Performance Chain. The differences between proposed model and the original model are three constructs that are added to the original model. This model also will evaluate performance by two different components which are students' grade and students' perception of learning. The constructs that are added to original model are:

- Culture: as it is mentioned in the literature, culture has direct influence on students' performance and using technology in virtual teams. It is one of the most important factors that influence student group work in online and face to face group learning. In this model individual characteristics and culture are both considered as a construct because based on the study that [26] Liu et al. (2011) conducted in the learning process, there are some structured tasks that the student does not have much flexibility to choose how to complete the task. In this case individual differences are ignored, but cultural differences still can affect students' performance.
- Social Network Sites: social network is offered as a technology to be used in online learning to meet the needs of the task which students must perform in groups. Based on the literature, it is expected that SNS can improve group performance (student's grade and perception of learning), reduce negative effect of cultural differences and fill the gap between the task and technology.
- Student satisfaction: satisfaction is an important component of online learning. Students that are less satisfied with technology are expected to participate less and communicate less in a virtual environment. The fundamental argument of the user satisfaction approach is that high levels of user satisfaction lead to high levels of user performance.

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