Assessing the needs of CSCL tool and its impacts in Malaysian context

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Abstract:- Reviewing on computer-supported collaborative learning (CSCL) tools revealed that CSCL is important to support collaborative learning (CL) strategy in school. Existing CSCL applications are mostly research-based and are not available for use. Through a survey on the needs for CSCL in Malaysia, it is confirmed that CSCL application is needed but the available one could not support CL activities. This paper discusses CSCL study in Malaysia, especially the relationship between user involvement and type of CSCL application needed. In particular, the CSCL application that could associate existing knowledge among students to build new knowledge for their better understanding and problem solving skills. We examine this need and assess its impact by developing Collaborative Environment for Teaching and Learning System (CETLs).

Keywords: computer-supported collaborative learning, CSCL, collaborative learning strategy, collaborative learning environment.

1 CSCL tool

The medium to support CL activities evolved from electronic mail, electronic conferencing, bulletin boards, hypermedia [1] and groupware [2]. This clearly shows that the computer plays a very important role as it empowers both the teaching and learning processes i.e. the interactions. The use of computing technology in CL is called CSCL [2].

Several CSCL systems have been developed to enable students to work together in a networked environment. For instance, CoVis, WebICL, CoMMIT, VLE, and GREWPtool. CoVis Project is specifically designed for learning to be used by students and teachers in a new groupware environments to support collaborative learning [3].

As described by O'Leary (2007), VLE (Virtual Learning Environments) is used for teaching and learning. VLE provides online courses and several facilities including chat room. The chat room is categorized into four major sections which are known as 'Study Room', 'General Office', 'Meeting Room' and 'Work Room'.

CoMMIT is a system which provides computer support for a variety of educational models including cooperative, distance, and problem-based learning [5]. It also provides a comprehensive and collaborative environment. The students could work together in a group, or do independent work that was later shared with the group. The students used an individual paper-based journal to record their findings. Using CoMMIT, notes can be generated by the individual group member, after that, every member can response to each individual notes. This is called a collaboration sequences among members. Notes can further be discussed among group members using the asynchronous activity sessions before they reach to a conclusion. At the end of the session, two reviewers will perform a scoring evaluation of the entries from both the electronic- and paper-based works.

GREWPtool is an online collaborative system that allows students to experiencing the collaborative learning environment. GREWPtool provides few communication tools among

students such as chat window which let the students communicate using an instant messaging. It is implemented as a collaborative editor that allows one or more students to simultaneously edit code, and a pair of browser windows where students can navigate through the assignment and a manual. All user interactions with the tool are logged and there is a playback mechanism, which allows one to analyze the learning session in great detail. Student will be given time frame to complete a test [6].

2 Collaborative techniques

There are many techniques available for collaboration. Some common collaborative learning techniques are:

2.1 Collaborative groups

Collaborative groups refer to a variety of structured classroom management techniques and grading systems. These terms usually do not refer to loosely structured group work in which students are told simply to "work together" on a problem or assignment. In order to emphasize the difference between unstructured group work and collaborative group work, groups are usually referred to as teams. Because students often lack of collaborative group skills, it is essential to target interaction skills and team building within the class. Students need to learn how to listen to other students, and to analyze and interpret what they are saying. Students must learn, for example, how to encourage others in their group to participate, how to ask questions, how to manage dominant personalities, how to monitor and modify the group dynamic, and how to communicate effectively [12].

2.2 Fishbowl

The concept of this technique is: teams of three or four work on a problem or exercise. At the same time, other teams of three or four observe the first teams. In particular, the first teams work on seeking other points-of-view, listening to and paraphrasing ideas, and other communication skills while solving the given problem. The second teams focus their attention on the team dynamic and make sure they are prepared to discuss how well or poorly the first teams worked together to solve the problem. After the given duration of time (even if every team has not finished the problem), the class discusses what had and had not happen during the activity [12].

2.3 Jigsaw

As stated by Gallardo *et al.* (2003), “Jigsaw is a method intended to provide collaborative learning environments. Hundreds of schools have JIGSAW in their classrooms with much success”. The Jigsaw technique begins with pairs preparation. Each pair has a subject to study. The students must read and summarize their material. They must also plan how to teach it to the rest of their own initial group. Then, new pairs of students are formed. Their objective is to practice how to teach the assigned material. Typically one student listens the material presented by the other and suggests improvements. Then, the roles are interchanged. The cooperative goal is that all students know all parts of the educational material. The students must teach and learn. While students work, the teacher moves from group to group. Her job is to observe the work and assist the students in their processes. At the end of the session, students’ learning must be evaluated using an individual test on all lesson topics [15].

2.4 Paired Annotations

Students pair up to review or learn the same article, chapter or content area and exchange double-entry journals for reading and reflection. Students will then discuss key points and look for divergent and convergent thinking and ideas. The pair (group) discusses the key points of the reading and looks for areas of agreement and disagreement. Together students prepare a composite annotation that summarizes the article, chapter, or concept. Finally, the group prepares a composite annotation that summarizes the article, chapter, or concept [13].

2.5 Think-Pair-Share

The tutor poses a question or a problem, then pairs of students work together to explore their ideas about some topic. They then separate and pair up with someone else to clarify, compare and justify ideas. The procedure can be repeated a number of times and students build on their

knowledge and understanding as they progress [14].

3 Collaborative Frameworks

Having a framework as a reference will improve the planning and management of the project. It shall also serve as a guideline. Therefore, people will have a thorough guide to refer to in order to produce the right product in a timely-manner. Figure 1 show the proposed framework which is named as 'Adjusted System Framework for Think-Pair-Share' (adapted from Dimitracopoulou (2005)). The framework shows that collaborative learning process requires both students and teacher to get involve. This framework particularly focuses on the process happen in the collaboration activity and interaction happens between users and the system; CETLs, where the users can be either students or teacher. The collaborative activities might happen between teacher and students, or between a pair of students. Students, who act as collaborator in pair-basis, will perform specific tasks and actions by having a teacher as an observer or supervisor. The attention of this framework is given to the 'teacher', 'pair collaborator', and the 'system' itself. Concerning about the existence of the teacher as an instructor to students in this collaborative environment, this framework highlights the usefulness of the collaborative system to the teacher, as well as the students. Specifically, the interaction between the system and user are classified according to the user level, focusing on the necessary functions supporting collaborative teaching and learning activities.

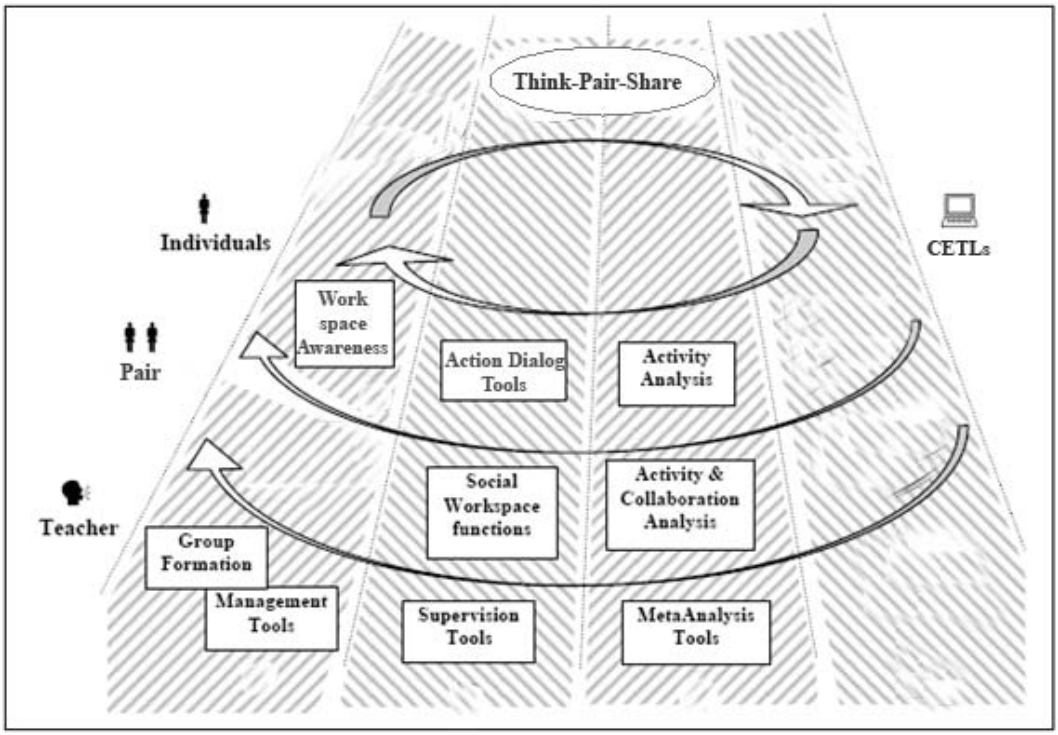

Figure 1: Adjusted System Framework for Think-Pair-Share

Table 1: Comparing the Five Existing Systems with CL Features and CL Framework Elements

CL Features and Framework Elements	System Functionality	WebICL	CoVis	VLE	CoMMIT	GREWP tool
Agent (Student) (Teacher)	Member Login	√	√		√	√
	Group formation	√	√	√	√	√
	Group Joining	√	√	√		
	Group Activity		√	√	√	√
Synchronous tools that support communication	Audio Conferencing					
	Video conferencing		√			
	Chat	√				√
	Instant Messaging					
	Whiteboards / Editor		√			√
Asynchronous tools to support communication	Discussion Boards / Forums	√	√		√	
	Calendar					
	Links /Search Engine	√	√	√		
	Group Announcements (Bulletin Boards)		√			
	E-mail		√	√		
	Survey/Poll					
Content Integration	Courseware		√			
	Streaming Media / Visualizer		√	√		√
	Narrated Slideshow					
	e-book					
Document Management	Resource Library		√			
	Upload / Download		√	√	√	
	Permission- based Access		√	√		
Workspace Awareness	Working Space	√	√	√	√	√
MetaAnalysis Tools	Online Assessment	√		√	√	√
Supervision Tools	Online Supervision	√	√	√		
Collaborative Technique	-	N/A	N/A	N/A	N/A	Paired Annotations

N /A= Cannot be determined.

4 Summary of existing CSCL tools

Table 1 summarises the features of existing CSCL tools against several common CL features and CL framework elements [11].

Table 1 places several CL Features on the leftmost column, where the first five rows are the CL features, while the rest of the rows are the CL framework elements. The 'System Functionality' column lists all the functions that are available in the collaborative system, which are categorized into specific sections.

From Table 1, it can be concluded that none of the systems fulfill all the CL features and CL framework elements. However, CoVis has fulfills all the Agent features, where CoVis is provided with the member login function, group formation by teacher, group joining by students, as well as group activity. The synchronous communication is done through the use of video conferencing as well as a shared editor, while asynchronous communication is supported with the use of either forums, search engines, bulletin boards, or e-mails [8]. The courseware and visualizer are used for the content integration. The document management is handled with the use of upload and download tool, as well as the resource library, where all the documents are accessed with the permission-based; only the appointed members can access specific documents. Having a supervision tool for the teacher/instructor, CoVis also provides a working space for all the learners. However, the collaborative technique used for CoVis cannot be determined.

On the other hand, it can be seen that the least complete system is CoMMIT, where it applies only seven out of sixteen CL features and CL framework elements. For the agent features, it provides only the login and group formation function. It is provided with asynchronous tool which is forum. No synchronous tool is available to support communication. CoMMIT is lack of content integration function. However it is provided with the upload and download function for the document management. The work space is provided for the learners while the instructor has the ability to do an online assessment. The collaborative technique used for CoMMIT cannot be determined as well.

Other three systems which are WebICL, VLE, as well as GREWPtool fulfill nine, eleven, and eight CL features and CL framework elements, respectively. Thus, they are considered as average collaborative tools, which are not too good not too poor. The most important thing is they are able to fulfill the least CL necessity.

Analyzing the table horizontally, it can be seen that a few features are not supported by any of the compared systems which are audio conferencing, instant messaging, calendar, surveys/polls, narrated slideshows, and e-books. On the other hand, the features that are supported by all the systems are group formation and working space. The only one system that can be determined its collaborative technique is GREWPtool.

Therefore, it can be concluded that all the systems have their own strengths and weaknesses. Better CSCL tool is needed which imposes all CL features and CL framework elements. Section 5 justifies the need for CSCL tool in Malaysia. Section 6 presents the teachers requirements for CSCL tool. Section 7 presents the quality of CETLs as a CSCL tool. Section 8 concludes the paper.

5 Survey on CL practices in Malaysia

A survey was conducted among more than 200 teachers in Malaysia. The survey reveals that there is a lack of CSCL tools and also a lack of user involvement in CSCL tool development [9][10]. The survey results indicate that the development of CSCL tools is important and teachers' involvement is essential.

5.1 Developing more CSCL tools to support CL activities

Hindrances in CL practices identified in the survey have stimulated the development of more CSCL tools. These tools are very important in implementing CL in teaching and learning. The existing tools are for general tool, and do not support learning in groups. They can generally be used for CL teaching and training, but they are not suitable for developing the expected problem-solving and communication skills in students. There are various categories of CSCL tools and each one is able to nurture specific skills among schoolchildren. Certainly, this augurs well for CL, for it is the objective of the Malaysian government to have more CSCL tools available to contribute towards achieving the Smart School objectives.

5.2 Emphasizing involvement of all stakeholders in the development of CSCL tool

Identifying suitable activities to be included in the CSCL tools is very much related to the teachers' role. They are aware which kind of CSCL tool is suitable. Many CL activities can be designed to incorporate many methods that they are familiar with. In addition, new and more interesting methods can be included such as Jigsaw and Think-Pair-Share, both of which draw on creativity. The survey also indicates that teachers' involvement ensures high commitment from them. The understanding generated by their involvement shall improve their tasks and they will be ready to accept the tool. More important, they also know when they should be involved. Their involvement is vital, as the survey shows that they were always given low priority. The courseware developers should consult teachers in the development of CSCL tools.

6 The CSCL needs and impacts

Identifying quality requirements is very important in supporting CL using CSCL tool [7]. Besides, reviewing existing system features and examining CL framework elements, it is important to identify these requirements from the domain knowledge experts. Hence, category of CSCL needed and impacts of CSCL to students are surveyed.

6.1 Category of CSCL tools needed

There are various categories of CSCL tools, each of which can help the user to achieve different skills. Results of the survey on the category of CSCL tools needed are shown in Table 2. The category preferred is considered strong or significant if more than 50% of the respondents select the statement. The top three are shown in Table 2.14, and are further discussed.

Table 2: Categories of CSCL tools (N=289)

Categories of CSCL tools	Count	(%)
Knowledge acquisition or knowledge-building (i.e. guide the student to build up knowledge from what they have learned such as deeper understanding of concept, theory or steps in doing something)	249	86.2
Skills acquisition (i.e. gain skills such as problem solving skills, communication skills)	247	85.5
Categorisation skills (i.e. guide students in categorising knowledge they have learned in order to achieve the goal)	244	84.4

'Knowledge acquisition' feature is the leading category which a CSCL tool is expected to have, based on feedback from the teachers surveyed. The CSCL tool should allow students to relate their

existing knowledge to the development of new knowledge. The tool needs to have features that can enhance problem-solving and communication skills among students. The other category of CSCL should teach students about team-work, as in real-life situation. The skills are needed to interact with other people in the team. Group activities in CL may require students to do categorisation of some information in order to produce a solution or an answer. The CSCL tool that builds categorisation skills enables them to categorise knowledge that they have learned in order to achieve the goal.

6.2 Positive Impacts of CSCL Tools

Results of the survey on the positive impacts of CSCL tools are tabulated in Table 4. The impact is considered strong or significant if more than 50% of the respondents select the statement. The teachers agreed that CSCL tools have positive impact on learning explicitly or implicitly. The top three are indicated by shaded rows in Table 3, and further discussed.

Table 3: Positive Impact of CSCL tools (N=289)

Positive Impact of CSCL tools	Count	(%)
It helps students to associate their existing knowledge to the learning of new knowledge	249	86.2
It guides students to solve problem	251	86.9
It makes students understand better	251	86.9

Knowledge possessed by each student in the group will be shared among group members in the understanding of certain concepts. Students will confer with each other within the group if they do not understand something. This builds closer peer relationship, motivates students to acquire more knowledge, and makes them understand better. The CL method usually has a step-by-step procedure that must be followed. The use of virtual character, on the other hand, will bring the students from one phase to another automatically. This leads them to find solution to the project given. The tool also helps students to associate their existing knowledge with the learning of new knowledge. This is in line with what the teachers expect the CL tool to have - knowledge acquisition (see Table 2). For example, by using the tool, students will be asked questions on topics they know most. Their existing knowledge leads them to or links the sources. In this way, they acquire new knowledge in their attempt to solve a given problem.

7 Evaluating CETLs for its needs and impacts required in Malaysian context

Many teachers believed that supporting activities in Science subject is practical and would be beneficial to students. Hence, a CSCL tool to support teaching and learning is developed. The tool called Collaborative Environment for Teaching and Learning System or CETLs.

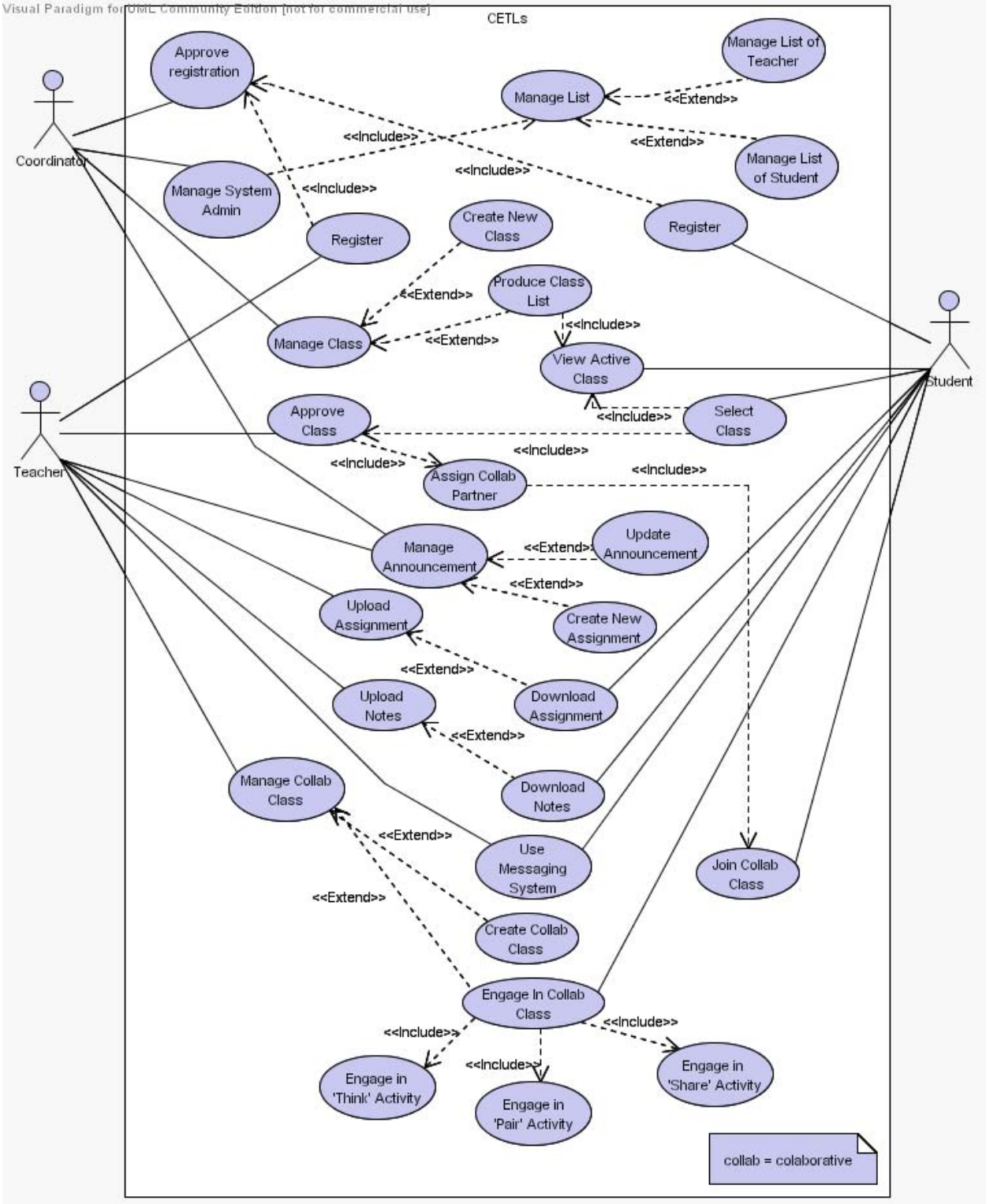

Figure 1: conceptual modeling of CETLs

Figure 1 shows the conceptual design of CETLs which will be involving a coordinator, teacher and student. CETLs provides a platform to teach and learn Science whereby a technique called think-pair-share is used in the problem solving strategy. Using CETLs, the students will work in pair to solve a laboratory assignment. Both of them will solve the problem, which is guided in three steps i.e. 'Think', 'Pair' and 'Share' using the TPS technique.

Table 4 shows the three major needs for CSCL tool in Malaysia i.e. knowledge acquisition or knowledge building, skills acquisition and categorization skills. In examining CETLs whether it has fulfilled this needs, we fielded several CETLs facilities into each of this needs. It shows that CETLs has fulfilled the first needs but requires some improvement for the third need. On the other hand, Table 5 shows the three impacts aimed from CSCL tools. In examining CETLs whether it has shown these impacts, we fielded several CETLs facilities into each of these impacts. It shows that CETLs has shown all the impacts aimed.

Table 4: Achievement of CETLs' needs

Description	CETLs	Improvements needed to CETLs
Knowledge acquisition or knowledge-building (i.e. guide the student to build up knowledge from what they have learned such as deeper understanding of concept, theory or steps in doing something)	Provides Think stage, which requires each student to propose idea for the solution based on what the knowledge that they have.	CETLs has shown this needs.
Skills acquisition (i.e. gain skills such as problem solving skills, communication skills)	Provides Pair and Share stage, in which they have to communicate what they know and ask what they do not understand.	CETLs has shown this needs
Categorisation skills (i.e. guide students in categorising knowledge they have learned in order to achieve the goal)		CETLs need to be improved to include this need

Table 5: Achievement of CETLs' impacts

Description	CETLs	Improvements needed to CETLs
It helps students to associate their existing knowledge to the learning of new knowledge	The 'Think' phase allows students to make use of their existing knowledge.	CETLs has shown this impact
It guides students to solve problem	The TPS technique leads them to solve the problem.	CETLs has shown this impact
It makes students understand better	The interaction between students themselves (during Pair stage) and student and teacher (during Share stage) require them to ask questions and rationalise their opinion.	CETLs has shown this impact

8 Conclusion

In this paper we have reviewed several CSCL tools to reveal quality requirements needed by the teachers in Malaysia as well as the impacts of CSCL on the students. For this, we have developed CETLs as a CSCL tool. In our examination, CETLs has the capability to develop knowledge building and acquisition skills among students. However, the facility in CETLs is inadequate to fulfill the categorizations skills. With regard to its impacts, by using CETLs students can have better understanding of certain concept and can solve problem that they have. In summary, the user involvement leads to the development of appropriate CSCL, which can be seen from the needs and impacts. Specifically, two out of three needs are fulfilled and all the impacts required are shown in the system.

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