4 EXISTING CLASSIFICATIONS AND FORMULATION OF THE MODEL

This chapter reviews three existing classifications for tools and features of CL applications. Section 4.1 presents and discusses the three types of classifications. Section 4.2 summarizes the classifications and in Section 4.3, a model is formulated which will serve as a basis for the organization of the content of WeRCLeA.

4.1 Existing Classifications for tools and features of CL Applications

As mentioned by Crawley (1997), there is still no agreed model so far for comparing and contrasting CL applications suitable to support learners’ and teachers’ collaborative activities. As stated in chapter 1, the term tools are referring to the main categories of support needed for learners’ and teachers’ collaborative activities. Each of the tools has its own list of features. A model that gives an overview of the tools and features of CL applications is needed. From the literature review carried out, there were only three sources identified that described the tools and features of CL applications in supporting learners’ and teachers’ collaborative activities. The sources are given by Kaye (1995), Landon (2002) and Koschmann (1996). Kaye emphasized on the learners’ collaboration tools, Landon focused on one type of CL applications and Koschmann stressed on the purpose of using the CL applications. As the focus of these sources is specific to certain contexts, they are referred as classifications which do not give an overall view of the CL application’s tools and features. The classifications are discussed in their respective subsections below.
4.1.1 Classification by Kaye (1995)

Kaye’s classification is emphasized on the support suitable for learners’ collaboration. Kaye has categorised the support into three categories of systems:

- **Communication system** consists of synchronous or real-time communication and asynchronous or deferred-time communication. These include synchronous text, audio and video communication, asynchronous electronic mail, computer conferencing, voicemail and fax.

- **Resource sharing systems** are used in real-time and asynchronous contexts. For real time, it is based on the principle of a 'public workspace' visible and accessible to all participants, each has access to a variety of tools for writing, drawing, painting, highlighting, erasing, etc. The problem of turn taking is resolved by assigning different colour to aid in identifying who is doing what. Real time resource sharing tools include synchronous screen sharing, electronic whiteboards and concept mapping. For asynchronous system, the resources can either be edited by any user before being transferred into a growing file of material reflecting the accumulated knowledge of the group as a whole or unedited resources which are used as core material for group discussion. Asynchronous sharing tools include asynchronous access to file systems and databases.

- **Group support system** includes project management tool for listing group and individual tasks to be done and deadlines for their completion, shared diaries and calendars with automatic reminder feature, tools for generating and prioritising ideas, co-authoring and voting tools.
4.1.2 Classification by Landon (2002)

Landon’s classification is focused on one type of CL applications which is the Course Management system (see chapter 2 for the classification for CL applications). Landon has categorized the tools in a Course Management system into four parts; learner tools, instructor tools, administrative tools and technical information. However, in focusing on teaching and learning, only the learner and instructor tools are taken into consideration. They are described as below:

Learner Tools

- Communication tools include discussion forums, file exchange, internal email, online journal/notes, real-time chat, video services and whiteboard.
- Productivity tools include bookmarks, calendar/progress review, orientation/help, searching within course and work offline/synchronise.
- Student involvement tools include group work, self-assessment, community building and students’ portfolios.

Instructor Tools

- Course delivery tools include automated testing and scoring, course management, instructor helpdesk, online grading tools, student tracking.
- Curriculum design tools include accessibility compliance, course templates, curriculum management, customised look and feel, instructional design tools and instructional standards compliance.

4.1.3 Classification by Koschmann (1996)

Koschmann’s classification is based on four purposes of using the CL applications. Koschmann gives examples of CL applications instead of listing out the actual tools and features. The first is
whether the application is used within the classroom or to connect users across classrooms (virtual classrooms). The given examples of applications used within the classroom are the Envisioning Machine (Teasley and Rochelle, 1998) and the Colab Facility (Stefik et al. 1987) which are for understanding concepts in the physics domain and augmentation of problem-based learning respectively. An example of applications used to connect users across classrooms is the Global Virtual Classroom (Riel, 1996) which has ‘Workroom’ for team members from three countries to communicate in the collaboration.

The second is whether the application is coordinated synchronously or asynchronously. If the coordination is synchronous, where the participants are online at the same time, tools such as videoconferencing and chat may be used. In asynchronous coordination, the exchange of information, data, text and file is not at the same time. The Global Virtual Classroom (Riel, 1996) is coordinated asynchronously for team members using threaded discussion and group email. For teams and the coordinator, it provides the ‘Weekly report’ space and for the teachers-in-charge, the ‘Teacher lounge’ space. There are other asynchronous tools such as Announcement, FAQ and Tech-support.

The third is according to the instructional role that the application is designed to serve, such as to present a problem-based study, to mediate communication, to introduce new resources into the classrooms, to provide archival storage for products of group work or to enable learners to model their shared understanding of new concepts. An example of application for mediating communication is the PREP Editor for writing classroom (Neuwirth and Wojahn, 1996). Another example is the Distributed Multimedia Learning Environments application (Pea, 1996) designed to introduce new resources into the classroom.
The fourth is according to the kind of support for teachers’ collaborative activities. An example of such application is PSE (Project-Support Environment), an integrated teacher’s tool which gives guidelines for teachers’ to do Project-based Science (PBS). It consists of PIViT (Project Integration Visualization Tool) to assist teachers in designing, planning and modifying projects, CaPPs (Casebook of Project Practices) to help teachers learn features of PBS, Personal/CaPP (Personal Casebook of Project Practices) to support teacher reflection by constructing their own case book and finally PSNet (Project-Support Network) to promote collaboration and sharing of documents (Soloway et al. 1996). Figure 4.1 shows a feature of PIViT called the design window which is a scaffolded, computer-aided workspace in which teachers can construct and modify project designs.

Figure 0.1: Design Window for PIViT (Project Integration Visualization Tool)
4.2 Summary of the Reviewed Classifications

All of the reviewed classifications focused on the support for students’ collaboration, namely the learner tools and two of them (Koschmann, Landon) considered tools for teachers’ collaboration, namely the teacher tools. The term used to refer to the main categories of support is dissimilar between Landon’s and Kaye’s classifications. Landon used the term tool which is used in this thesis, while Kaye used the term system. In relation, some of the terms used to describe the tools were also dissimilar, for example, Kaye used ‘Group support’ while Landon used ‘Student involvement’. Kaye and Landon listed out the actual features for each category of the tools while Koschman mostly gave examples of CL applications for some of the tools and features.

There were common aspects of support in CL applications that have been emphasized in the reviewed classifications. The presence of those aspects is summarised in Table 4.1.

<table>
<thead>
<tr>
<th>Aspects</th>
<th>Researchers</th>
<th>Kaye</th>
<th>Landon</th>
<th>Koschmann</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Shared Repository</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Group Learning</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Assessment</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

The first aspect is communication, which is important for collaborative learning. Support can be provided by the CL applications in real-time and at anytime communication. A real-time communication can be achieved through synchronous tools such as chat. As for anytime
communication, asynchronous tools such as threaded discussion are used. The presence of communication tools in all of the classifications reflects the importance of this aspect of support.

The second aspect is shared repository. The CL applications should allow for sharing of resources and provide archive storage for group work, thereby supporting knowledge building as specifically suggested by Koschmann (1996). In relation, Kaye suggested asynchronous access to file systems and databases in his resource sharing system and Landon had listed features such as bookmarks, search and students’ portfolios which are features that support shared repository.

The third aspect is group learning, in which there is a set of tools which supports collaborative activities. These set of tools are different from the tools supporting the communication process. Koschmann mentioned tools to create representation to enable students to model their shared understandings of new concepts. Tools for organisation of groups according to intra, inter, or extra-classroom activities, namely those within the classroom and in ‘virtual classrooms’ were also mentioned. Kaye had listed tools for the category group support system, as mentioned in Section 4.1.1, while Landon included group work and community building in his category of student involvement tools.

The fourth aspect found is assessment where Landon listed self-assessment as one of his student involvement tools and automated testing and scoring, online grading tools and student tracking as teacher tools for course delivery.

The above discussion shows that all of the existing classifications focus on the support for students’ collaboration and two of them consider the support for teachers’ collaboration. Consequently, none of these classifications gives an overall view of the tools and features of CL applications to support both the teachers’ and learners’ collaborative activities. Here, a model that will combine the tools and features of CL applications gathered from the reviews in this
chapter and in Chapter 2 is proposed. The next section describes the formulation of the proposed model.

4.3 The Proposed Model for classifying tools and features of CL applications

A model is proposed to become the basis for designing the reviewing tool for CL applications for this research. The model is derived from the summary of the reviews of three classifications as discussed in the previous section and the reviews of existing CL applications in Chapter 2.

The four aspects found from the review of the classifications are to be the main categories of tools in CL applications. The categories of tools are:

- communication tools
- shared repository tools
- group learning tools
- assessment tools

This is depicted in the diagram to represent the model shown in Figure 4.2.
Looking from the centre of the diagram outwards, it is indicated that a CL application should consists of communication tools, shared repository tools, group learning tools and assessment tools. Each of the four main categories of tools provides the support features for the learners and
teachers. The outermost boxes separate the list of features for learners and teachers in each category. These features have been gathered and chosen from features in CL applications, collaborative sites and classifications of CL applications, reviewed in Chapter 2, 3 and 4 suitable for collaborative learning activities. From the descriptions of the features, each feature is then placed under a category appropriate for it. The strengths, the benefits or advantages and the disadvantages of each feature are elaborated in Appendix D.

The following sections describe each category of tools and their features. Section 4.3.1 highlights the communication tools for learners and teachers. For communication tools, learners and teachers basically use the same set of features which are grouped under asynchronous communication and synchronous communication tools. However, since learners and teachers have different purposes for collaboration, the teacher tools for shared repository, group learning and assessment tools for supporting collaborative learning are different from the learner tools for these categories of tools. Thus, Section 4.3.2 highlights the shared repository tools, group learning tools and assessment tools for learners while Section 4.3.3 highlights the shared repository tools, group learning tools and assessment tools for teachers.

4.3.1 Communication Tools for Learners and Teachers

Communication tools are required to allow communication at anytime between students, teachers, a student and a teacher, an expert or anyone taking the role of a mediator to help the group of learners at anytime to sustain collaboration thus creating a community of learners with a learning culture where knowledge is shared. These tools must be capable of supporting person-to-person interaction and talk, for learning purposes (Wegerif and Scrimshaw, 1997).
Asynchronous Communication refers to the exchange of texts, data and files where the correspondents are not online at the same time.

The following are the main features of Asynchronous Communication Tools.

- **Group Email** is used to communicate to all in a group, several groups or individual user including the teacher. New users will automatically be added according to the chosen group in the address book. A dynamic email lists based on certain learner characteristics may possibly be created.

- **Threaded Discussions** are discussions listed according to topics, with date, sender's name and related comments threaded together for easy viewing. New discussion topics can be created and comments on any available topics can be posted at anytime providing the opportunity to discuss prior topics continuously.

- **Announcements** are important notices for all or for a specific group. It may also be a programmed reminder as well as a calendar or list of events which highlights the dates or deadlines for activities.

Synchronous Communication is a real-time information exchange where the correspondents are on line at the same time.

The main features of synchronous communication tools are as follows:

- **Chat** which is a facility for conversation using real-time text exchanges. It may be archived and searchable. A moderator may determine the topic and monitor the discussion.

- **Shared Whiteboard** facility includes a shared text window that may also support shared drawing.
• **Application Sharing** includes the running of an application on one computer and sharing the window view of the running application across the Web. There may also be provisions for sharing mouse control of the application.

• **Virtual Space** consists of virtual meeting rooms with more than one discussion groups going on at the same time using real-time text exchanges. The time and topic is usually preset and a moderator is usually available with occasionally guests present.

• **Voice Chat/Audio Conferencing** is an audio communication facility for real-time audio exchanges usually involving more than two persons.

• **Video Conferencing** Broadcasting video with real-time Q&A for instant feedback and instructor floor control.

### 4.3.2 Shared repository, Group learning and Assessment tools for Learners

**Shared repository tools** enable sharing of resources and provide archival storage of learning products (Koschmann, 1996). The tools allow shared authority by learners to choose tasks as each become more responsible for their learning (Tinzmann *et al.* 1990; Gallagher, 1997).

The six main features of learner tools for shared repository are as follows:

• **Search facility** searches documents for specified keywords and returns a list of the documents where the keywords are found.

• **Shared Bookmarks** support the ability to create, display, manage and update identified sites. This helps users to construct a knowledge base for themselves and contribute to their group as well. Sharing a Bookmark is the choice of each user. Links to hot lists or suggested resource archive may be available.

• **Real-time data** from primary source. Data from reliable sources is normally online and up-to-date.
• **Data Collection** includes the facility to create a customized form to get user’s input. It can also be a simple online voting poll.

• **List of Projects/Courses/Activities** usually categorized according to subject areas, age/curriculum level, duration, starting date thus can usually be searched by a Search engine. The lists are provided by many web sites of organisations organising collaborative activities.

• **Curriculum Objectives/Syllabus** includes course outline, expected duration, important dates so that students have curriculum guidelines for planning their activity.

• **Frequently Asked Questions (FAQ)** is a collection of questions frequently asked.

**Group learning tools** support group processes such as the formation of suitable group composition, in-depth group exploration and group decision-making activities. Group learning tools require innovative interface designs that maximize collaborative support for peers and accommodate active collaboration (Kumar, 1996).

The main features of group learning tools are as follows:

• **Project Space** or group space is a facility for students in project organizing, which contains all information regarding the project and the group. The facility acts as a log book, recording all ideas as it prompts all members to contribute ideas and may be accessible for instructors or others to monitor and comment.

• **Personal Workspace** is a space for self-management of one's learning or activity. There may be a scheduler, grade profile or own profile in a personal homepage.

• **Group Forming** is a facility for choosing group members or collaborating partners in two ways, either by invitation or application. This may be in the project space or under a list of groups being formed. It may have links to the possible members’ homepages and
may include conditions laid out by instructors. It may include a facility for instructors to form the groups.

- **Negotiation** is a facility in the project space, which systematically organizes and encourages contribution of opinions and ideas of group members, their comments on others' opinions and their defending statements in negotiating for a group conclusion. There may be some voting by the group.

- **Expert Services** is a facility to ask questions online, which includes links to global expert services sites as well as email links to local instructors.

- **Presentation and Submission** is a facility to send and present a group's assignment to an instructor or a bigger audience and an ability to give feedback, be graded and archived, with full multimedia uploading capability.

- **Online guide** is a facility to find answers or advice on any subject.

**Assessment** is one of the key issues in collaborative learning (Kumar, 1996). There are situations where a learner would want to know and reflect on his status of progress to provide meaningful feedback. Assessment tools allow students and teachers to monitor the learning process.

The main features of assessment tools are:

- **Performance Rubric** is a tool for assessment according to prescribed criteria and level of achievement for any activity or skill. This can also be a guide in performing the activity and should be accessible to students from the beginning.

- **Self-reflection** is a facility to evaluate oneself after a certain activity or period and may be made accessible to others especially the teachers for monitoring.

- **Self-assessment** includes multiple choice practice quizzes or other types of assessment, which is automatically marked online with instant results and feedback.
• **Progress Tracking** folder in each student's personal space enables him/her to track his/her overall progress throughout the course.

• **Online Survey** is a tool which allows evaluation or voting through an online poll.

### 4.3.3 Shared Repository, Group Learning and Assessment tools for Teachers

The planning and implementation of collaborative activities for students require active collaboration among teachers (Koschmann, 1996). In relation to this, Kumar (1996) mentioned that in order to maximize collaborative support for teachers, effective group learning tools are required. Table 4.2 presents the main features for the tool categories of shared repository, group learning and assessment for teachers.
**Table 0.2 : The main features for the different categories of tools for teachers**

<table>
<thead>
<tr>
<th>Category of tools</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shared repository</strong></td>
<td><strong>Design Guidelines</strong> for collaborative tasks and lesson plans may include task formats or different learning activity formats, the layout of the design process possibly in the form of flow charts and template for creating lessons or activities.</td>
</tr>
<tr>
<td><strong>Group learning</strong></td>
<td><strong>Online authoring</strong> for creating and maintaining course materials include facilities to create web-based learning environment, which can be created offline but uploaded for use with the Internet. <strong>Presentation</strong> is for displaying course materials over the web including images, videos and audios.</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td><strong>Assessment manager</strong> includes facilities for creating and giving feedback for quizzes, tests, assignments and projects. It keeps track of the progress of every student under the responsibility of a teacher. It may include statistical analysis of student-related data and a question databank. <strong>Monitoring</strong> tool includes some facilities for teachers to monitor all the communication tools available such as the discussion forum and chat to evaluate students’ progress while giving guidance, support and motivation directly or by assigning assessment. <strong>Personal workspace</strong> is important for the management of a teacher’s resources and record keeping. It automatically lists out courses given by and taken by the teacher. The Calendar reminds the teacher of tasks and events.</td>
</tr>
</tbody>
</table>
4.3.4 Relevance of the tools for successful collaboration

This section relates the conditions for successful collaboration described in Section 2.3 to the four categories of tools as an extension of the proposed model. Mediation and community building relates to communication tools, appropriate tasks to shared repository tools, suitable group composition to group learning tools and regular monitoring to assessment tools, as illustrated in Figure 4.3.

![Figure 4.3: Conditions of successful collaborative learning](image)

The communication tools allow mediation between the teacher and the students, where it can be done regularly any time, anywhere using email and threaded discussion. Community building among students is also obtained using communication tools, with which students can share
relevant experiences and resources, argue against or for ideas rather than people and also respect each other as part of the team or community in learning. Further, the wide choice of resources contributed and gathered by students and teachers, in the shared repository allows for appropriate tasks to be determined by each student independently. While the group-forming feature in the group learning tool category allows suitable group composition to be created. Lastly, the assessment tools allow monitoring to be done regularly. These factors which are mediation, community building, appropriate tasks, suitable group composition and regular monitoring are the main conditions for successful collaboration (Dillenbourg and Schneider, 1995; Bracewell, 1998; Kumar, 1996; Bakker et al.1990). These conditions can be satisfied by using the tools in a CL application.

4.4 Summary

This chapter has reviewed three classifications to explore the tools and features of CL applications with respect to the support for collaborative learning activities for learners and teachers. A model has been proposed from literature reviews not only from this chapter which is on the classifications, but also from Chapter 2 on conditions for successful collaborative learning and on CL applications. The model forms the basis for designing the questionnaire and development of the web-based tool for reviewing CL applications, all of which would be discussed in detail in the next chapters.