CHAPTER – 6

EVALUATION
6.1 Introduction

Evaluation is integral to every aspect of WBLE. It helps in clarifying students and their values, identifying needs, considering alternative ways to meet, conceptualizing a design, developing prototypes and implementing and delivering the instruction, managing the learning experience, and improving the evaluation itself.

Since the system developed rely heavily on social computing technologies and other infrastructure, understanding long term usage and its acceptance is of utmost importance for determining if the system is worth to have been implemented in real time environment or not. Performing such an evaluation is absolutely essential and it can help in formulating better corrective strategies to increase user or student base in the WBLE. Hence, the focal aim of this evaluation is to identify and determine the factors influencing students to adopt the WBLE. The purpose of this chapter is to test and evaluate the devised framework and the developed system based on social computing perspective.

6.2 Methods of Evaluation

The system was evaluated with the following methods:

- Interview
- Knowledge Sharing Network Growth

6.2.1 Interview Questions

The use of interviews in evaluation is inevitable. This tool collects information and points of view, and analyses them at each stage of evaluation. The interview usually takes the form of a face-to-face discussion between the evaluator
and the interviewee. Interviews are used in many fields, such as psychology, ethnology, sociology, anthropology, and philosophy. The interview is thus used to study learner actions.

To determine its feasibility in enhancing sharing of teaching knowledge, the devised framework in section 4.3 and the system developed in section 4.4 were presented to some students for evaluation and feedback. The interview aimed to evaluate the system at the three levels: i) Framework ii) The developed system iii) The use of WBLE and Perceived Usefulness (PU).

6.2.1.1 Evaluation – Framework

In doing the evaluation of framework two questions were asked to students after they had reviewed the framework and tested the system. The questions focused on the features presented in the framework. These are:

- Do you think the devised framework is useful in supporting the sharing of knowledge?
- Do you think the framework needs changes or is it functionable as it is?

In response to the first question one of the students gave the following comments:

"...the framework is a good idea and it is quite appropriate..."

The second student had the following response:

"...I think it is useful and appropriate for knowledge sharing..."

From this feedback it could be seen that the framework is a potential solution in enhancing the sharing of knowledge and experience in WBLE that incorporates social computing technology.
However the following suggestion was provided by one of the students concerning of willingness of participation:

"...the willingness of participation is going to be a large hurdle to get over in the beginning..."

This means that increasing participation to be considered and one of the major hurdles the students often encounter with a WBLE especially during the beginning phase of the course. If only a few students participate by volunteering answers, asking questions, or contributing to discussions, class sessions become to some extent a lost opportunity to assess and promote learning. The WBLE should provide more ways and means to encourage the quiet learners to come forward and share their learning experience and knowledge.

In responding to the second question about the framework which was “Do you think there has to be some changes to the framework or it can be workable?” the following comments were provided:

“I think the training problem is less of an issue, I think if you look at the usability aspect... people are familiar with using the Web...if you talk about recording lectures it may need a certain amount of facilitation for that...”

The above feedback generally suggests that although people are familiar with the Web they need requires a considerable amount of training in using some new tools such as video and audio podcasting which also supports the results obtained from the question in section 3.2.2.8 (Barriers to Social Computing) where surveyed respondents answered that lack of training was one of the barriers for social computing uptake.

6.2.1.2 Evaluation – The System

The evaluation investigated the use of the learning environment and perceived usefulness. It aimed to answer the following questions.
1. Do you think the system developed is useful in facilitating sharing of knowledge?

2. How did the students use this WBLE?

3. What was the perceived usefulness of the WBLE?

In response to the first question which was: "Do you think the system developed is useful in facilitating sharing of knowledge?" the following feedback was obtained from one of the students:

"...It is a good integrated idea to have all the tools in support of knowledge sharing...so it has potential and I think it is interesting"

Which means that student accepts the system and finds it workable.

However they have recommended that an important thing is to get people who will use the system and measure the benefit after a certain period of time. Hence the important thing is to measure the benefit over long period of time which suggests that the framework which emphasises on improving knowledge culture must be well implemented as Reid [160] suggested so as to achieve the real benefit of the system.

The following discussions were made on the basis of the feedback obtained from the students with respect to the use and perceived usefulness of the WBLE.

6.3 Use of the Web Based Learning

6.3.1 Pedagogical Aspect

During the evaluation of the pedagogical aspect of the learning environment, the students were asked to choose topics, several groups chose the same topics, as these topics looked easier or were more familiar to them. The instructor had to intercede to ensure that each group focused on a different topic. The students found the flexibility feature involved in the learning environment useful.
The students primarily relied on the suggested reading materials to study the topics. In the KS spaces, the students basically shared and discussed issues introduced by the suggested learning materials. Their KS efforts were also mainly based on these resources. Nevertheless, most students used extra information resources and added resources.

The students were given 15 minutes to write online reflections during each session. Most of them completed it during the session. Those who could not complete it during the lessons managed to finish it in the following one or two days. Although the students put a great deal of effort into their learning, their reflections were to an extent rather superficial. They did not comment on the usefulness of the content or how to apply it in real situations.

6.3.2 Social Aspect

The use of KS space varied among the groups. A majority of students used the KS space frequently and posted a large number of messages and a few students did not use the KS space quite often. The forum served the purpose of sharing information and knowledge adequately.

6.3.3 Technological Aspect

Basically, the platform was easy to learn and easy to use. However, sometimes the access speed was slow when all the participants used the system at the same time. Synchronous discussion messages often popped up in blocks. The students found the customization feature useful. It allows users to update their photographs, contact numbers and email addresses. Only a few students updated their profile.

6.4 Perceived usefulness

As displayed in Table 6.1 the learning environment was perceived to be rather useful as the mean scores for those questions that were not negatively stated were high.
1. Function of the Learning Environment was clear. & 3.7 & 2 \\
2. Learned more from the Learning Environment. & 4.1 & 3 \\
3. Learned little from the presentations made by other groups. & 2.7# & 2 \\
4. This WBLE was a good sample of constructivist learning. & 3.7 & 2 \\
5. Knowledge sharing spaces in this learning environment were helpful for knowledge sharing and construction. & 3.3 & 3 \\
6. Flexibility with the WBLE and learning content and courseware is good & 4.1 & 3 \\
7. Learning activities in this WBLE encouraged collaborative learning. & 3.7 & 1 \\
8. I don’t like the way of delivery in this course, I prefer tutor’s presentation & 3.1 & 2 \\
9. I did not think critically when I was writing online reflections & 2.2# & 1 \\
10. No strong social relation existed in this WBLE & 2.7# & 2 \\
11. Liked to share my ideas, resources, questions with others in this learning environment & 3.6 & 2 \\
12. Our group members worked collaboratively on the topic(s) and or the final project. & 4.2 & 3 \\
13. The theoretical background for communication and collaboration in this learning environment were clear. & 3.8 & 2 \\
14. Adequate coordination and support from the lecturer. & 3.9 & 3 \\
15. Knowledge sharing space helped me clarify issues and construct meaningful knowledge & 3.6 & 3 \\
16. Easy access with this learning environment. & 4.2 & 3 \\
17. This WBLE was easy to navigate and use. & 4.1 & 3 \\
18. Easy to download and upload resources with the WBLE & 4.2 & 3 \\
19. No difficulties during group sharing and online discussions. & 3.8 & 3 \\

| Table 6.1: Perceived usefulness of the learning environment. |

Note: *: 5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, 1= strongly disagree; #: Negatively stated question.

6.4.1 Discussion

The results indicate that the pedagogical design of the WBLE was sound. To a certain extent this learning environment presented a good example of
constructivist learning and also promoted students' collaborative knowledge construction and knowledge sharing.

With regard to the social aspect, the results show that the learning environment promoted collaborative learning, as the students could share knowledge and further discuss the topics within the environment. The results also indicate that the discussions and collaboration helped them in knowledge construction and sharing and social relationship building.

With respect to the technological aspect, the students agreed that the WBLE was easy to access and navigate. They could also readily download and upload resources. However, the mean score to question confirmed that the students occasionally had difficulties when using the system.

Additionally, they stated that supporting materials were insufficient. Further comments and suggestions were also given on the design of the learning environment. As to the pedagogical design, a number of students mentioned that they liked the course design because it provided them with a certain flexibility to choose topics and assignments, which was not available on other courses. Two students commented that this course was an example of student-centred learning. Additionally, a number of comments were made on student presentations. Three students indicated that they did not learn much from the presentations given by other groups. Another student suggested that the presentation in each lesson should be confined to one group only. Two presentations on the same topic might result in redundancy or inconsistency. One student further suggested that the group presentations should be short and precise, so that the lecturer had more time to summarize.

With regard to the social design aspect the students enjoyed the group work, as it had provided them with more opportunities to work with others. A few students highlighted that with Knowledge sharing space, they were able to collaborate and share their knowledge frequently and enabling them to enhance their reflective learning skill.
Regarding the technological aspect, three students complained that the access or processing speed was sometimes too slow. Two students indicated that using the WBL gave them a new experience, as they had never used it before.

This research has confirmed that design plays a crucial role in the development of WBLE. Educators commonly agree Interactive Learning that simple placement of hardware and software will not result in ICT integration and effective learning naturally following [56]. The primary factor that influences effectiveness of learning is not the availability of technology but the design [112]. Technology is merely a tool that makes pedagogical design feasible. In this study the pedagogical design of providing reading materials, allowing lecturers and students to add extra resources, writing online reflections and topic study in groups promoted student collaborative learning and knowledge construction.

This study has also revealed that the students liked the learning environment to be flexible and negotiable. Constructivists claim that instructional design is a set of processes that must occur during as well as before instruction. The determination of student needs and learning activities is best characterized as a process of negotiation, rather than being imposed by the instructor [90]. The results of this study have confirmed that the students appreciated the design flexibility and negotiation involved in the course, as it met their various needs and expectations.

In addition, this study has indicated that the nature of a topic was an important factor that affected lecturers’ choice of topic. It was a challenge for the lecturer to moderate the process of topic selection, as some groups initially chose the same topic to study. It might be a good idea to allow the teachers to propose topics to explore.

Social interactivity seems to be a vital element of a WBLE. In this study both face-to-face and online interaction were involved. Many interactive social activities happened within the learning environment. It seems that using online discussion in a web-based learning environment can promote more social interaction in an interactive context.
Moreover, the majority of groups chose to conduct seminar discussions online. This finding has reinforced some reported advantages of online discussions, such as providing a more comfortable atmosphere or more equal opportunities for interactive participants to voice their opinions [195] and automatically recording discussion details to make report writing easier [194].

This study has confirmed that more social activities must be seamlessly integrated into a learning environment. We cannot assume that having been given communication tools, students will naturally interact with others. Much research has indicated that students show a reluctance to participate in online discussions, although online discussions have a number of advantages. If a social activity is not integrated or graded students may never use it at all and those who start to use it may gradually lose interest [125]. In this study the learning environment provided with a variety of tools for social activities. The results show that the participants were engaged in these social activities.

This study has indicated that the technological dimension is the initial requirement for the construction of an effective computer-based learning environment. One of the differences between a computer-based learning environment and a traditional classroom setting is the degree of technology involvement. In a technology-enhanced learning environment ICT becomes an integral part of the learning process. In this study most learning activities, such as providing reading materials and online discussion and reflection, depended heavily on the use of and support by technology.

Without technology the learning activities and processes would be inefficient and hard to implement. The technological aspect provided a solid base for the pedagogical and social design.

This study also identified that ease of access is critical for a WBLE. It seems that ease of access is a crucial dimension of any network based learning environment, because the learning activities and processes heavily depend on the support of computer networks. Research has indicated that those who have easier
access tend to participate more in online learning [76]. The learning process is unlikely to happen if users have difficulties in accessing the resources on the network. In this study the speed of access and response was occasionally slow. This problem frustrated the students to a certain extent. This study has suggested that an effective WBLE must be easy to access and available at all times.

6.5 Network Growth

The focus in the past has been measuring the usefulness and ease of use to predict actual system use. However, with the development of social computing systems and the concept of the network effect, the experience and competency of users, (i.e. technology adoption competency) must also be measured to determine how they affect the adoption and use of these systems.

Another factor that influences the spread of innovation adoption is network effect. Network effect or network externalities describe the change in benefit that an agent derives from a good when the number of other agents consuming the same kind of good changes [109]. One of the prominent examples of network effect is the telephone. As the number of users that uses the telephone increases, the benefit for the next user that adopts telephone will increase because the number of connections that can be made increases as in Figure 6.1.
Metcalfe, founder of Ethernet, mathematically expressed the number of unique connections in a network of a number of nodes (n) as \( n(n-1)/2 \), implying that there are \( n^2 \) unique connections. The expression is called Metcalfe’s Law. The law measures the potential number of contacts that can exist in a network. One of the key considerations of the Metcalfe’s law is to distinguish between the potential number and the actual social utility of a network. The social utility of a network depends on the number of nodes that are in contact or linked [79]. This means that even though \( n^2 \) models the total possible connections, only those nodes that are connected will create utility.

With social computing systems, this is more easily achieved because of the social constructs encouraged within them [79]. The interactions between users and
the links that are created between them generate the network effect. Specific technologies such as tagging, folksonomies, RSS feeds, permalinks and other Web 2.0 artifacts make the social connections even stronger. The prevalence of users who generate content allows the utility for other members to increase. This effect is especially more predominant within a business enterprise [109]. Employees within a firm will be more likely to adopt specific innovations if it is compatible with the rest of the firm. Liebowitz and Margolis [109] state that compatibility within the firm is of greater importance than compatibility with external organizations. This point emphasizes the network effect of social computing system within business enterprises.

Another driving motivation behind the concept of network effect within businesses is the concept of social capital. Social capital is a social construct that highlights the importance of networks of strong interpersonal relationships for trust, cooperation and collective action. It encourages members that are participating in a social computing system to be more willing to generate content that will enhance other’s performance, as the success of the overall organization will create mutual benefits for all members.

This study analyzes the discussion forums in two different sessions. The discussion forum being the site for knowledge sharing, the “place” where 26 students used to exchange their ideas, discuss assignments, and share work, both with each other and the facilitator. A study on network growth was conducted at two different points of time.

Table 6.2 presents descriptive statistics for the network at the beginning and end of the course. Arithmetic, means, variances, and ranges of both degree centrality and closeness centrality measures show a significant increase during the term, which indicates a considerable development in the network of the overall class.
<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Mean</td>
<td>20.00</td>
<td>22.07</td>
<td>34.00</td>
<td>58.39</td>
</tr>
<tr>
<td>Std Dev</td>
<td>13.08</td>
<td>2.41</td>
<td>14.40</td>
<td>7.80</td>
</tr>
<tr>
<td>Sum</td>
<td>472.00</td>
<td>443.62</td>
<td>850.00</td>
<td>1450.97</td>
</tr>
<tr>
<td>Variance</td>
<td>147.92</td>
<td>2.00</td>
<td>155.77</td>
<td>54.95</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.00</td>
<td>17.51</td>
<td>13.60</td>
<td>42.67</td>
</tr>
<tr>
<td>Maximum</td>
<td>42.55</td>
<td>23.43</td>
<td>65.66</td>
<td>76.00</td>
</tr>
</tbody>
</table>

**Table 6.2: Descriptive Statistics for the Network**

The outcome of the study clearly indicates that there was considerable amount of growth within the first and the second network. Hence, the network effect and the number of active users for the system have become key characteristics of user acceptance for WBL systems. The network effect will continue to affect perceived usefulness for the system until it becomes obsolete or it no longer has any active users.

### 6.6 Summary

This chapter was aimed to experiment the developed system, and evaluating the framework. The targeted students used the working version of the system and also reviewed the framework. The overall feedback from the students have shown that both the framework and the system have potential and can be deployed in an academic environment to enhance collaboration and sharing tacit and explicit knowledge and hence support the key objective of this research. However some students suggested that the working system should be run over a longer period of time to understand its usage statistics and to measure its real benefit in improving learning performance.
CHAPTER 7

CONCLUSION

7.1 Introduction

The main objective of this research was to evaluate the potentials of social computing tools in enabling the process of sharing of knowledge in WBLE in the context of higher education. The knowledge investigated was both implicit and explicit knowledge. The answers from the students have shown that not only are these tools useful for helping in learning and teaching process but they also facilitate the sharing of their knowledge. The aim of this chapter is to revisit the whole study and it provides a summary of the research work and some suggestions for future research.

7.2 Contributions of This Research

Based on the main findings, several contributions of this research can be identified. The findings contribute to the theoretical state of the art about KS in WBLE.

7.2.1 Theoretical Contributions

The overall contribution of this research is the development of a theoretical framework for studying the nature of KS in WBLE by integrating different theoretical domains: theories dealing with KS, social learning theory, ICT and social computing, SNA theory. Since the theoretical framework is based on considering KS as a social process, taking place within particular relationships of learners and within particular settings, it provides support to theories that stress the importance of the context dependent nature of KS [4].

The theoretical contribution is the application of the social learning theory on KS. Even though all social behavior can be described and analyzed, it has not
been elaborated on with respect to KS. This research has investigated the structure of KS behaviour in the WBLE.

7.2.2 Practical Implications

With the development of both the theoretical framework and the insights of this research can be used to enrich social network theory in a similar way. So far this theory has, as its primary concern the structural features of networks and their impact on what members expend and gain through participating. Network theory research concerns the impact of structural features as network density, centralization, fragmentation and structural holes [5]. Within network theory, the concepts of strong and weak ties between actors play an important role [10]. The research study can complement the social network theory by not only addressing the strength of the relations, but also by determining the nature of these relations.

The WBLE is to improve learner’s performances through participation in communications. The system will give lecturers/teachers specific recommendations in the form of interventions on the actual social network that can improve a student’s performance. The framework and the system developed in the research study can be extended to other contexts. Certainly system will be adopted in the teaching community and contribute to the success of students in various different contexts. Knowledge hubs in a class can be identified and those hubs can be encouraged to share knowledge with other students. Lecturers can possibly group weaker students with stronger students to promote the flow of knowledge.

7.3 Research Conclusions

Each chapter in this dissertation explained directly or indirectly the importance of the inclusion of social computing in disseminating academic knowledge in WBLE. The Literature survey (Chapter 2) was an in-depth study of three core concepts which are learning theories, KM, knowledge sharing social computing and social computing perspective for KS. The learning theory section discussed theories namely, behaviourist, cognitivist and constructivist learning
theory. The learning theories reflect the evolution of opinions of human learning, from traditional behavioural theories, an instrumental approach to teaching and learning, through cognitivist theories, providing a variety of ways with human development cognitively, and through constructivism, which emphasises knowledge is constructed and learning varies depending on historical and socio-cultural context. Undoubtedly, in this era, information technology is rapidly improving and the study into the understanding of human learning has its specific characteristics, for instance: drawing more attention to the web-based learning environment.

KM was discussed and appeared to be important in this research to identify approaches, models, and techniques of KS. Since this research is focused on the sharing of knowledge in WBLE using social computing tools, understanding the context in which KS exists is vitally important. This section reveals that a range of approaches have been applied in the past to using social computing tools in sharing knowledge. The following are important highlights of chapter 2.

It was observed that KM could be more enhanced using social computing tools. Most of these tools appeared to support particular KM aspects in different ways. But still, usage of these tools must be improved through some other initiatives.

In HEI, knowledge management is being vigorously undertaken in some institutes. Various initiatives are being initiated to ensure that KM is practised in higher education. The most important factor which appeared to be given little consideration by KM initiatives is academic knowledge which is related to research, assessing, teaching and learning. There are very few findings regarding management practices of this knowledge.

The key challenge in WBL is to encourage KS through social interaction, participation, and engagement in various forms. It is commonly argued that the use of educational technology improves learner participation and interaction in both traditional and online learning. However, recent studies have also found that educators and students are not always fully engaged in an active or sustained manner in activities that use information technology, and other studies have found
that learner participation varies significantly across individual courses and individual institutions. These inconsistent results brings into question whether the presence of education technology alone is sufficient to facilitate KS among learners. So the research work argues that the use of social computing perspective for KS and it was reported in the chapter 2. This part was essential and had to be explored since the main objective of this research was to investigate the usefulness of social computing tools in enhancing the sharing knowledge. Although the essence of social computing tools is based on participation and collaboration which could foster more KS, there are few findings which show that these tools are used for KS. The objective of this review was to determine which social computing tools exist, what social computing means, and what the current state of the art is in social computing technology. From this review of the literature there a variety of tools available in social computing that have potential to facilitate the sharing of knowledge about teaching computer science. The following are most important highlights of social computing section;

It can be observed that there is no consensus definition regarding social computing. A number of definitions of the term social computing were reviewed. However most of them are based on the services and values that are provided by new Web tools and applications which have changed the role of Web users in interacting with Web where they have a new role of contributing and shaping the Web contents. Based on the framework proposed in this research and research findings, social computing is the ‘architecture of participation’. In this part of the social computing section, several web tools such as Wikis, Blogs, social Bookmarking and Tagging, and Mashups constituting the features of social computing were discussed and examined for their general use. The important thing which must be noted regarding these tools is a group of learner is required to use them which align with the ‘architecture of participation’ and it can arguably be said that, the more they are used by the community the more their usefulness and values could be realised.
The next part of social computing section discussed in detail the extent to which social computing tools are used in higher education. It was observed that these tools are widely used in learning environment and they support range of aspects involved in education such as teaching and learning. However lecturers must be involved in mentoring the usage of these tools among students in higher education.

Chapter 3 primarily was associated with the basic research which was done in this research. The research took the form of questionnaires. The objective was to identify the views of students with regard to the sharing of knowledge using social computing technologies. Mostly their responses were comparable.

The questionnaire which also aimed at investigating the applicability of social computing tools in higher education as well as verifying whether they are useful in sharing of knowledge was divided into four main sections.

There are ten questions in the first section and set to focus on studying the individual behavior toward KS in term of knowledge sending and receiving from the students of higher education institutions located in Chennai. From the answers to the questions pertaining to the issue of knowledge sharing, it was found that individual behaviour among students toward knowledge sharing shown a positive finding. The analysis also shown there was a correlation between enjoymnts in helping others and self efficacy with knowledge sharing.

The second section of the questionnaire aimed at understanding to what extent students are familiar with social computing tools and applications. Generally the survey results from respondents has shown that students are aware of SC tools such as Wiki, Blog, RSS, Podcasting, Social Networking tools and forum although in utilising these tools students tend to interact more with their counterparts.

The third section of the questionnaire aimed at understanding whether students in higher education prefer to use social computing tools while learning.
The fourth section of the questionnaire intended to verify the usefulness of social computing tools in sharing knowledge.

The interesting thing is that there is some scepticism about some tools whether they are suitable to share knowledge, however they agree that they are useful. But due to this fading uncertainty of social computing tools students still prefer some other applications which are not related to social computing tools, such as MS PowerPoint and MS Word to share their knowledge. Nevertheless these applications in a virtual environment cannot support real time KS, as social computing tools do.

However lack of enough time for individual students to have a thorough training in these tools could be argued as the potential reason for scepticism on social computing tools. After obtaining the results, Chapter 4 endeavours to interpret the results of the analysis of all the data collected concerning the viability of sharing knowledge using social computing technologies and tools. The analysis has uncovered the fact that social computing tools have a great deal of potential in terms of the feasibility to allow sharing to occur.

The main aim of this research was to investigate the usefulness of social computing tools in sharing of knowledge within higher education context. The knowledge that was dealt with was the tacit and explicit knowledge related to their studies. The results showed that they are useful for that purpose.

One of the objectives of this research was to propose a set of social computing tools that could be useful for sharing of knowledge based on the findings. Hence from the findings the proposed tools that seemed to be useful were Wikis, Blogs, Podcasting, Forums and RSS. However there is some element of scepticism and recommendations have also been provided by some students in using these tools for sharing knowledge about teaching. Some have suggested that sharing must ensure the lecturer-students relationship is not violated during the process.

Also based on the objectives of the research, a framework was devised for social computing tools in sharing of computer science teaching knowledge. This
framework will be acting as a methodology that will guide higher education institutions in establishing social computing a technology-centred approach of KM initiatives aiming at the sharing of academic expertise within the academic context. The framework was devised basing on the research findings and the literature as well. The foundation of this framework depends upon the SECI model of KS.

Based on this framework the working system was developed to fulfil another objective of this research. This system constitutes all the necessary tools of social computing as proposed by students in KS enabled learning environment.

The main focus of the chapter 5 on KS analysis in WBLE is to provide to clear picture of what is happening in the WBLE when learners start sharing or communicating with other learners. Current Learning Management Systems (LMS) do not provide much information regarding the communication structure of the group, level of participation, group cohesion, and other structural characteristics of the discussion forum. The educators of an WBL system are not provided with those structural indicators that would allow them to evaluate the participation and interaction in their classes. In some cases, only statistical information, such as frequency of postings is provided, but this is not a very useful measure of activity or interaction.

So far, researchers have tried to study online interactions applying traditional research methods, like survey and content analysis. Text or content analysis is time-consuming, and although it may provide deep information about single participants or interventions, this analysis may neglect the relationships between the participants as its focus is on content but not on structure.

SNA techniques have been used in an array of situations and proved to be a successful approach to discover relationships that traditional methods had ignored [89]. Methods for quantifying interactions among group members can be used as sensors in online environments to assist instructors or students in establishing the quality of group interactions.
SNA techniques paired with recent developments in software for visualizations could help provide a clearer picture of what is happening in the WBLE. In this study, a web based class of 26 learners was examined in order to bring new insights on knowledge sharing. The study of this case, one online class, showed that SNA provided useful information about virtual interactions in asynchronous spaces. The SNA metrics and graphical representations were able to reveal structural characteristics of the group, identifying central members, bridges, and isolates in the class.

These techniques constitute a powerful tool as an analytic method for evaluation and monitoring of KS and online interactions. If embedded into LMS, they could bring social and visual aids for instructors and students, making them aware of social relationships developed in the class.

This line of research should be extended to more cases, for example with different audiences and class size. Similar or different patterns of interactions may be revealed. Other promising strand of research would be the investigation of patterns of interaction according to members' attributes, like gender, age, or educational background.

The framework and system developed were evaluated in Chapter 6. The outcome from the evaluation has revealed that the framework and system are useful.

The evaluation process was done through conducting interviews with some students after they had reviewed the framework and tested the system. What was interesting here was that some of the responses suggested that the tools could be expanded, modified and changed. Generally most of the students agreed that both framework and system are potentially useful. In the researcher's opinion, it could be argued that the overall implementation of framework and its system might yield a quality teaching and learning experience in the same way as the quality software product is produced. By using social computing tools the learners could have a potential collective ownership of a certain learning skills and approaches.
Generally speaking the results obtained from the analysis of the research findings, and evaluation of the developed system, most students have agreed with the main hypothesis of this research which is that social computing tools have potential in enhancing sharing of knowledge.

7.4 Directions for Future Research

This research work devised a framework for KS based on the social computing perspective for enhanced collaboration and sharing knowledge among students and educators. However, several additional research opportunities are available for future and extended analysis of the collective work in online environments. Continued research in the areas of KS and WBL seem to be important as more people are involved in open Internet spaces for learning opportunities. In order to be able to expand upon this research, several possible additions could be attempted.

Besides looking back on the research, this thesis concludes with looking into the future by providing some directions for further research. These research directions are partly based on the ‘shortcomings’ of this research, and partly based on the findings, which suggest further exploration or testing.

Investigation On Other Social Computing Tools: In this research, only select social computing tools were considered for KS in WBLE. An investigation of other social computing tools is essential in improving KS and KM in the higher education domain. In this research the social computing tools under consideration were Wikis, Blogs, and Audio and Video Podcasting with an RSS feeds. A wide range of other social computing tools exist, for example, Cascading Style Sheet, XML-based applications, AJAX technology, and SVG (Scalable Vector Graphics). The existing System could be enhanced to include these other social computing technologies to determine if any of these would further contribute to the ability of students and lecturers to share knowledge about computer science education. Furthermore social Networking tools seemed to have significant potential in enhancing KS practices such as Communities of Practice as claimed by Yang [202].
So its feasibility must be also explored to determine if they could nurture the sharing of knowledge about computer science education and incorporated into the current system.

**Towards Other Knowledge Management Process:** This research focused principally on the idea of collaborative learning and KS. A range of other knowledge processes exist within the scope of KM. The questions and interviews undertaken in this research were specifically geared towards evaluating the possibility of KS using social computing tools. Alternatively new questionnaires could be designed to assess the viability of using social computing tools for WBL to consider knowledge acquisition, knowledge evaluation, knowledge authentication, knowledge creation, knowledge capturing or any other knowledge processes.

**National and International Focus:** This research focused principally on HEIs in Tamil Nadu. To extend and expand this research it might be interesting to compare other states and countries with a similar educational background to determine if web based learning, in general, differ significantly from the results of the surveys and interviews in this research. For example, the results obtained from Tamil Nadu students could be compared to a survey deployed in Kerala. Similarly the results from the Indian could be compared with the ones in the UK or any another comparable country.

**Knowledge Acquisition:** The triadic method was used to uncover students’ views on both education and technology. It could be extremely successful and suggest that future interviews should incorporate other knowledge acquisition approaches in the research such as laddering, card sorting, 20-questions, Observation and Commentating.

**Scope Of The Evaluation:** The system was up-and-running for only short period of time and the evaluation process was done with few participants from educational environment. If there were more people in the evaluation process and the system was up-and-running for a longer period of time and was evaluated over that time, and could look at the range of usage statistics, and could undertake
periodic surveys, as well as look at what aspects of the system people are focusing on, and uncover shortcomings of the system and identify new potential approaches that could be employed within the system.

**Corporate Environment:** Other future work that might be done is to investigate the application of social computing tools in non-academic organisations or corporate environments in Indian that might foster KM practices. As we see KM is still a new field in the mainstream academics and it is found mainly in corporate business in India. However people are enthusiastic in using Web due to increase availability of broadband. So investigating KS and social computing tools could lead to encourage people to practise some form of KM and to provide a roadmap toward KM initiatives in academics as well as it is done in corporate environment.

**Attitude towards Knowledge Sharing:** The influence of attitudes toward KS intentions and behavior has been investigated rather extensively using the theory of reasoned action. However, few studies have examined their antecedents. Several researchers showed that the richness of channel for KS and one's absorptive capability to learn from others has a positive influence on individuals' attitudes toward KS. They argued that individuals with higher absorptive capacity are more likely to experience the benefits of KS resulting in more positive attitudes toward KS. Future research will benefit from focusing on understanding how to enhance positive attitudes toward KS.

**Role Of Motivation:** Furthermore, although the role of motivation has been recognized and emphasized in the KS literature [49] [68] [73], it is somewhat surprising that traditional motivation theories such as expectancy theory and social cognitive theory [35] have not been used as often in KS research. Future research should investigate KS using these theoretical frameworks given the insight these theories have provided in understanding other types of voluntary employee behavior such as participation in training and development [118].
In some HEIs student perhaps consider KS an extra-role behavior, i.e., it is not included in course descriptions, while in others it is considered an in-role behavior because KS is expected and is evaluated and or rewarded [179]. Future research needs to investigate whether there are differences in the type or quality of knowledge shared when it is considered an in-role versus extra-role behavior. Theories related to pro social organizational behavior and personality may be useful for increasing our understanding of KS when it is considered an extra-role behavior.

Finally, more research drawing upon the team composition literature is needed to increase our understanding of how to engage team members to enhance KS and positively affect team and organizational performance. For example, surface level and deep-level diversity (i.e., demographic differences and attitudinal differences) [76] within a community of practice may influence KS between community members. More KS may occur as the members learn more about the other members. Also, to better understand KS in teams, research is needed to investigate whether the frequency and type of knowledge shared differs based on the team's stage of development, especially when teams are managing multiple tasks [114].

**Reasons for Sharing Or Not Sharing Knowledge:** It is important to recognize that learners may decide to share (or not share) knowledge for various reasons. For example, as we reviewed earlier, research has shown that individuals may share knowledge because they enjoy helping others (or altruism) or as a result of reciprocation [93]. While reciprocation arguably has attracted most attention, the researcher believes there are other reasons that deserve further research attention.

**Impression Management and Attribution:** Learners may choose to share knowledge as a way to help develop personal relationships with peers or to simply manage their impression on others. These different intentions may influence with whom knowledge is shared (e.g., supervisors, co-workers within the same unit, or managers across units whom they do not know at a personal level). Learners' personal characteristics may also influence the extent to which they share knowledge for different purposes. Simultaneously, how KS intentions are perceived
and interpreted by others may also influence future KS behaviors of the knowledge recipient as well as whether the knowledge provider will be able to make a good impression on others, resulting in other benefits such as better performance evaluations and career advancement opportunities [19]. If KS behavior is attributed to impression management motives or politics, knowledge providers are likely to be viewed less favorably and the recipient is less likely to reciprocate by sharing knowledge.

**Power Perspective:** One major inhibitor of KS is that knowledge can be considered a source of power and superiority [71] [182]. Employees' unique knowledge often results in positive evaluations from human resource systems and personal gains such as cash bonuses, promotions, stretch job assignments, and protection from layoffs [85]. This creates a disincentive for KS because by sharing knowledge it becomes a common good and individuals lose their distinctiveness compared to others. Researchers have suggested the need to provide incentives to motivate employees to share their knowledge but few studies have directly examined KS from a power perspective [107] [161].

Studies of the role of learners' perceptions of how knowledge may serve as a source of referent, expert, and reward power are needed. Although individuals may refrain from sharing knowledge for fear of losing power it is also feasible that individuals can increase their expert and referent power by sharing knowledge. For example, high self-monitors may be more likely to identify circumstances when they could gain expert power through KS. As a result, high self-monitors might be more likely to share knowledge with someone with higher status such as their supervisor compared to a co-worker.

Concerns about losing power might be greater when sharing occurs in an electronic KMS where knowledge contributed is recorded and may be viewed by all users even those not making contributions. However, it might also be easier to gain power by sharing knowledge in a community of practice facilitated by technology because it is easier to reach a larger audience and therefore increase the likelihood of receiving personal recognition.
Issues Derived From Evaluation Apprehension: Evaluation apprehension inhibits KS [22]. Evaluation apprehension may result from self perceptions that shared knowledge is inaccurate, not valued, and likely to result in unfavorable criticism from others. How can evaluation apprehension be reduced? From a situational perspective, research has shown that organizational culture that emphasizes trust and innovation is conducive to KS. Future research is needed to examine whether such cultures help reduce evaluation apprehension by reducing the likelihood that knowledge shared will be critically judged. Bordia [22] directly examined the evaluation apprehension–KS relationship. However, the fear associated with possible negative evaluation also relates to one's self-evaluation. Although it was found that several studies have examined individuals' knowledge self-efficacy, research on related but unique concepts such as organization-based self-esteem (OBSE) is necessary to better understand the role of self-evaluation in KS.

OBSE, a core component of self-evaluation and a specific form of self-esteem, has been defined as “the degree to which an individual believes him/herself to be capable, significant, and worthy as an organizational member” [148]. Self consistency theory suggests that individuals tend to behave in a way that is consistent with their current views of self-worth [98]. Therefore, employees with high OBSE are more likely to share their knowledge with others because they believe they are capable and competent to contribute to the organization through KS. OBSE may also moderate the relationships found in the literature. For example, it is possible that although the trust and KS relationship tends to be positive, the strength of the relationship may be contingent upon the knowledge sharer's OBSE. Behavioral plasticity theory suggests that low self-esteem individuals are more likely to be affected by social and situational cues [27]. Therefore, individuals with low OBSE may be more affected by their level of trust with the knowledge recipient.

Similarly, recent research on a broad personality concept, core self-evaluations, which consists of global self-esteem, generalized self-efficacy, locus of
control, and emotional stability [91], may also contribute to our understanding of KS. It would be interesting to investigate if core self-evaluations influence KS through influencing perception of the usefulness of KS and reducing evaluation apprehension.

Furthermore, research investigating different types of interventions designed to help enhance one's KS-related self-efficacy is needed. For example, receiving organizational recognition, positive feedback on the knowledge shared, or feedback on how the knowledge shared has helped co-workers or the company may facilitate KS self-efficacy. When the value of one's knowledge is recognized by others, individuals may gain an enhanced self-perception of competency, credibility, and confidence [177] which increases the likelihood they will share their knowledge with others.

**Social Costs:** Research on hidden profiles focuses on how information sampling affects team decision-making [177]. The issue of social costs associated with unique information may help us understand why certain information/knowledge is less likely to be shared. Specifically, it is important for future research to examine when individuals are likely to share knowledge that might be inconsistent with others' knowledge. This is important from an organizational perspective because disagreement is likely to facilitate the development of new ideas, contributing to creativity and innovation. It is also possible that a learner might be less likely to share knowledge in a team or an online community of practice that may reveal mistakes or errors made by his/her boss or an influential peer.

**Knowledge Sharing As A Learning Experience for the Sharer:** One reason learners seek knowledge in an online community is to learn [196]. However, there are also circumstances when KS may be considered a learning process for the sharer. For example, learners high in learning goal orientation may perceive KS as a learning opportunity because they will not be able to successfully explain something well to their peers unless they fully understand it themselves. If learners are motivated to share knowledge with their peers but they are not sure if they are able
to communicate the knowledge in a manner in which it will be understood, they are more likely to use KS as an opportunity to deepen their own understanding and find a better way to organize and explain the knowledge before they share it. Learners high in performance goal orientation, on the other hand, are likely to be more concerned about demonstrating their competence and effectively perform while avoiding risks and negative judgments [54]. They may feel that KS depletes the time and effort available for other work activities that can result in greater personal benefits and rewards by exceeding expectations on performance goals [182]. Also, highly performance goal-oriented learners may not want to devote the time necessary to engage in exchanges with others who are attempting to understand and apply the shared knowledge to their work. As a result, they are less likely to share knowledge.

Moreover, in an online organizational community of practice, knowledge sharers may learn others' perspectives on the same issue or problem being discussed. Additionally, learners may share their ideas with others to further develop them and to facilitate creativity [140].