Knowledge Sharing and Knowledge Exchange in Distance Education Online Group Work

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***Abstract*—A literature review in e-learning technology, group work and activity theory revealed a knowledge gap as what knowledge activities happen or how collective knowledge works in the use of online group work technology in distance education. This article explores how knowledge could be exchanged and shared successfully amongst distance education students in their online group work activities. In particular, it discusses the types of technological tools that support the knowledge sharing and knowledge exchange activities. The research is articulated within an activity theory framework. It adopts a qualitative case study method using the data collection techniques participatory observation, documentation and online survey questionnaire. The research investigated student knowledge activities in a postgraduate subject called "Information Management in Organizations". It explored a learning management system (LMS) on a Sakai platform called Interact. Distance education students were grouped together to work online with team members geographically located in Australia and around the world. With knowledge sharing and knowledge exchange that happened through the project timeframe, students duly developed their assignment in Wikis for submissions. It was discovered that students could effectively use group work tools for their communication and storage of documents. A model of an activity system is developed to explain how knowledge exchange and knowledge sharing activities are represented through activity theory notions for distance education online group assessments. It also explains various ways of improving knowledge sharing and knowledge exchange activities.**

***Index Terms*—Knowledge sharing, knowledge exchange, online group work, learning and teaching, distance education.**

I. Introduction

There is research available on the use of online collaborative tools to create virtual workplaces for employees as the learning and teaching communities [13, 14, 27]. How people work collaboratively in virtual teams for work or learning purposes is well-researched. However, there has been limited research that investigates how students share and use their knowledge in online group project work assignments as online knowledge activities. This research explores the types of knowledge activities and the ways to improve these knowledge activities in online group work.

Working in the library and information science (LIS) sector requires the workers who not only have team work skills but also have working knowledge of collaborative tools and technology. To promote the skills needed in the LIS job market and to promote interaction among distance education students, group assessment tasks have been incorporated into several subjects in the mainstream curriculum of School of Information Studies. This research explored a subject named 'Information and Knowledge Management in Organizations' in a postgraduate subject undertaken in masters programs as Master of Applied Science (Library and Information Management) and Master of Information Architecture programs. Amongst these students, one of the students undertook the subject as an elective from a different program, Master of Information technology, offered by School of Mathematics and Computing.

In the subject, students in every group were asked to develop a case study for a selected organization of their choice to identify its information/knowledge deficiencies and propose solutions for information management and knowledge management (IM/KM) gaps. They were grouped in various groups of 3-5 students to develop their case studies. They used 'Interact', an online learning management system provided by of the university, for distance education online group work. Interact was built on the Sakai platform. Interact had multiple tools to support team work including: wiki, chat room (synchronous messaging chat), group mail, announcement and resources (media repositories). Each group was provided with an Interact project site for the group work purpose. Students were asked to develop their assignment in Wiki and use other tools for their communication and storage of documents. Students worked in virtual teams to complete their case study assignment. These students were geographically dispersed and therefore it was not possible for them to have physical face to face meetings. This research explores the kinds of knowledge activities that need to happen in order for distance education students to conduct online group work. It also proposes a model of such an activity system.

The structure of this article is as follows. Section II is a literature review. Section III explains that case study research method is adopted in this research. Section IV reports the findings and provides further discussions based on the findings. An activity system is developed based on distance education online group work showing how knowledge is shared, used and exchanged amongst the members. Section V concludes this article.

II. Literature Review

There are many benefits associated to the practice of group assessments in higher education. Group assessments have been commonly used in higher education institutions for a long time. The main reason for an inclusion of group assessments is to promote team work skills such as communication and leadership skills which are required by the employers nowadays. Further, teamwork is associated with higher-level learning outcomes [22] such as greater group work involvement, accountability of students as team

members within the group, redistribution of team power and promotion of team member autonomy as a student [11].

E-learning is a form of technology used for learning and teaching purposes. Group work can be facilitated using online technological tools in e-learning. Tennent, Becker and Kehoe [23] report that there is an overall shift towards a preference in the higher educational institutions to include group work assessments. This is contrary to the general opposition to group assessment traditionally encountered in tertiary students. Group work however has become salient in the consideration, design and development of assessments.

Research has shown that making activity assessable in some way is a great motivator when it comes to online tools [2]. Literature is also available to discuss the learning paradigms in relation to technology use. The most commonly listed learning paradigms are the cooperative/collaborative learning paradigm and the constructivist paradigm [16].

There is abundant literature discussing e-learning. Ad Hamid et al. [1], Kotzinos et al. [9], and Morales and Garcia [12] explore the use of learning objects in e-learning. Petal and Petal [17] focus their research on online learning systems. In the recent years, Reinhart [20] examines technology in learning and teaching in the digital frontier. He discusses the use of technology such as learning management systems (LMSs), learning objects, iPods, blogs, student e-mail, wireless connectivity, Google's search capacity, distance (web-based) education, and blended learning on the pedagogy of tertiary education. Winzenried [26] discusses generally the use of Interact tools such as chat, wikis and blogs for distance education in global learning. While the use of technology may relate to e-learning or how group work tools can be used, there is limited literature on specific use of tools for knowledge work in group assignment project particularly in distance education.

In recent literature, Wiki is a dominant tool used for group assignments. The use of wikis for educational purposes has become a popular topic in the recent literature. Many types of research that deal with wikis in education explain how a wiki is used to support a particular approach to learning. Wikis enable information sharing and collaboration which allow learners to be actively involved in their own knowledge construction [24]. Wikis have primarily been used in writing assignments, group projects and online/distance education although innovative uses in other areas can be found as well [16]. Some embedded wiki functions (visioning, tags, comments, linkers) support the monitoring of both the students' activities and their level of contribution to the collaborative work which makes it a challenging issue in assessing group works [23]. In collaborative class projects, wikis allow students to meet virtually at their convenience and work on projects together [5]. Because all comments/ideas are consolidated on one webpage, a wiki creates a clearer picture of team direction than to individual email messages [13]. In the previous work, how students could use technology for group work has been discussed. However, there is a significant paucity of research about what knowledge activities happen or how collective/ group knowledge could work in relation to the use of online group work technology in distance education.

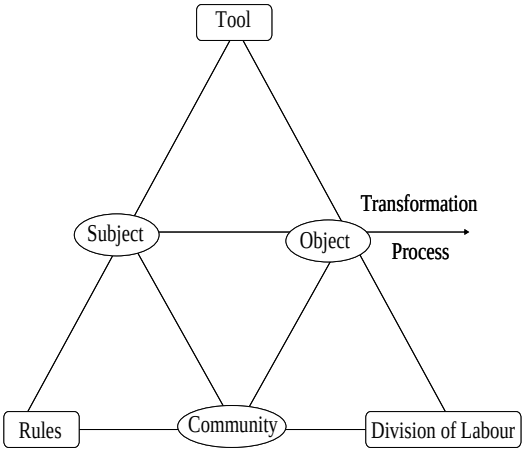

Figure 1. Basic Structure of an Activity [10]

In this research, it examines what knowledge activities happen in online group work. To analyse the underlining concepts better, activity theory as a psychological social cultural theory is used to explore student knowledge activity in online group work. Activity theory provides a theoretical framework to help understand how knowledge is used and exchanged in human interaction in online group work. Activity theory was developed from the original ideas of Soviet cultural historical psychologist Vygotsky [8, 4]. Activity theory is cultural-historical psychological having an origin in sociology [6]. Activity theory provides a helpful theory and framework within which one can base a software design [7].

TABLE 1 AN ACTIVITY SYSTEM IN THE PORTAL [10, P.36]

Operational-level support	**Action-level support**	**Activity-level support**
Tool, instrument (or artefact)		
Automating routines	Supporting transformative and manipulative actions Making tools and procedures visible and comprehensible	Enabling the automation of a new routine or construction of a new tool
Object		
Providing data about an object	Making an object manipulable	Enabling something to become a common object
Actor (or subject)		
Triggering predetermined responses	Supporting sense-making actions within an activity	Supporting learning and reflection with respect to the whole object and activity
Rules		
Embedding and imposing a certain set of rules	Making the set of rules visible and comprehensible	Enabling the negotiation of new rules
Community		
Creating an implicit community by linking work tasks of several people together	Supporting communicative actions Making the network of actors visible	Enabling the formation of a new community
Division of Labour		
Embedding and imposing a certain division of labour	Making the work organisation visible and	Enabling the reorganisation of the division of

Operational-level support	Action-level support	Activity-level support
	comprehensible	labour

This research adopts Kuutti's [10] activity theory framework as in Figure 1, which is well referenced by researchers in human computer interaction. It is most relevant to this research about online group work. Kutti [10] provides clear explanations for the use of theoretical notions in Table 1 for analysing an activity system. In particular, his theoretical notions will be used in the Section 4 when discussing the case study (with empirical data) involving the knowledge activities in online group work. This paper argues that an LMS needs to be properly planned and designed to articulate the improvement of knowledge activities in online group work.

III. Research Method

This research adopts case study research method. It uses data collection techniques such as participatory observation, documentation and survey questionnaire to investigate how technology support online group assignments. Content analysis is also used to conduct further analysis of certain details of the collected data.

A. Research Context and Research Design

A small class-sized subject was chosen as this research aims to qualitatively examine knowledge activities. A small class size should be selected so that the researcher could make more effective and careful examinations in this qualitative research. Initially, 37 distance education students who undertook a postgraduate subject were involved in this research project before the start of the semester. 8 groups were initially formed as virtual teams with 4 or 5 members (i.e. 5,5,5,5,5,4,4,4 members). The students were notified of their group formations via emails. After the enrolment cut-off census week of the semester, the postgraduate cohort had 26 students remaining. Amongst them, only 17 of them left in 4 groups (5,4,4,4) completed the subject at the end of the semester. The high number of withdrawals was due to various reasons commonly identified as work or personal commitments. Some students withdrew due to they saw that collaborating with distance education students dispersedly located in Australia and overseas in the subject was too challenging and time-consuming for them in their time commitments. Before the beginning of a semester, the subject coordinator decided for the postgraduate cohort of students to use a set number of predetermined features and tools in the Interact with the optional use of public freeware for interaction and communication in distance education.

The group members were given project site owner rights of the Interact which allow each group and its members the rights to add, edit and delete using all tools. There were two assignments involved in each of the subject. Both the assignments required the group members to work together. Assignment 1 particularly required all members to contribute work in a group wiki report. Assignment 2 only required members to communicate and agree on some ground rules on working on their individual assignments, so that all members chose different sub-topics. Hence, all submissions were different. For the purpose of this paper, we only focus on group work in the first assignment (a case study project to be completed by each and every group).

B. Observation

There were two main data collection techniques used in this qualitative case study research. The first is participatory observation. It was performed allowing the subject coordinator to view instant messaging happening during or after the chat room activities. The subject coordinator was able to send, receive and reply group emails in all project sites. The subject coordinator observed when group members edited Wikis. The subject also viewed all posted messages in forums. The subject coordinators were also able to read group announcements and view their calendared events in various project groups. Participatory observation also included any groups that invited or made an arrangement for the subject coordinator to use Skype with an entire group with all the members if it was needed in any group assignment discussion. As the subject involved a lot of interaction with the subject coordinators in all groups, this data collection technique provided very rich inputs to the details of knowledge activities.

C. Documentation

As there was a Resource option in the Interact, all groups could upload commonly shared learning materials and web links to external resources. The material resources form a major part of documentations in this research. Recorded messages in forums, chat rooms, announcements, calendars and group emails were also important parts of documentations. Even the submitted assignments were a form of documentations in this research. In qualitative evaluation, content analysis is the process of identifying, coding and categorizing the primary patterns in the data [19]. In this research, qualitative content analysis is performed to examine coherent categories, trends, patterns and themes in documents [21, 18). Data collected from documentations were used for triangulation when comparing/ contrasting them with data collected in participatory observations. Both the data collected from documentations and observatory participation went through a process of qualitative content analysis.

IV. Findings and Discussion

Using the activity theory for analysis, it was discovered that various Interact features (e.g. forums, chat rooms, wikis) were used in knowledge activities by different groups in different ways in their group assignment projects. Every group member was an actor or subject. All members in a group formed a community. Their discussion topics or central themes in meetings were objects. In the community, members adopted rules that regulated the group communication and steered the group dynamics. There was a division of labour whereby every member made an effort in the group work interaction and contribution. The following are fact-findings obtained from this research.

A. Using Technological Tools in Internet

As in Figure 2, a group assignment project site with useful enabling Interact features (as tools in activity theory) was created for use by every group. All members have owner access (add, edit and delete) rights to their relevant project sites. Major tools used include *announcement*, *calendar*, *chat room*, *group email*, *resource*, *forum* and *wiki*.

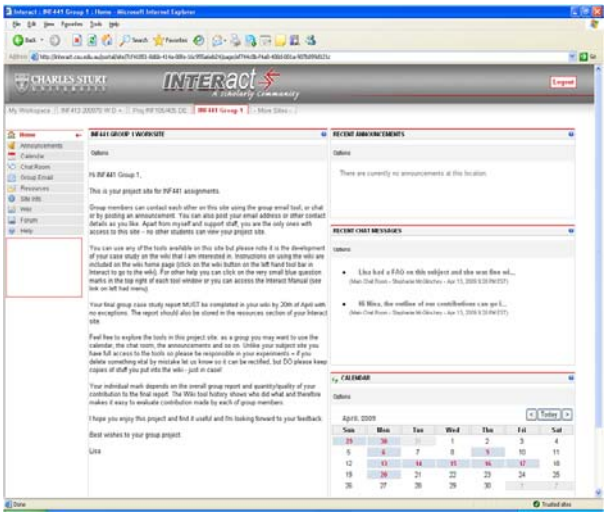

Figure 2: An Example of a Project Site

Students observed the key instruction information about the project on the project home page as in the central larger text area in Figure 2. The top right text area with a single line of text indicated the latest subject heading of the announcement in Figure 2. All postgraduate student groups were able to use the **announcement** tool to make an announcement to the group. It will display on the project site home page for a chosen timeframe set by a project site owner (any group member). The announcement can also be sent out as an email to all group members by selecting a choice in an email notification drop-down box (high - all participants; low – only participants who have opted in; and None – No notification). Many group leaders used it to announce chat room meeting time, additional uploaded materials for knowledge sharing that enabled group work in 'Resources', etc. The announcement is a great tool. It helped make an announcement as well as selectively send out the same message as an email to all participants of the project site. However, the lack of training and poor knowledge of the tool Announcement allows all members in a group to share a common understanding and be provided with some key instructions about the undertaking of the project. However, the lack of training and poor knowledge of the tool hindered its use. Not all groups used the tools.

Right under the announcement on the right hand side in the home page showed the most recent chat session by indicating a few chat room messages. **Chat room** was important for group collaboration. It was popular in many groups for collaboration where knowledge exchange took place in their group projects. All postgraduate groups used chat rooms in brainstorming ideas in which members shared the understandings and experience of other members. In the group assignments, the selected case study was about performing an information audit in order to address the information deficiency and knowledge gap. All members had to study the case together by visiting the organisational materials, knowing the organisational work procedures and critiquing the present work system before recommending solutions. Group members exchanged thoughts, shared mutually agreed ideas and collectively decided what were best solutions to the problems in their case study. Every group member simply read all provided shared materials. They were well aware of all chat room meeting messages. From casual chat to assignment related chat, members used this tool for effective rapport and knowledge building to complete the assignments together. Figure 3 shows a snapshot of chat room communications of a postgraduate group.

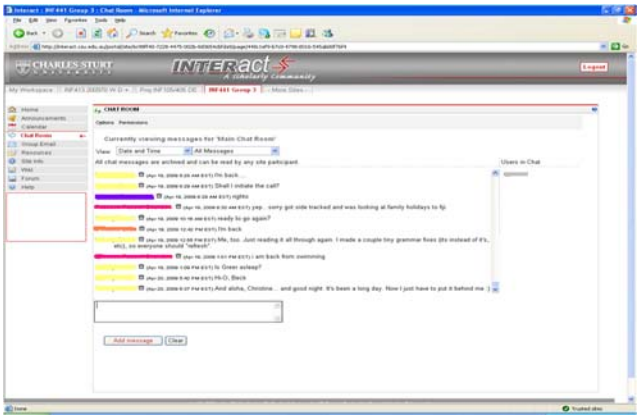

Figure 3: An Example of Chat Room on a Project Site

From the investigations of assignment 1 wiki reports, various teams revealed that discussions generally took place amongst members at their mutually agreed dates and times amongst postgraduate groups. However, they remarked their differences in time zones, English fluency and culture were barriers in their communication and collaboration. Chat room displayed permanently recorded chat messages in the project site. Few postgraduate groups initially used the freeware Skype for communications but noticed that the chat room in Interact had the advantage of permanently showing each and every recorded messages in their virtual meeting when they did not have to take minutes. With a different colour designated to each member's name, a group could easily see who said what in which meeting clearly.

All postgraduate student groups scheduled meetings in chat room and participated actively. Many groups also used supporting tools like calendar or announcement to remind members of the meeting dates and times. In the chat room, mutual knowledge and understandings were formed. For example, a group would discuss and agree with what, why and how they wanted to do in the individual work tasks. In various groups, members appeared to have a same wavelength in their thoughts. It was noticed that should a member be not able to make a chat room meeting, the member would inform the group in advance in a previous chat room meeting. Sometimes, a member who could not make a chat room meeting due to unexpected sickness would have a group email sent to the group on or before the day of meeting.

A **calendar** is by default displayed at the bottom right hand side of the home page of the project site. The bottom right text area in Figure 2 displays some marked dates of important meetings and assigned task completions of a postgraduate group. With the calendar feature, every group set up meeting times, project tasks and activities on their monthly calendar. When the calendar is put in an editing mode, every group could choose to display the daily, weekly, monthly or yearly calendar when setting a meeting, activity, web assignment, cancellation, deadline, etc. Calendar could be used to schedule the frequency of their group work knowledge exchange activities such as their chat room meetings and durations of feedback for their scheduled forum topics. It was observed that calendar was not a popular tool that the postgraduate student groups could effectively use to mark events and set reminder dates in their project. Examining the items marked in the calendar, it was found that lecture, tutorial, class session, examination, computer session for face-to-face interaction were not appropriate for distance learners' use. Unlike the Microsoft Outlook calendar, the calendar in Interact did not effectively send a reminder message to the team member to remind them of a meeting or task completion.

Any member could always send a **group email** to all fellow members from a project site. This tool was popular as all group emails were sent to the selected personal email accounts of all members as in the student enrolment details with the university. From the investigated group emails, it was found that they were used for many purposes. Figure 4 shows how Interact was used for members to email the group about any assignment and non-assignment related issues.

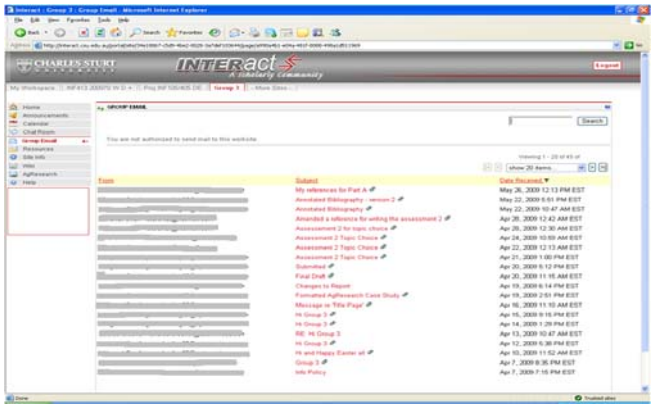

Figure 4: An Example of Group Email on a Project Site

Group emails were favourably used when a member informed other members about the individual task progress, a member needed to seek advice, the group wanted some suggestions from all members, it was due time for the completed work to be provided for group checking, etc. As many group members worked part or full time and could not be contactable for group project discussion at all times, the group email became useful. The email attachment features was popularly used. Through the analysis of documentation of assignment wiki reports and participatory observation, the investigation revealed that several groups used the group email tool to send their part of work as assignment contribution in an email attachment to the group for comments.

'**Resources**' was a tool in Interact that allow any team member to upload their materials or share some web links. The shared contents form a strong basis of group knowledge. There was a mutual understanding in some groups that all members must read the shared uploaded materials especially before a next scheduled meeting. 'Resources' was great and useful for group information sharing and using it allow all members of critical knowledge to continue their talks at the same wavelength. It was popular and used in many groups. All postgraduate groups used this option. Resources uploaded by students include their findings of websites related to their case study group assignment, reading materials for sharing, group meeting reports, etc. They created different folders to keep different categories of shared materials.

Forum was provided on the request of postgraduate students. While the forum messages were posted to all group members, they were also posted to the subject coordinator for the group work monitoring purposes. Two out of the remaining four groups used forums for communications. It was observed that they preferred forums as their posted forum messages remained as recordings in the project sites. These same forum messages were also sent out as emails with attachments to the members in their groups. Any member could reply and followed up with a forum topic. Using this method, the few groups that use forums had a common understanding of what they wanted as a solution in an issue that they would like to address. Forum discussions were great for these few groups to seek viewpoints and common agreement in some issues in their assignments.

Wiki was the only tool that all groups use. It is because all students were informed in the assignment specifications that the final version of every group's documented work on the wiki was used in marking immediately after the due date. No editing was allowed after the assignment due date and the marker could detect any changes made on the project site after the due date. Students could choose to present their group work as a single web page document as in Figure 5. This single web page is longer and need to be scrolled down to read further. Optionally, groups could also present a single wiki page with various links showing content headings. These links could like to further web pages showing section contents.

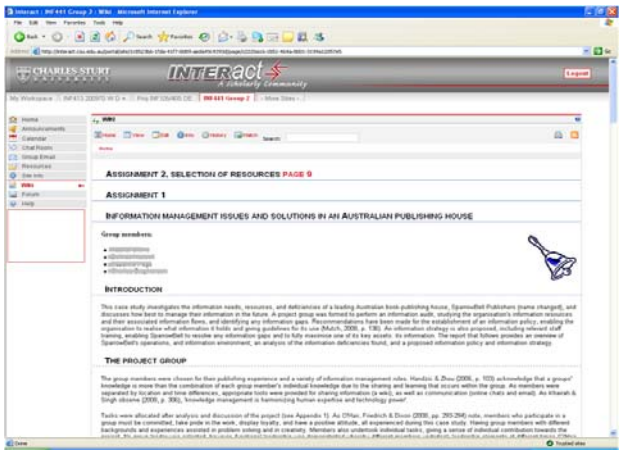

Figure 5: A First Example of Wiki on a Project Site

The wiki reports allowed members in all groups to show

the knowledge of the part of report tasks they conducted. Legitimately, the task owner produced it with a single person's knowledge. However, collective knowledge is used in checking to verify the produced work. It is discovered that through negotiation and agreement, members in many groups modified, edited and polished the contents before the assignment due date. A few group had peer-check done on individual tasks but usually an appointed editor as a group member to edit the entire report.

Some comments were found from the assignment reports and emails about a class concern on wikis as follows. Some project groups remarked that the option to use a single web page document wiki is more suitable in academic report writing. Using the style of a single wiki page with various content headings that link to several web pages later quite was technically proper webpage design, but was not well regarded as a good report by some groups, seen in their chat room discussions. Through a few telephone calls to the subject coordinators in student consultation, students reported frequent downtimes of Interact and the impact on their inability to access it to complete assignment in time. In the survey results, it was reported that using wiki for reporting as assignment was a new experience to many of them. A few students pointed out a significant weakness of wiki - when two or more members edited a project wiki at the same time, they could not have all their work saved successfully. Some work was lost and unexpected changes happened.

B. Discussions

Table 2 below shows the use of Interact tools by the postgraduate student groups. All groups involved Australian domestic students. In a few groups, one or two members resided overseas when time zone differences was a big challenge for members to attend meetings together regularly - a meeting could take place in the day for some and the night for others. Some student member lived in very far-away places and countries such as New York and Qatar.

TABLE 2: TECHNOLOGY USED BY POSTGRADUATE STUDENTS

Tool\Group Number	Group 1	Group 2	Group 3	Group 4	Total
Announcement	×	✓	✓	×	2
Calendar	✓	×	×	✓	2
Chat	✓	✓	✓	✓	4
Group Email	✓	✓	✓	✓	4
Resources	✓	✓	✓	✓	4
Wiki	✓	✓	✓	✓	4
Forum	×	✓	✓	×	2

Using technology effectively, the postgraduate students collaborated well and perform tasks in their expertise or preference areas despite of time zone differences. They adopted many tools in the Interact project sites. Although some team members were new to each other at the inception, they worked cooperatively in order to achieve their common goal. Initial challenges posed by location (interstate and international) and time differences were overcome. The members in all postgraduate project groups selected an organisation for the case study, divided initial tasks with purpose and flexibility to achieve the goal. Knowledge activities were shown in the Interact group work tools particularly in forums, chat rooms, resources, wikis and group emails. These tools demonstrated a great deal of knowledge sharing, knowledge exchange and knowledge use. The interaction and communication tools recorded very rich sharing of knowledge, exchange of thoughts and believes and selective knowledge use.

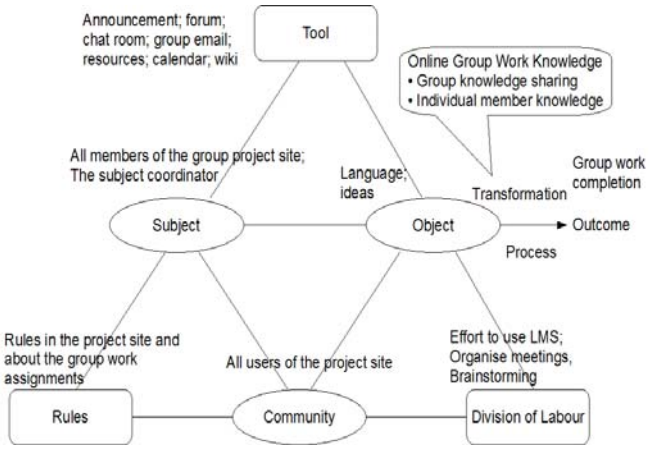

Figure 6: An Activity System

Turner, Turner and Horton [25] highlight that an activity is described as a human activity system whose components include those who carry out the activity, the tools and concepts used, the object, the community in which it takes place and the rules governing the conduct of that community. Figure 6 is developed to model an activity system of a distance education online group work in any of the project sites. In the system, the subject coordinator and all group members of project site are subjects/actors. Interact features like calendar, forum, group email, resources, chat room, and wiki are tools for communication and interaction in the knowledge activities. Language and ideas are objects in communications and interaction. All users of a project site were actors who form a community. There are rules set by all project site users about the group work and the assignment task handling. All users are to commit to meetings, brainstorming and sharing of tasks in their division of labour.

Many postgraduate groups consisted of members that ensured they could do their best so that their group work was successful. Postgraduate groups were proactive with their sharing of group information and knowledge while having to handle individual member tasks. It was observed that constructive feedback was provided between members. Regular review of work and process was encouraged amongst the team members. A group report revealed that the group members willingly volunteered to 'take on their share' therefore reducing the tensions and difficulties in their group work. Almost all postgraduate groups worked efficiently together. In a particular group, they made an exceptional initial group telephone conversation (teleconference) on Skype. The subsequent meetings were conducted according to proper meeting procedure with agendas, motions and minutes, distributed to all members via the calendar in Interact. More interactive exchanges between the scheduled teleconferences were recommended. It was found that in one group, a group member withdrew from the unit towards the end of the semester for personal reasons. The remaining

members volunteered to carry out his work as the additional load to them. They demonstrated skills in planning, coordination, willingness to share work and taking a leadership role in many members.

V. Conclusion

Although e-learning is prevalent, there is limited research on how knowledge activities happen in online group work, especially in distance education. This research discusses how knowledge sharing, knowledge exchange and knowledge use could happen in the knowledge activities in a human activity system involved in distance education online group work. The qualitative case study research explored how student worked in group assignment work online through the use of technology for collaboration with fellow members in distance education. In particular, it explains how each type of group work tools such as calendar, resources, forum, chat room, group email and wiki were used for interaction and communications.

Through the activity theory framework, it reflects a theoretical understanding of how knowledge use, knowledge exchange and knowledge happen in distance education online group work. In the discussions in reporting, it also suggests ways of improvement to the use of technology to further support knowledge activities. This research provides a theoretical activity system showing how knowledge sharing, knowledge exchange and knowledge happen in human activities through online distance education group work.

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