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MICRO-COLLABORATIONS IN PIAZZA

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Abstract:

Social question answering (SQA) services are social media applications rich in micro-collaborations where users ask, answer and rate content interactively. Information Systems (IS) research paid considerable attention to applications like SQA services that revolutionize business practices. However, very little research focus on how SQA services influence education in IS discipline. The study examined knowledge, cognitive process and social dimensions in micro-collaborations. The study maps the dimensions of collaborative learning to the four IS skills thus emphasizing the skills gained by IS professionals while using SQA services in IS courses. This study thus demonstrates to the IS community that by using a SQA in an IS course, the students acquire skills required for IS profession such as collaboration, negotiation, communication, analytical and critical thinking.

Keywords: social question answering, micro-collaborations, IS Skills, collaborative learning

I. INTRODUCTION

Today we witness a burgeoning phenomenon where companies have adopted social media platforms like Social Question Answering (SQA) services for supporting knowledge sharing among customers and employees. SQA services are rich in micro-collaborations, where individuals ask and answer questions with each other among the community to share their need and knowledge. Companies like IBM, CISCO, and APPLE were early adopters of SQA services for engaging customers and employees to harness the power of collective intelligence, manage customer relationships and lower operational cost. Other examples of SQA services used in community are queries in government websites [Chua et al., 2012] and inquiries in library websites [Shachaf, 2010].

The Information Systems (IS) research has paid considerable attention to how social media applications like SQA services can revolutionize business practices and build new business intelligence [Morris et al., 2012]. On the other hand, in IS education, researchers have focused on the use of social media applications like social networking and wikis [Kane and Fichman, 2009] in online learning. A recent study in IS education [Waters and Gasson, 2012] explored how student learning via asynchronous discussion boards may be managed successfully. However, there is very little studies that engage in understanding how SQA services influence education in IS discipline. In particular, how the micro-collaborations in SQA service enhance collaborative learning in an IS course

Micro-collaborations in SQA service are referred to as brief, informal episodes of collaborative information seeking [Gazan 2010]. In other words, micro-collaboration involves mutual interest and mutual effort to seek or address an information need. Further, micro-collaborations have gathered interest in the IS educational domain because of new ways of engaging students in collaborative learning [Brown, 2012], for example, user endorsements, collaborative answers, and follow-up discussions.

Thus, micro-collaborations stimulate different knowledge, cognitive and social skills for learners and hence the implications of understanding micro-collaborations are important. In IS discipline, only limited literature has discussed how micro-collaborations prepare learners with the skills required for collaborative information seeking or sharing at their workplace [Brown, 2012]. For these reasons, the purpose of this study is to investigate micro-collaborations and the dimensions of the learning process that influence collaborative learning. This study use PIAZZA

an SQA service in an IS course and analyze data collected from two semesters with a total of 15 students to evaluate the micro-collaborations and the dimensions of the learning process.

II. LITERATURE REVIEW

This study review various strands of research to interweave them together namely various computer supported collaborative learning (CSCL) theories and research in IS education.

COMPUTER SUPPORTED COLLABORATIVE LEARNING (CSCL)

Collaborative learning is a group-based learning approach where learners participate in the learning process to achieve a goal [Dillenbourg et al., 1996]. Computer supported refers to using technologies to facilitate face-to-face interactions. Today, with the advent of social media and ubiquitous technologies, the boundary between computer supported collaboration and other forms of collaboration is vanishing. Previous studies related to CSCL have produced complex set of models, ideas and results based on various theoretical and methodological approaches as listed below [De Wever et al., 2006].

Bloom's Taxonomy is a hierarchical model for examining learning outcomes [Bloom et al., 1956]. Bloom's Revised Taxonomy [Anderson and Krathwohl, 2001] includes the knowledge and cognitive process dimensions. Bloom's Taxonomy has been used in IS education to examine learning outcomes [Johnson and Fuller, 2006]. Moreover, in a recent study [Lin et al., 2013], the Revised Bloom's Taxonomy was adopted to analyze and represent students' discussion on social media (e.g. Facebook) in terms of knowledge and cognitive process dimensions.

The community of inquiry model is used for analyzing on line education in terms of interactions among participants to achieve deep learning [Garrison and Cleveland-Innes, 2005]. The community of inquiry model consists of teaching, cognitive, and social presence. Social presence in communication is described as having the presence of communicating participants and how such presence facilitates relationship building and interaction in communication [Short et al., 1976]. Social presence has emerged as one of the major concepts in online learning [Rourke et al., 1999; Kim et al., 2011; Remesal, and Colomina, 2013]. Another study used social presence to understand how social interaction among learners help in constructing collaborative knowledge [Garrison et al., 1999].

According to social constructivism, knowledge is co-constructed by the interaction of participants in a social context [De Wever et al., 2010]. Collaborative knowledge construction happens when learners are able to discuss ideas and share opinions among other participants in a learning community [Gunawardena et al., 1997]. Weinberger & Fischer, [2006] proposed argumentative knowledge construction based on the assumption that students construct arguments in interaction with their learning partners in order to acquire knowledge. Argumentative knowledge construction facilitates deep thinking among learners [Kuhn, 1991] and influences decision making in a methodical fashion [Sandoval and Millwood, 2005].

Based on the literature reviewed, this study extends pervious work [Blooma et al., 2013] and use an integrated framework to examine how learners demonstrate knowledge, cognitive process and social dimensions in micro-collaborations while using SQA services for computer supported collaborative learning in an IS course. Thus, to investigate various dimensions of micro-collaboration influencing collaborative learning in IS education, as review of IS education and profession is given in the following section.

RESEARCH IN INFORMATION SYSTEM (IS) EDUCATION

The discipline of IS has emerged as a result of the interaction and integration between computer science and social science domain. The creation of this discipline was an overarching necessity to understand the complex inter-relationships among technology, user behavior and social structures [Sidorova, 2009]. The technological advancement not only provides the backbone for

information processing in organizations, but leverage critical changes in the fundamental ways organizations and information system professionals interact and integrate in a community [Lee et al., 1995; Sidorova, 2009]. Therefore, emerging IS professionals should be equipped with the rapidly changing requirements of the IS profession and one of the avenues to achieve this objective is through IS education [Lee et al., 1995; Dodson and Giorcelli, 2008, Topi et al., 2010]. Thus, the use of technological advancements in IS education will foster the mental model of emerging IS professionals and to equip them with the skills required for their workplace.

IS profession have seen rapid changes over the past few decades. Some studies suggested that industry will demand an IS professionals with knowledge and skills not only in technology but also in business operation, management and interpersonal skills to effectively lead organizational integration [Lee et al., 1995; Sidorova, 2009]. Therefore, the requirements for IS professionals are becoming more demanding in multiple dimensions, particularly in the areas of business functional knowledge and interpersonal, management skills [Lee et al., 1995]. The highest level outcome expectations can include high level IS capabilities such as improving organizational processes, exploiting opportunities created by technology innovation, understanding and addressing information requirements, designing and managing enterprise architecture, identifying and evaluating solution and sourcing alternatives, securing data and infrastructure & understanding, managing and controlling IT risks [Topi et al., 2010].

Many scholars have worked on the required IS knowledge and skills and particularly on the IS curriculum in IS education. Lee et al., [1995] proposed the 4 critical knowledge and skills for IS professionals are knowledge of technology management, business functional knowledge, interpersonal and management skills. Latest IS Education 2010 by Topi et al., [2010] provided a clear analysis and guidelines on the required knowledge and skills. The authors listed the three key knowledge and skills namely IS specific knowledge and skills, foundational knowledge and skills & domain fundamentals.

Thus, from the three different strands of literature reviewed it is evident that use of SQA services in higher education promotes various levels of skills required for IS professionals like information acquisition, dissemination, organization and sharing at different levels of use. The requirement of these skills are re-emphasised on the review of IS education as it is the complex inter-relationships among technology, user behaviour and social structures. Micro-collaborations in SQA have been evidenced to promote skills like mutual interest and mutual effort and stimulate altruism and need for interaction. Hence, it could be concluded that micro-collaborations in SQA aid IS professionals to promote the four critical skills required for IS listed as knowledge of technology management, business functional knowledge, interpersonal and management skills. To evaluate these skills, knowledge, cognitive processes and social dimensions are used in this study to map the four IS skills. Hence, this study analysis the micro-collaborations in SQA used in an IS course to understand how the three dimensions routes to the skills required for IS professionals.

III. METHODOLOGY

This section describes the procedures for data collection and analysis involved in this study. The integrated framework is first summarized. The SQA service, PIAZZA used for this study is then elaborated. The data collection method is then explained. Finally, qualitative content analysis of the data collected used for this study is described.

INTEGRATED FRAMEWORK

The study first extends previous work [Blooma et al., 2013] and use the integrated framework on PIAZZA, an SQA service, for collaborative learning in an IS Course. The integrated framework is summarized below.

Knowledge Dimension

The knowledge dimension refers to the type of knowledge that learners acquire or are able to share during the process of learning [Anderson and Krathwohl, 2001; Lin et al. 2013]. The

four types of knowledge dimension that learners acquire or share during micro-collaborations in SQA are factual, conceptual, procedural and meta-cognitive knowledge defined as follows:

Factual Knowledge (KF): The basic elements that student must know to be acquainted with a discipline or solve problems in it

Conceptual Knowledge (KC): The interrelationship among the basic elements within a larger structure that enable them to function together

Procedural Knowledge (KP): How to do something, methods of inquiry, and criteria for using skills, algorithms, techniques and methods

Meta-Cognitive Knowledge (KM): Knowledge of cognition in general as well as awareness and knowledge of one's own cognition

Cognitive Process Dimension

Cognitive processes describe the level of cognition occurring in learning processes. The cognitive process dimension is classified into six hierarchical levels: remember, understand, apply, analyse, evaluate, and create [Anderson and Krathwohl, 2001; Lin et al., 2013]. The six levels are defined as follows:

Remember (CR): Retrieving relevant knowledge from long-term memory

Understand (CU): Determining the meaning of instructional messages, including oral, written and graphic

Apply (CA): Carrying out or using a procedure in a given situation.

Analyze (CN): Breaking material into its constituent parts and detecting how the parts relate to one another and to an overall structure or purpose.

Evaluate (CE): Making judgments based on criteria and standards.

Create (CC): Putting elements together to form a novel, coherent whole or make an original product.

Social Dimension

The social dimension focuses on community commitment and co-construction of knowledge. The community commitment in micro-collaborations is measured using social presence and social mode of argumentative knowledge construction. Social presence is defined as the ability of learners to project themselves socially and affectively into a community of inquiry [Rourke et al., 2001]. The social mode of argumentative knowledge construction is referred to as the degree to which students acknowledge contributions from the learning partners (Weinberger and Fischer 2006). The elements of social dimensions are listed as follows:

Affective Responses (SA): The expression of emotion, feelings and mood. Affect is expressed in computer conferencing in a number of ways, including the use of emoticons, humor and self-disclosure

Interactive Responses (SI): Evidence that the other is attending is a critical feature in promotion of socially meaningful interaction

Cohesive Response (SC): This category is exemplified by activities that build and sustain a sense of group commitment

Social Mode of Argumentative knowledge construction (SR): Extent to which learners refer to contributions of their learning partners

PIAZZA

Piazza[1] is a social question answering service that helps students to interact among themselves and with their teachers. Piazza can be described as a mixture between a wiki and a forum that can be used with learning management system. Piazza is free and available online for all the teachers and students around the globe. The open and interactive nature of Piazza offers a collaborative learning environment where students are encouraged to ask questions and share answers. Piazza emphasizes on seeking help from peers, collaborative thinking, and the formation of a community having similar information needs. Students have the freedom to create their own profiles like any other social media application. Piazza also supports wiki-style collaborative answering by students and facilitators.

Piazza offers numbers of activities that participants can do such as posting questions, posting answers, posting comments to an answer, endorsing answers, endorsing questions which create an interactive environment. Piazza provides to course instructors with statistics on the participation of overall courses like total contribution, messages, number of questions, number of answers, average student response. It also provides each individual participant's details such as each individual's day online, posts viewed, number of total contributions, number of question asked, and number of answers. Figure 1 and Figure 2 provide the screenshot of class report and class statistics which includes all the snapshot and statistics regarding the participation of the whole class and each individual in Piazza.

DATA COLLECTION

Piazza was used for students pursuing their bachelors in Business Information Systems (BIS). The course was offered as full-time and students had the facility to access Piazza during the scheduled teaching hours. Piazza was used for micro-collaborations both during and outside the scheduled teaching hours. Piazza was used for teaching and learning since facilitators and students were able to exchange questions and answers in an interactive online environment both during and outside the scheduled teaching hours. All students whose micro-collaborations are used in this research have already completed the course. A total of 15 students participated across two semesters. The students' participation in Piazza was voluntarily and there were no rewards given for their participation during the course. Students were with an average age of 21. A total of 286 contributions were received over 2 semesters. These micro-collaborations namely, questions, answers, comments, follow-ups, and endorsements were analyzed in depth.

Thus for this study, the unit of analysis is a message. A message in Piazza is questions, answers, comments or follow-ups, but does not include endorsements or edits. Previous research have used message as the unit of analysis for content analysis and has been widely researched [Garrison et al., 2001; Anderson et al., 2001].

CONTENT ANALYSIS

A quantitative analysis of the data collected was initially done to gain an insight regarding the participation and interaction of students in the SQA service [Lin et al., 2013; Rose et al., 2008; Weinberger and Fischer, 2006]. The number of contributions and responses indicates that relatively good discussion and interaction happened in the SQA service. The two groups of students including fifteen students and one teacher contributed a total of 53 topics with 64 posts, 286 contributions. All the students participated in answering questions as well as in follow-up discussions which indicates that 100% of the students expressed their mutual effort and mutual interest in micro-collaborations.

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[1] www.piazza.com
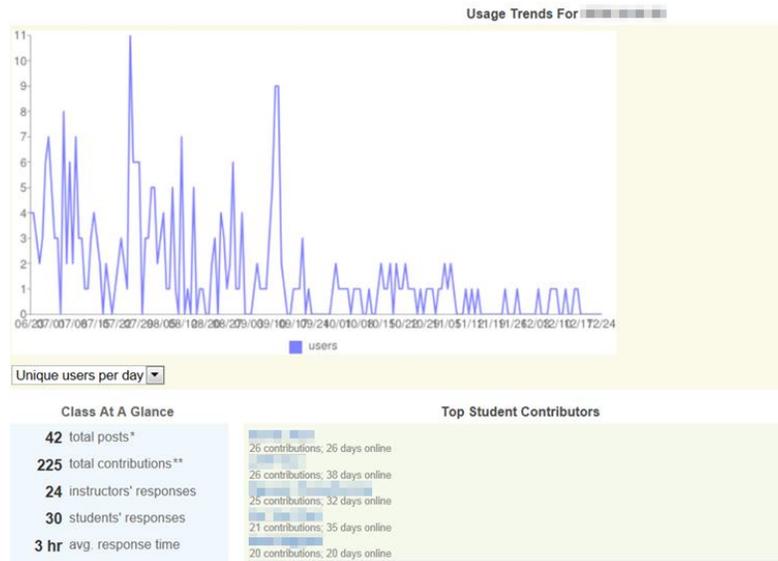
Figure 1 Screenshot of Class Report in Piazza

Figure 2 Screenshot of Class Statistics in Piazza

Further, by applying the integrated framework to measure the level of knowledge, cognitive process and social dimensions on micro-collaborations in SQA services, it was found that social dimension was the most significant dimension akin to earlier study [Blooma et al., 2013]. The micro-collaborations were further analyzed by two evaluators who are experts in IS domain to understand how the three dimensions in learning theory routes to the skills required for IS professionals. Relevant examples for elements representing knowledge, cognitive process and

social dimensions are given in Table 1. The results and findings are discussed in the following section.

Table 1 Knowledge, Cognitive and Social Dimension, Elements and Examples

Dimensions	Elements	Examples
Knowledge	Factual	What is object persistence?
	Conceptual	Which one of the following declares a primitive variable?
	Procedural	When a connection is created, it is in auto-commit mode.
	Meta-cognitive	I need you to collaborate, debug and check why it is not working.
Cognitive Process	Remember	There is no need of Scanner... because there is nothing to input
	Understand	Interface seems a blueprint that tells developers how to build a module.
	Apply	The exercise … mentions about the AmaterasUML plugin. However, I can't download & install any plugin.
	Analyze	This is because you didn't install Java JDK …
	Evaluate	In what context you used static method and why?
	Create	Try out an example of inheritance and post your answers here.
Social Dimension	Affective	Yeah! We will take everything easy huh!? :D
	Interactive	Student A is right.
	Cohesive	Hello everyone
	Argumentative	The answer is False but I dont know why it is False =,= anyone help me?

IV RESULTS AND DISCUSSION

KNOWLEDGE DIMENSION

Knowledge dimension refers to the type of knowledge that learners learned or shared. The figure below (Figure 3) illustrates the spread of various elements of knowledge dimension in micro-collaborations. Procedural knowledge was found to be the most prominent knowledge dimension (54%). Factual knowledge also represents a large proportion of the knowledge dimension (33%). The conceptual knowledge and meta-cognitive knowledge constitutes only 10% and 3% respectively as illustrated in Figure 3.

The findings related to knowledge dimension were not in consensus with a recent study that used a social networking site (Facebook) for collaboration in an art course (Lin et al. 2013). It could be primarily due to the subject diversity as meta-cognitive knowledge was the only significant knowledge dimension observed by [Lin et al., 2013]. While, they applied the knowledge dimensions in the art course for a project based learning assessment, this study examined micro-collaborations in an IS course. Although, knowledge dimensions vary depending on the context, it was evident from this study that micro-collaborations in an SQA service facilitate various elements of knowledge dimension in learning.

On further analysis, it was evident that knowledge of terminology or specific details is extensively discussed in the micro-collaborations. For example, a fact like "*Class is the file that is created after we run java file program in Eclipse*" is disclosed by students in a very simple language that helps other students. Instead of just copying the definition from another source,

students use the words like "*we*" to represent the whole cohort while answering which adds value to the facts discussed. Knowledge of terminology evidenced routes to the functional knowledge component of IS skills.

On another instance, a general definition of a Java package was also discussed in a free and understandable form for example, "*A Java package is a set of classes which are group together*". Thus, it could be concluded that that the students are involved in genuine discussion with altruistic notion, promoting information dissemination and sharing skills. Micro-collaborations also highlight that there are subject-specific skills that are shared for example, "*When a connection is created, it is in auto-commit mode*". It was also found that apart from subject specific terminologies, definitions and skills, micro-collaborations also demonstrated the presence of meta-cognitive knowledge. For example, "*We need to take a really intensive look since the difference is only the case-sensitive*". Meta-cognitive knowledge shapes organization skills and interpersonal and management skills in future IS professionals.

Thus, from various types of knowledge disclosed, it was evident that micro-collaborations enhance knowledge and skills not only in technology but also in interpersonal skills which is indicated as one of the requirements for IS professionals. Micro-collaborations in SQA therefore enhance IS knowledge and skills of IS students that are translated well into high level capabilities for IS profession [Topi et al., 2010].
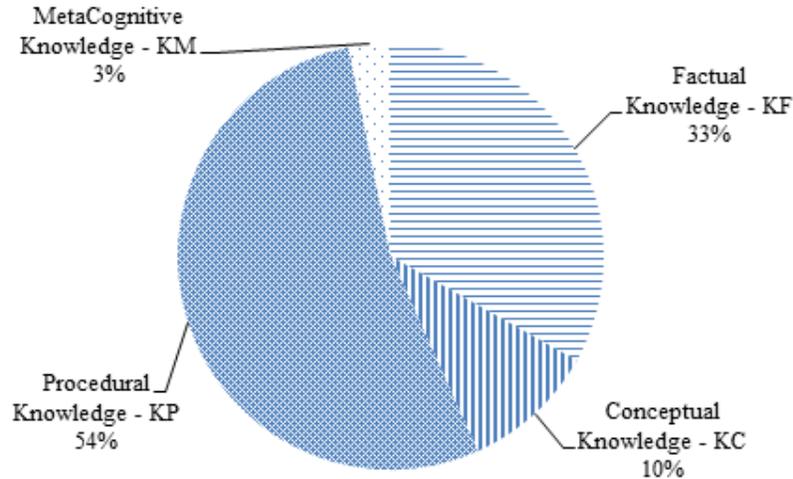

Figure 3 Results of content analysis on knowledge dimension

COGNITIVE PROCESSES DIMENSION

Cognitive process dimension measures the level of cognition that happens during the learning process. In a SQA service, the learning process takes place while asking a question, answering a question or during follow-up discussions. Similar to knowledge dimension, it was also found that 61% of the micro-collaborations were related to various cognitive process elements. Therefore, while seeking help by asking questions and sharing knowledge by answering, learners demonstrate mutual interest and mutual effort [Gazan, 2011].

On a deeper analysis, Figure 4 illustrates the spread of various elements of cognitive process dimensions in micro-collaborations. It was found that among the elements that measure the cognitive process dimension, "understand" was the most prominent element in micro-collaborations (54%). "Remember" (14%), "create" (13%), and "apply" (11%) follow "understand" with respect to the cognitive process involved in micro-collaborations. Further, "create" element accounts for 11% which demonstrates that micro-collaborations lead to the highest level of cognitive process in learning.
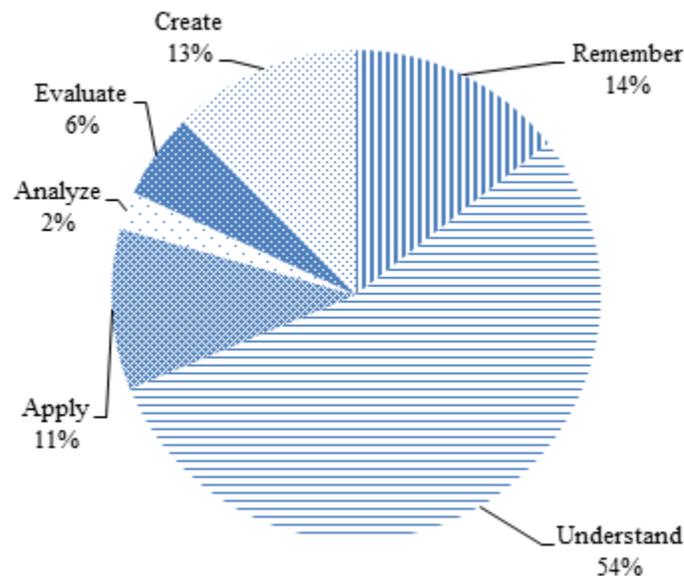
Figure 4 Results of content analysis on cognitive process dimension

Going together with the knowledge being displayed in the micro-collaborations is the presence of cognitive process that the students demonstrated during their discussion. The students illustrated various learning abilities regarding the learning process. At the most basic level, the students have shown that they were able to recall a subject area in conversations like "*There is no need of Scanner…because there is nothing to input*". Classifying a concept or algorithm, summarizing a piece of code or explaining a concept or an algorithm was evident which leads to information acquisition skill as well as knowledge of technology management skill.

The students also demonstrated that they were capable of executing or implementing a process, algorithm or design pattern for example, "*I do not know how to write a bug report and list of assumption. Can anyone tell me what the right way to write it is*". Although, micro-collaborations were regarding a programming course, the students were found to be breaking the tasks and organizing component parts to achieve an overall objective. This is a clear example of IS specific knowledge and skill.

In addition, the students were also able to determine whether a piece of code satisfied the requirements through defining an appropriate testing strategy and also critique the quality of a piece of code. For example, "*We don't need a Scanner in this project*" and "*This is because you didn't install Java JDK. Just follow this link*". In the highest level of learning process, the students were able to generate the new alternative algorithm, devising an alternative process and also constructing a code segment or program leading to organizational integration skill essential for IS professionals.

The cognitive elements clarifies the level of IS skills gained during the processes of micro-collaboration like critical thinking, managing and integrating pieces of tasks. Thus, by engaging in micro-collaborations, the cognitive process involved foster the mental model of emerging IS professionals to equip them with the skills required for their workplace.

SOCIAL DIMENSION

Social dimension is measured by social presence and social constructivism as discussed earlier in the integrated framework. The most prominent element is "interactive" with 43% of the social dimension categorized under this element. It was found that interactive element accounts for 43%, followed by "cohesive", "argumentative" and "affective" with 21%, 18% and 18% respectively (Figure 5). The predominance of "interactive" element among social dimensions is supported by previous research since micro-collaborations improve relationship among a

community of learners on a platform which provides a free and convenient environment to express opinions [Warschauer, 1995; Kern, 1995; Wang and Woo, 2007]. Considering other social dimensions apart from the "interactive" element, "argumentative" element scored the next highest distribution. Thus, micro-collaborations elicit social interactions as well as coordination of tasks among a community of learners. The third significant element in social dimension is "affective" which is indicated by the "expression of emotions". In an educational context, "affective" element of social dimension foster successful interrelationship (sense of community) among a community of future IS professionals.
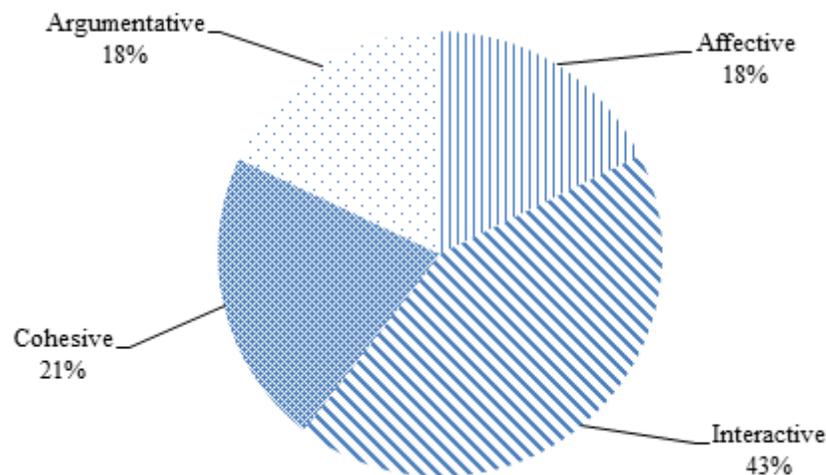

Figure 5 Results of content analysis on social dimension

Firstly, there were numerous conventional and unconventional expressions of emotion, such as punctuation, conspicuous punctuation and emoticons. In addition, there were also a lot of self-disclosure of the instructor and the students regarding their personal life for example, *"Let me introduce myself first. I've got a background in electronics and communications engineering".* Such interaction and expression in micro-collaborations foster collaboration and communication skills.

Secondly, there were interactions with clear indicators like continuing a thread, quoting from other's messages or asking question, giving compliments and expressing agreement. For example, *"I got a problem when following the step…Is there any way to install Green UML Eclipse plugin?".* Such instances clearly indicate that there are interactions and involvement between different instructors and students in SQA. The predominance of interactive element among social dimension is supported by previous research since micro-collaborations improve relationship among a community of learners on a platform which provides a free and comfortable environment to express opinions [Warschauer, 1995; Kern, 1995; Wang & Woo, 2007]. Thus, interactive element leads to interpersonal and managements skills in IS profession.

Thirdly, there were also cohesive responses such as communication that serves a purely social function, greeting, and closure for example, addressing the group as "we, us, our". These socializing skills are important in IS profession and for business communication. Cohesive element stimulates interpersonal, collaboration, communication and management skills by participating in micro-collaborations as a social community in Piazza.

Lastly, the presence of argumentative indicator was found in micro-collaborations. Articulating thoughts to the group, for example, "*I thought we'd use this thread to introduce ourselves as a start to getting online activities happening*". Questioning the learning partner to provoke for example*, "I don't know how to write a bug report & a list of assumption. Can anyone tell me what is the right way to write it?".* Further, accepting the contributions of the learning

partners like *"Agree that the correct answer should be True"* and also integrating and applying the perspective of the learning partners like *"A good round of discussion…I am happy to see you all active. For those who have not yet installed…try this version of eclipse".* Although face to face communication is the most preferred way of communication when compared with online communications, it was evident in this study that students tend to increase their social presence in SQA services resulting in relationship building and interaction in communication. Moreover, students in the 21st century are technological savvy and hence they are more "interactive", and "affective" in using SQA services and eventually building IS skills.

The presence of social dimension in SQA is very well matched with the IS required knowledge and skills for IS students. According to IS 2010 [Topi et al., 2010], the foundational knowledge and skills for IS students include leadership and collaboration, communication, negotiation, analytical and critical thinking. Likewise, ABET Curriculum Standards also listed out collaborative skills as one important skills that must be developed and applied in the IS program [Dodson and Giorcelli, 2008]. Therefore, it can be clearly seen as the usage of SQA enhance the required knowledge and skills for IS students and hence their future IS profession.

VI. CONCLUSION

This study examines micro-collaborations in a SQA service like Piazza to understand the distribution of knowledge, cognitive process and social dimension that learners demonstrate. It was found that the social dimension outweighs knowledge and cognitive process dimensions though SQA services promote all the three dimensions. This study also shows that the SQA services support the required IS knowledge and skills for IS profession. Although students had little prior experience in using Piazza, they were able to demonstrate social presence by posting questions when seeking help, and contributing answers when sharing knowledge. This study thus demonstrates to the IS community that by using a SQA in an IS course, the students are acquiring the skills required for IS profession [Dodson and Giorcelli, 2008; Topi et al., 2010]. Moreover, the participation in SQA service was on a voluntary basis and hence leads to the concept of crowdsourcing and altruism which are well presented as the future of IS in social media. It was interesting to note that students took the initiative to extend Piazza from an individualistic learning space into a social learning space by seeking and sharing knowledge collaboratively. Thus, use of SQA service to foster collaborative learning and offer an innovative teaching method in IS education, that have the potential to add value in grooming the next generation of students and business leaders.

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