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Collaborative knowledge creation in the higher education academic library

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Collaboration has become a core competency of the 21st century workforce. Thus, the need of collaboration is reshaping the academic library in higher education to produce competent future workforce. To encourage collaboration in the academic library, knowledge commons that integrate technology to infrastructure and system furniture are introduced. The article examines college students' collaborative activities for knowledge creation at a university academic library via a survey, using the theory of organizational knowledge creation. It analyzed student group activities, based on the four types of activities in knowledge creation. A total of 385 undergraduate students completed the survey. The survey results indicated that the most frequent group activity is individual-oriented activity, followed by socialization activity, creating contents as a group, and group learning activity. However, when analyzed by frequent activities by the same users, the majority of users were doing all four activities, followed by individual-oriented activity only, and individual-oriented and socialization activities. The results revealed different trends in the engagement of the four knowledge creation activities between knowledge workplace and the academic library. Several implications to encourage collaborative activities are suggested.

Introduction

The academic library in higher education is undergoing challenging times. Due to advancements in technology many of the traditional functions and roles of the academic library have become obsolete. While searching for new purposes in the digital era, many academic libraries in the US have incorporated the concept of commons that is library spaces where students can meet to learn together outside classrooms. After a long history of storing and managing information serving as their major functions academic libraries concluded that the fundamental function of libraries is not about information itself, but a place to enhance learning and enrich learning communities (Demas, 2005).

As collaboration has become a core competency of 21st century academic curriculum, and business workplace, libraries are changing to accommodate the need for collaboration and socialization. Rapid changes in the global economy have created a need for organizational agility and collaboration between and within organizations (The Economist Intelligence Unit, 2007). Organizational collaboration has been emphasized in the business and industry fields as a means for improved organizational functioning (Kezar, 2005). To address the needs of society and industry, the pedagogical paradigm in higher education has shifted to provide individuals with collaborative skills. As a result, academic libraries are becoming campus collaborative learning hubs outside classrooms.

In addition, the shift in learning patterns of the current generation is also motivating the changes in the functions of academic libraries. Today's college students: are interconnected to each other at all times through technology; use personal electronic devices simultaneously for learning and personal interest; virtually communicate with each other in real time; and multi-task to manage constant influxes of information. Libraries are expected to accommodate the work styles and demands of this generation's learners (Sens, 2009). Under these circumstances, academic libraries are changing to become technology-enhanced collaborative research facilities (Lippincott, 2006; McLaughlin and Faulkner, 2012).

However, it is not always clear what types of activities libraries should support in order to enhance collaborative work from a pedagogical point of view and align the academic library's function with the need of the future workforce.

This article examines the meaning of collaboration and student group activities at an academic library at a university in the eastern US, using the concept of organizational knowledge creation in the field of knowledge management. Due to similarities in how knowledge work is conducted in both instances, the organizational knowledge creation concept was employed to compare student collaborative activities in higher education libraries with workplace collaboration among

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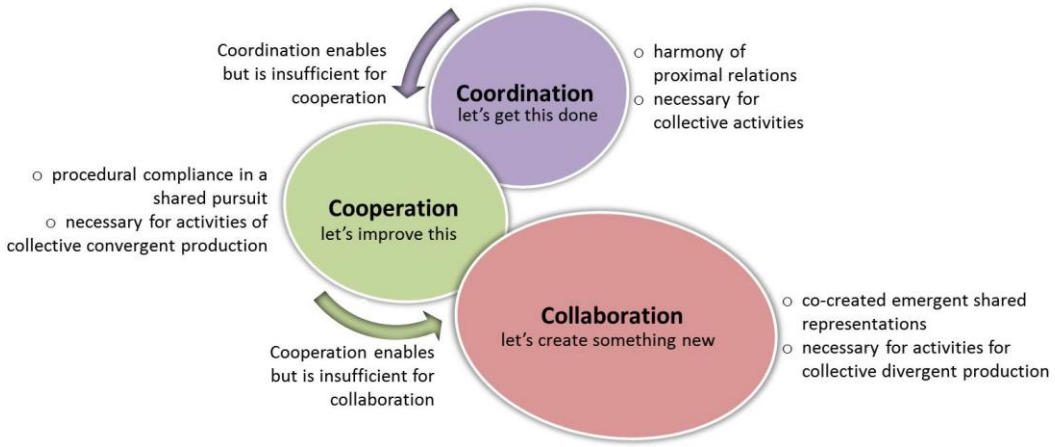

Figure 1.Relationship between Collaboration, Cooperation, and Coordination. Adapted from Stigmergic collaboration: a theoretical framework for mass collaboration (p. 41) by M.A. Elliott, Copyright 2007 b7 M.A. Elliott. Designing effective collaboration (p. 5) by EIU. Copyright 2008 by EIU. The role of trust in business collaboration (p. 4) by Economist Intelligence Unit. Copyright 2008 by EIU.

knowledge workers. The purpose of this study was to discover whether student collaboration in the higher education academic library occurs at a desirable level and if this collaboration is comparable enough to workplace collaboration to prepare the future workforce. The study focused on an academic library function of preparing the future workforce as part of a higher education institution. The study was implemented through a survey with college students, aimed at analyzing their collaborative activities when working in groups at the aforementioned library.

Literature Review

Collaboration and collaborative spaces in the academic library

Collaboration has often been simply interpreted as working together in groups with a common goal and used interchangeably with cooperation (Smith and MacGregor, 1992). However, collaboration contains different attributes from similar terminologies, cooperation and coordination. Collaboration is a process of shared creation for a common goal, based on diverse perspectives and expertise in a group. It differs from cooperation in that it values diverse opinions and expertise more than agreement; it also differs from coordination in that it focuses more on achieving desirable results than achieving efficiency of process (Denise, 1999). In his generalized framework for collective activity, Elliott (2007) explains the relationship between these three terms within the context of collective activity. Cooperation solves a problem via convergent thinking "without a creative component," while collaboration solves a problem via divergent thinking, resulting in "collective creativity" (Elliott, 2007, 40-41). However, unlike these two, coordination is not a means of problem solving, but simply an arrangement among parts of collective activities. Coordination and cooperation can occur as part of collaborative activities achieving shared creation of something new, these are the basic forms of collective activities necessary in collaboration. The importance of collaboration and the need for careful articulation between these three terms have also been emphasized in business environments.

In their studies on business collaboration, The Economist Intelligence Unit (EIU) (2008a, 2008b), well known for economic forecast research, highlights the shift towards value-creating collaborations that create something new while members share common goals. Meanwhile, the EIU defines cooperation as improving something and coordination as simply completing a task. Figure 1 is recreated by the authors to illustrate the relationship between the three collective activities, combining the concepts of collaboration from Elliott (2007) and the EIU (2008a, 2008b). The definitions and functions among the three collective activities are critical in identifying appropriate strategies and tools for achieving organizational goals (Zomorrodian, 2011).

The need for collaborative spaces for the future planning of libraries to enhance intellectual teamwork was predicted a decade ago (Wilson, 2002). Since then, the level of necessary spatial accommodations for collaboration in libraries has evolved from information commons to learning commons to knowledge commons (Shuhuai, Xingjun, Haiqing, and Jialin, 2009). The concept of information commons focused on accommodating information seeking activities by introducing technology, while learning commons focused on accommodating information sharing activities in groups in addition to

information seeking activities (Somerville and Collins, 2008). Information commons allowed students to coordinate information seeking activities, whereas learning commons allowed students to cooperate in groups.

The concept of learning commons contributed to advancing the planning practice of library commons in two respects (McMullen, 2008). First, it integrated clusters or pods of workstations, moving away from the computer laboratory configuration typical in 1990s information commons. Second, it expanded learning areas into casual and social areas such as cafés and lounges. However, collaboration was still understood as any interaction in groups, without distinction from cooperation or coordination. Thus, it simply created clusters of workstations in which students sat next to one another without necessarily making true collaboration occur.

Knowledge Work Modes and Collaboration

There has recently been an effort to integrate theoretical frameworks from the field of knowledge management into the role of the academic library. This is because of similarities in how knowledge work is conducted in both places (Townley, 2001). Knowledge work is broadly defined as producing and distributing knowledge products and narrowly as creating original knowledge products (Mosco and McKercher, 2007). Knowledge workers' main capital is knowledge and they are known to spend a substantial amount of time searching for information. Information means data that is processed with purpose, in context, and has little value until human interpretation occurs (Lee, 2000). Knowledge is created by a process of transforming data into information and, then, information to knowledge (Wah, 1999). Creating and managing knowledge within an organization have been emphasized for organizational success and innovation in the knowledge workplace. Organizational learning that exchanges and circulates organizational knowledge has also become important.

In higher education the academic library is a place where knowledge work is conducted. As in the knowledge workplace, students in the academic library communicate information and advance it autonomously, unlike in classrooms where they are instructed by faculty. For instance, students seek, gather, and sort data to create information within the purpose and the context of their tasks, and interpret information to analyze subject matter that they research or study. Due to the recent emphasis on collaboration in higher education, these activities have been more frequently occurring through group work in the academic library. The recent concept of knowledge commons is grounded in the definition of collaboration: the process of shared creation in a group, as well as the organizational knowledge creation framework of Nonaka, an organizational theorist best known for his study of knowledge management (Shuhuai et al., 2009). This is parallel to a recent pedagogical approach that also embraces this framework and defines the learning objective in higher education as new knowledge creation beyond mere acquisition of knowledge (Paavola, 2004).

Nonaka's knowledge creation theory explains the process of innovation and knowledge creation among knowledge workers by the involvement of four activities: socialization, externalization, combination, and internalization of knowledge (Nonaka and Takechi, 1999). In this theory, creation of knowledge and innovation is the process between tacit knowledge and explicit knowledge. Tacit knowledge takes oral and intuitive forms and explicit knowledge in the form of written statements (Daud, Eladwiah, Rahim, and Alimu, 2008). The cycle between tacit knowledge and explicit knowledge occurs between individuals in an organization through the process of four activities: socialization (exchange of individual tacit knowledge by sharing experiences and ideas); externalization (transfer of individual tacit knowledge to organizational tacit knowledge by documenting); combination (transfer of organizational tacit knowledge to organizational explicit knowledge by spreading through an organization); and internalization (transfer of organizational explicit knowledge to individual tacit knowledge through training).

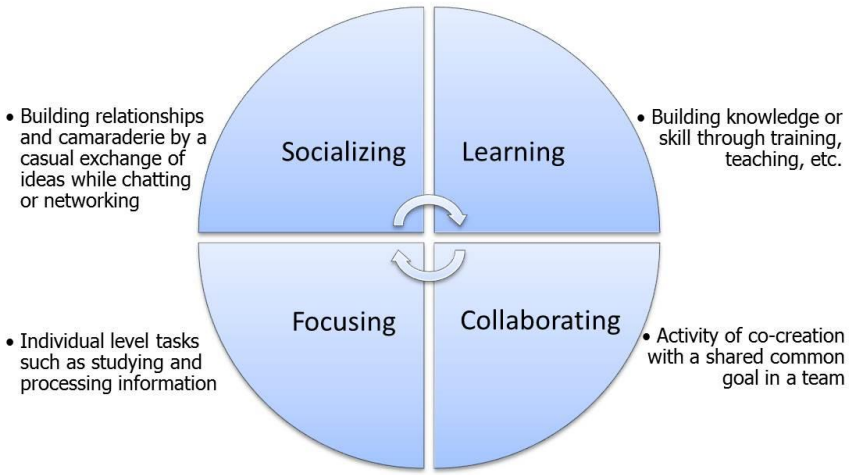

Figure 2. Four Work Modes in Knowledge Workplace. Adapted from "SECI, Ba and leadership: A unified model of dynamic knowledge creation," by I. Nonaka, R. Toyama, and N. Konno, 2000, Long Range Planning, 33, p.12. Copyright 2000 Elsevier Science Ltd.

Nonaka's knowledge creation theory has recently been adopted by the spatial planning and design of the knowledge workplace as well as academic libraries (Andreou, Barber, Riordan, and Lucken, 2009; O'Neill and Wymer, 2009; Steelcase, 2011a; Steelcase, 2011b). Four exploratory zones and work settings have been created to facilitate and accommodate four work modes corresponding to Nonaka's four activities of knowledge creation in these spaces: socializing, learning, collaborating, and focusing. Socializing means building relationships and camaraderie by a casual exchange of ideas while chatting or networking; learning is the activity of building knowledge or skill through training, teaching, etc.; collaborating is the activity of co-creation with a shared common goal in a team; and focusing means concentrating on individual level tasks such as studying and processing information (Andreou et al., 2009; Steelcase, 2011b). Figure 2 is recreated by the authors to explain the four work modes of the also been developed, emphasizing only the three work modes including socializing, collaborating, and focusing (O'Neill and Wymer, 2009; Steelcase, 2011a).

Method

Questionnaire

In order to understand student collaborative activities and work modes conducted in a group, a survey instrument was developed. The questionnaire asked about group activities regarding the four work modes of knowledge work discussed in the literature section: focusing, learning, socializing, and collaborating. The

Question	Answer	
What types of activities do you do? Check all that apply.	1. Focusing	- Individual - oriented studying, researching, or creating electronic files for class or leisure related activity in a group
	2. Group Learning	- Reading or watching as a group for assignment or research of own interest
	3. Socializing	- Chatting, discussing, watching visual contents, and listening to audio contents for leisure, blogging, or social networking
	4. Collaborating	- Creating contents as a group for either class assignment or research of own interest
Change in major tasks during the exam periods (mid-term and finals)?	1. More Focusing	- More individual - oriented studying, researching, or creating electronic file for class or leisure related activity in a group
	2. More Group Learning	- More reading and watching as a group for assignment or research of own interest
	3. More Socializing	- More chatting, discussing, watching visual contents, and listening to audio contents for leisure, blogging, or social networking
	4. More Collaborating	- More content creation as a group as a group for either class assignment or research of own interest
	5. No change in the activities	
What personal devices do you typically use while using the space? Check all that apply.	1. Personal laptop 2. Tablet 3. Cell phone 4. MP3 Player 5. Other	
How many personal devices do you use simultaneously when using the space?	1. Zero 2. 1 3. 2 4. 3 5. 4 or more	
What is the typical number in a group?	1. 2 including myself 2. 3-4 including myself 3. 5-7 including myself 4. More than 8 including myself	
Your gender	1. Female 2. Male	
Your academic status	1. Freshman 2. Sophomore 3. Juniors 4. Seniors 5. Other (specify)	

Table 1. Questions and Measurement

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study examined these four work modes in group work, rather than individual work, in order to understand how collaboration occurred in the academic library. Specific descriptions for each mode were provided in the questionnaire to increase respondents' understanding. Focusing meant activities of individual-oriented studying, research, or creating electronic files in a group; learning included activities of group reading and watching; socializing included chatting, discussing, and watching/listening to audio-visual contents for leisure, blogging, or social networking; and collaborating meant creating content as a group. Respondents were asked to select all activities they conducted in a group while using the library. In addition, respondents were asked background questions, including personal device use, number of students in a group, changes in activity during exam periods, and demographics. The answers were given in categorical or numerical scales. Table 1 illustrates the questions and the measurement used in the survey.

Sample and data collection

The questionnaire surveyed undergraduate students in a university library on the East coast of the US. It was administered online from September to December in 2011. In order to include appropriate descriptions in the questionnaire, the authors conducted two preliminary site observations and visual surveys in the library to increase their understanding of user activities and the library's spatial features. A pilot test of the survey questionnaire was conducted to examine the accuracy of terminologies and appropriate laymen's terms. Based on the results of the pilot test, the questionnaire was adjusted and finalized. With help from University IT personnel, an email invitation with a survey link was sent to the undergraduate student body. A link to the external survey website was embedded in the main library's website. To encourage user participation, a pop-up page that introduced the survey and the link was created on the desktop computers in the main library with help from the library IT department.

The survey was provided to students who had used one of the following three spaces in the main library: electronic information center spaces where desktop computers were provided in individual carrels; group study rooms with wireless access; or café areas with wireless access in open spaces. A question in the beginning of the survey screened participants for eligibility by asking whether they had used these spaces in the main library. If they chose none of these spaces, they were disqualified. This disqualification was intended to retain consistency of the demographics and experiences of the participants who had used the same spaces in the main library, since there were other campus and department-owned libraries. Another question regarding their group use experience checked for eligibility of participants. This study presents only the data and the analysis of group use of these spaces in the main library.

A total of 385 undergraduate students completed the survey. Among the participants, 61.2% were female and 38.8% were male. A nearly even distribution of participation was observed across class levels in the undergraduate program, with 22.1% from freshmen, 32.2% from sophomores, 25.4% from juniors, and 20.3% from seniors.

Findings and discussions

Descriptive statistics were used to analyze the data and explain the trends in students' activities when using the library by frequencies and central tendencies. The survey results indicated that the most frequent group activity was individual focus work (96.5%), which included individual-oriented studying, researching, or creating electronic files for each part of a group assignment or leisure-related activity in a group. The second most frequent activity was socializing activities (60.0%) which included chatting, discussing, and watching and listening to audio-visual content for leisure, blogging, or social networking. The third most frequent activity was collaborating activities (50.9%), which included creating content as a group for a class assignment or research of their own interest.

The study exhibited a substantial gap in these activities between the library and the knowledge workplace. In the knowledge workplace, employees spent an average of 48% of their time in focused work, and 32% in collaborative endeavors resulting in co - creation and innovation (Andreou et al., 2009). In particular, top performing companies spent 20% less time on focused work but substantially more on learning, socializing, and collaborating activities than average companies (Andreou et al., 2009). In addition, these top performing companies considered collaboration two times more critical, and socialization three times more critical than the average companies. Another study in 2009 showed that industry leaders anticipated a decrease of focus work by 25% over the next three years (O'Neill and Wymer, 2009). While workplace models may not be adopted directly to the library space planning, examining the current function of library spaces and user activities in comparison to trends in knowledge workplace is helpful as a guide for future library planning as it relates to preparing the future workforce.

According to the authors' study, students in groups using the library engage more social activities such as chatting, discussing, watching visual content and listening to audio content for leisure, blogging, or social networking than group learning activities of collective reading and

watching. A similar shift is observed in a workplace study that showed industry leaders' anticipation for more social activity but a small decrease in information-sharing activity (O'Neill and Wymer, 2010). The results from the authors' study also indicate that students may rely more on social media than traditional methods to find information. Online social media are interwoven in college life. According to a survey, 90% of college students use Facebook, and nearly 60% of them use it several times a day (Dahlstrom et al., 2011). Figure 3 shows the overall frequency distribution pattern between activities.

However, when the data were analyzed by frequent activities by the same users, it was found that the majority of users were conducting all four modes of knowledge work (18.0%), followed by individual focus work only (17.0%), and individual focus work and socializing activities (15.1%). Figure 4 presents the distribution pattern between activities by the same users. Among those

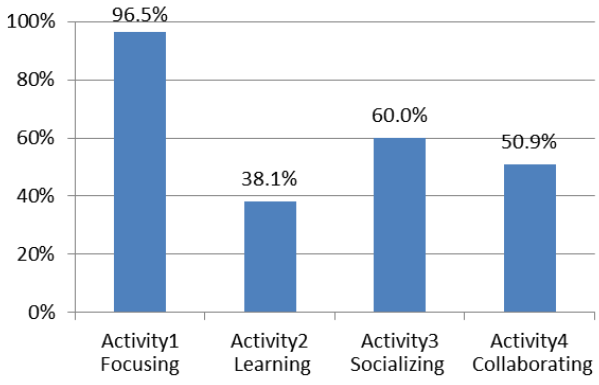

Figure 3. Frequency of Four Activities

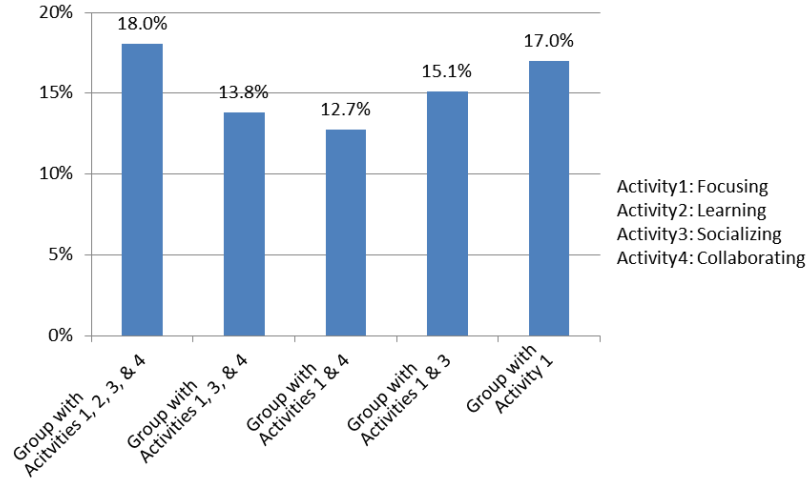

Figure 4. Frequency of Activities by the Same Users

conducting all four modes of knowledge work, there was not a particular space that was more heavily used than the others. The survey results exhibited that individual focus work in group work was a common denominator of collective activities in the library; all five most frequent combinations of activities by the same users included individual focus activities. Of those combinations, it was rare to observe users who conducted group learning activities in combination with collaborating activities in the library. Group learning activities were only conducted by those also utilized all four modes of activities. Thus, it is indicated that group learning activities alone did not frequently lead to collaborating activities.

This might have been attributed to the fact that the library did not have technology to support the transition from collective viewing of digital information to the group content creation activity in these spaces. This was another difference between the library and the knowledge workplace. According to the top-performing companies, all four modes of activities in the knowledge creation process were equally supported in their work environments (Andreou et al., 2009). Similar to group learning activities in the study, socializing activities alone rarely occurred with collaborating activities (1%). Instead, socializing activities were accompanied by individual focus activities by many users (36.3%). This may mean that socialization itself does not lead to collective content creation without the groundwork accomplished through individual-oriented focus tasks.

It is also worth mentioning that, when analyzing data by the same users, it was rare to observe users who utilized only one particular work mode, except individual focus mode in the library. There were merely 0.3% of students doing only group learning, 1% only socializing, and 0.3% only collaborating, whereas there were 17.3% of students doing only individual focus work in a group. However, doing only individual-oriented focus work in a group is not considered true collaboration since it does not lead to co-creation of knowledge as a group. This is a simple division and assembly of individual parts of a group task without the process of group interaction necessary to co-creation of knowledge.

While group learning was overall the least frequent work mode, an interesting pattern was observed when the activities were examined by the library spaces. The least frequent work mode in both the group study rooms and the café areas was group

learning activities; the least frequent work mode in the electronic information center spaces was socializing activities. This seems to be attributed to bigger desktop computer monitors available in the electronic information center spaces which allowed easier group viewing of electronic materials. Group viewing of materials is more difficult in the group study rooms and the café areas where students have only smaller monitors of personal laptops to use. Collaborating activities were the second most frequent work mode in both the electronic information center spaces and the group study rooms, while socializing activities were the second most frequent in the café areas. Figure 5 presents the distribution pattern of activities among the three spaces.

The main activity of the majority of the users shifted to more individual focus work in a group during exam periods such as mid-terms and finals (59.7%), followed by no change (24.9%). When analyzed by the spaces, the users of both the group study rooms and the electronic information center spaces conducted more individual focus work in a group. The majority of the café area users, however, had no change in their tasks during the exam periods (44%). When working in groups, small groups between three and four students (58.6%) were most popular, followed by groups with two students (33.3%). Groups with more than five were rare (8.2%). The majority of students used up to two personal electronic devices simultaneously (53%). The most frequently used personal electronic devices were laptops (92%) and cell phones (80.2%).

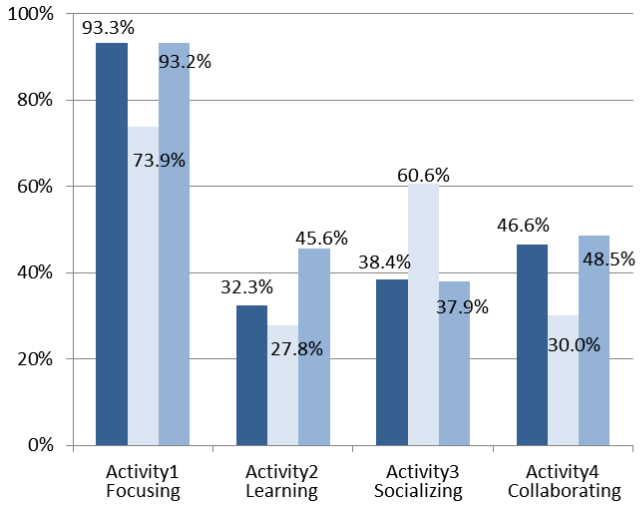

Figure 5. Activities by Spaces

Implications and Limitations

Several possible implications can be suggested from the study findings in order to encourage true collaboration in the academic library. First, understanding information flow between the four modes of user activities is a key to creating collaborative spaces that allow efficient information flow and lead to effective co-creation of knowledge contents among the students. The study showed that nearly half of the students were conducting collaborating activities in combination with the other modes of activities. It would be worth examining the sequence of their work flow among the modes as well as particular spatial planning and technology that would promote user engagement in all four modes of activities.

Second, it is important to provide library spaces with appropriate work settings and various low and high technologies to promote user behaviors that can easily progress from individual-oriented work to the other modes in the knowledge creation process of group work. According to the study, individual focus work was a common activity that students were engaged in when conducting collaborating activities. The concepts of *horizontal and vertical workspace integration* can be valuable in examining possible solutions. In workplace literature, the concept of *horizontal and vertical workspace integration* is suggested to increase organizational effectiveness that support information flow as well as physical movement within and between work modes and spaces (O'Neill and Wymer, 2009). This is proposed by considering three components: space, technology, and workflow. In higher education academic libraries, *horizontal workspace integration* can be applied to the planning of easy workflow from the individual focus activity zone to another zone for the other modes of activities throughout the facility. *Vertical workspace integration* can be applied to the planning of easy shifting from individual focus activities to other modes of activities within the same zone or space.

Third, a directly coordinated effort to link faculty teaching methodology and learning space settings in the library will contribute to more easily extending student learning experiences from the classroom to the library. This is necessary for students to take advantage of work settings with technologies that are provided to enhance the capacity of collaborative knowledge creation in group tasks. An example may be technology-enriched active and collaborative learning settings. Technology-enriched active and collaborative learning settings are currently becoming

popular for group tasks in classrooms as well as in library spaces. However, there are presently no standards or suggested teaching models that link the advanced technologies available in these spaces to higher performance of co-creation of knowledge beyond simple acquisition of knowledge in student learning. When students experience active and collaborative learning tasks that are structured on the true meaning of collaboration and co-creation of knowledge beyond simple acquisition of knowledge in those classroom settings, they can more easily take advantage of such technology settings in the library. Ultimately, this will facilitate extending student learning from the classroom to the library and thus contribute to the overall student learning experience.

A limitation of the study was that the sample was restricted to one institute and was, potentially not representative of the general population. The survey targeted undergraduate students as they constitute the majority of the library users. Thus, the findings and suggestions do not apply to other demographics such as graduate students or faculty.

Possible future studies include conducting the same study in a larger scale from various institutions to examine general patterns; implementing diverse research methods such as observations and interviews to examine students' collaborative activities in the academic library; and comparing the patterns of collaborative activities between various demographics such as disciplines, previous experiences, and class levels of students.

Conclusion

This study examined college students' collaborative activities based on the four work modes that are crucial to organizational knowledge creation. The findings indicated that there was a gap between the patterns of collaborative activities between the academic library and the workplace. Since one of the purposes of higher education is to prepare college students to become future members of the workforce, these findings are valuable as a guide to promote collaborative activities which lead to collective knowledge creation that current and future workplaces expect from graduating college students.

The necessity for collaboration is reshaping the landscape of higher education in the US. Student hub zones have been created throughout campuses to encourage collaboration and socialization and libraries are one of the most frequently chosen locations (Herman Miller, 2011). Various types of collaborative spaces have been introduced to academic libraries through the integration among technology, system furniture, and spaces. The integration of IT and learning spaces is one of the driving factors of this focus. The development of technology-integrated educational furniture and industry research on teaching and learning are also contributing to these trends.

However, instead of merely chasing trends, it is important for libraries to establish ultimate goals and objectives for changes and create a pedagogical framework in which to base strategic planning. In order to promote desirable user behaviors and activities towards meaningful collaboration, it is necessary to establish strategic planning based on knowledge of the current use of a particular library. A careful interpretation of the current user behaviors and demands should be integrated with strategic planning. As shown in many customer satisfaction and preference surveys, accommodating users' desires can be nothing more than making them happy, but it does not necessarily lead to desirable behaviors and outcomes in line with the institutional goals and mission (Jackson and Hahn, 2011). In this context, the framework used in this study can be an advantageous tool in aligning the library's functions with the needs of the future workforce, as well as an example for other library planning personnel and researchers.

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