

USING WEB-BASED KNOWLEDGE FORUMS TO INTERNATIONALIZE CONSTRUCTION EDUCATION

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SUMMARY: This paper is based on research exploring the potential of using Web-based knowledge forums to support knowledge sharing among geographically dispersed graduate students. The paper focuses on establishing a case for using knowledge-based forums to support graduate research on international themes. The paper's introduction explains the need for internationalizing the curriculum, and also argues the potential of using Knowledge Management (KM) to augment the education of students who never participate in study-abroad programs. The paper then presents the problem statement: most graduate students do research on local topics. A discussion of the methodology for the study as well as the key findings constitutes the main body of this paper. The adopted methodology involves: 1) reviewing published theses and dissertations to establish the extent to which students explore international themes in their research; 2) conducting a comparative study between research by a local student and a foreign-based student on a similar problem statement; 3) administering a survey aimed at establishing the potential effect of using a Web-based academic knowledge forum to aid the selection of dissertation or thesis topics, and; 4) holding an informal workshop, based on the use of a conceptual knowledge forum, to establish the students' expectations and requirements. The paper establishes that there are potential benefits from using KM approach to create a common pool of knowledge in international themes, and that this could further the internationalization of college education.

KEYWORDS: Web-based Knowledge Forums, Internationalization, Construction Education

1. INTRODUCTION

For the US to continue to be regarded as a country at the forefront of innovation across the different sectors of economy, its future professional must be educated in a global context (NSF, 2004). Consequently, "internationalization of the curriculum" has become a topical theme in North American Universities and significant investments have been made in educational activities such as student exchanges, study-abroad programs and overseas summer projects. The term "internationalization," as used in this context, has been defined as the process of integrating an international dimension into the research, teaching, and service function of higher education (Nilsson, 2003). However, such activities tend to be expensive and remain beyond the reach of many students. The research reported in this paper uses the "Internationalization at Home" (IAH) approach to make international educational activities accessible to a larger proportion of the student community. The IAH is based on designing internationally integrated activities that do not require student and staff mobility (Teekens, 2005).

This paper contends that graduate students' research "interests," as demonstrated by their selection of dissertation or thesis topics, are directly influenced by the knowledge environment in which they are immersed. This view is supported by Gooding's (1992) position that researchers learn as they are immersed in a world of people, environments, and objects (which implies situated learning). This position is also consistent with findings from research by other scholars on how researchers' thinking and learning (cognitive processes) are influenced by their research environment. Basing their position on Clancey's (1997) argument that scholars adapt, reflect, judge, compare and make seemingly appropriate decisions from the work and concrete interactions within a meaningful social setting, Bond-Robinson and Stucky (2005) assert that situated learning requires 1) a level of concrete interactions between individuals who act in a meaningful social environment, and 2)

transactional relationships composed of back and forth interactions between environmental resources, tools, people, and constraints. The success of any initiative focusing on increasing graduate student interest in international themes will therefore depend, to a great extent, on the ability to globalize the knowledge environment to which the graduate students are exposed as they learn how to carry out scientific inquiry, reason scientifically, and acquire scientific knowledge.

There is a specific focus on the internationalization of the research among graduate students. The paper's research is further restricted to an analysis of students' research endeavors within the University of Florida's College of Design, Construction and Planning (DCP). The proposed approach to using the Web to build global relationships that promote international learning among graduate students is based on the Knowledge Management (KM) approach developed by Gregoris et al (2001) and Hanzic (2001), which was further customized for the Higher Education context by Ismail and Yang (2005). Fig. 1 identifies the main elements in the adopted KM framework as: 1) an external environment providing knowledge input; 2) a knowledge distribution and segregation section acting as a communication node; 3) a strategic planning section, which encompasses the vision, scope and objective of the KM initiative; 4) a knowledge organization section capturing KM cases, knowledge content and knowledge assets, and; 5) a knowledge portal, which publishes compiled knowledge in a global environment. The research documented in this paper attempts to define the external environment for the proposed Web-based forum. The subsequent sections define the global, social and technological Web environment necessary for supporting graduate research on international themes.

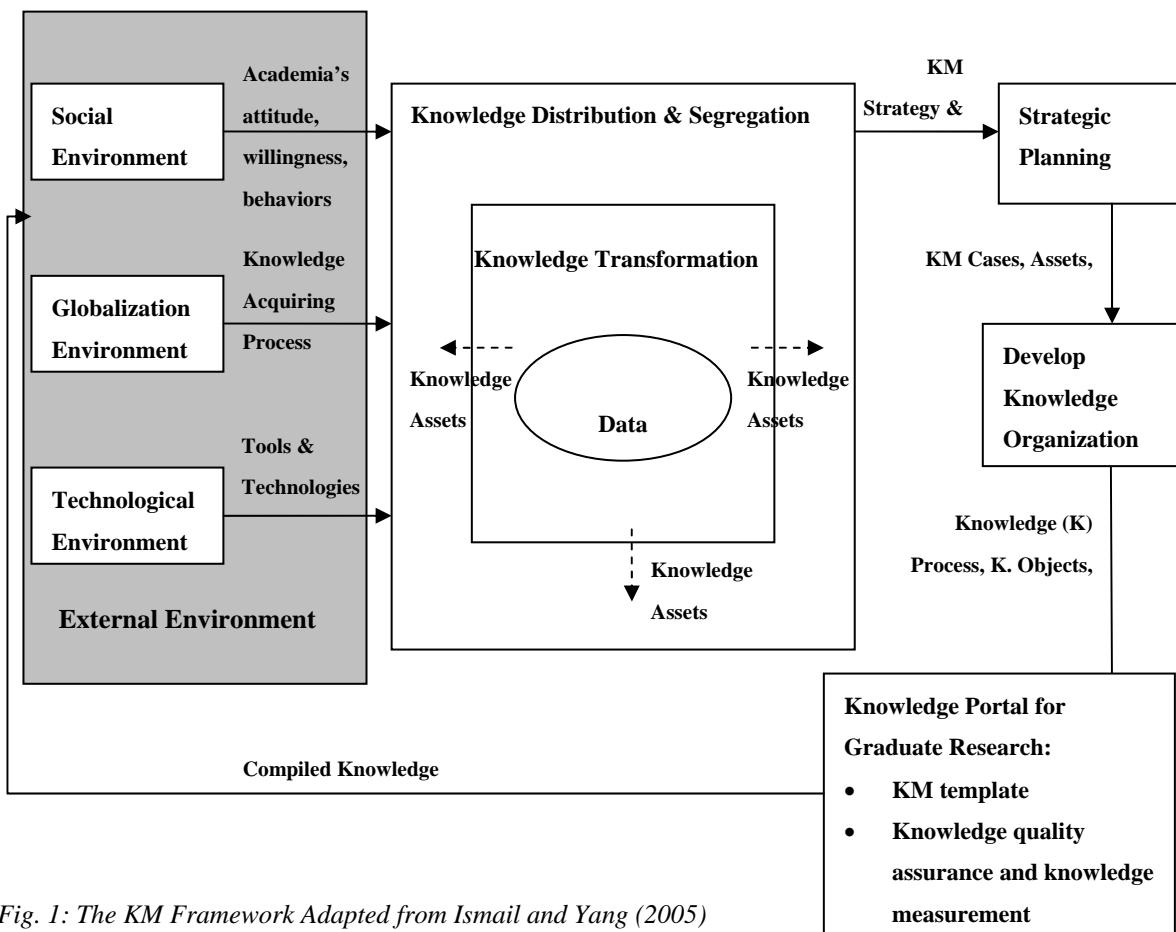


Fig. 1: The KM Framework Adapted from Ismail and Yang (2005)

2. THE GRADUATE RESEARCH ENVIRONMENT

The process of mapping the external knowledge environment for graduate research involved: 1) reviewing published theses and dissertations to establish the extent to which international themes have been explored in student research; 2) conducting a comparative study between research by a DCP student and that by a University of Nairobi student in Kenya on a similar problem statement, to establish the potential benefits of developing international knowledge sharing through a Web-based knowledge forum; 3) administering a survey to 25 DCP

students to establish the potential effect of a Web-based academic knowledge forum on the selection of dissertation or thesis topics, and; 4) holding an informal workshop on the use of a conceptual knowledge forum to establish the students' expectations.

2.1 The Globalization Environment

A preliminary study of the historical records in the University of Florida's Architecture & Fine Arts Library was done to establish the number of publications with international content that originated from graduate dissertation and thesis research. The findings reported in this section are restricted to an assessment of dissertations and theses written by graduate students majoring in Architecture (ARC) and Building Construction (BCN) between 2000 and 2006. Results indicated that although dissertations and theses on international topics were few. The proportions of publications focusing on international topics were as follows: 5.3% PhD dissertations, 5.6% BCN Masters theses and 23.8% ARC Masters theses.

Among the ARC dissertations, one research had striking similarities to a project undertaken by an architecture student at the University of Nairobi in Kenya. Both students conducted research on the design of affordable housing based on the same brief and same site. In recent years, a significant amount of development work, championed by international organizations such as UN-HABITAT, has been focused on generating adequate housing for the masses in Sub-Saharan African. The international community has invested significantly in the upgrading of informal settlements, with the Kibera slums in Nairobi, Kenya being one of the significant beneficiaries in the region. It was, therefore, not surprising that two independently conceived student projects had the same design brief: developing a design and construction strategy for the upgrading initiative in the Kibera slums. Both students donated their project documentation to the research, thus allowing an in-depth comparative study to be undertaken. The results presented in this section are not intended to provide an exhaustive list of similarities and differences between the two projects, but focuses on collaborative opportunities, thus demonstrating the potential value of using Web-based knowledge forums to link students with their geographically dispersed peers.

A detailed analysis of the two students' responses to the design brief revealed that there were generally many similarities in their approaches. For example, they both developed schemes that addressed the inadequacy of existing access routes and the lack of recreational spaces. There were also areas where their research efforts were complementary. Given the broad scope of the problems inherent in providing adequate housing within a limited budget, work in a project undertaken by one individual cannot be expected to cover all issues. Examples of themes that a scholar may choose to focus on, range from developing strategies that exploit the use of innovative building materials to producing building systems that use renewable sources of energy as well as designing the infrastructure (including water, sanitation and the road network). Although both students did extensive research in their respective projects, combining their ideas would produce a more holistic solution for the context. There were areas where each student invested significant effort based on their interests and expertise. For example, the UF student's adaptation of local building materials currently used by the slum dwellers, and the Kenyan student's innovative water and sanitation scheme, were both well thought out. Had they shared their knowledge, their team-based efforts would have resulted in inadequate housing issues being explored more holistically.

The analysis also revealed some radical differences in their thought processes. Fig. 2 and 3 shows typical units from the respective projects. Many of the apparent differences could be largely attributed to the fact that the students were maximizing the use of what constituted their local knowledge resources. The DCP student executed his research remotely, limiting his appreciation of socio-anthropological issues specific to the Kenyan context. However, his being domiciled in North America also provided him with easy access to information on the latest innovations in low-cost building technologies. Discussions with the DCP student revealed that because of having to work remotely, he spent a significant amount of time analyzing the digital images of informal settlements to develop an understanding of the context. He also shared that he had had broad exposure to literature on designing for the urban poor, and that his knowledge had been augmented by real-life examples from study exchanges to Canada and South America. Based on the wealth of knowledge he had gathered from all these sources, he ruled out the use of high-rise construction in his proposal.

The University of Nairobi student, on the other hand, was at the grassroots-level and thus had unlimited access to prevailing local conditions and other contextual issues. He had better exposure to the reality of overpopulation in the Kibera slums. Focusing more on maximizing space, he proposed the use of high-rise construction. It was later established that a low-rise scheme is generally the most optimal solution for slum upgrading initiatives.

Constructing high-rise facilities inflate construction costs through the requirement of additional features such as the reinforced concrete frame and service cores. The information held by the DCP student had the potential to substantially influence the thinking of his Kenyan counterpart.

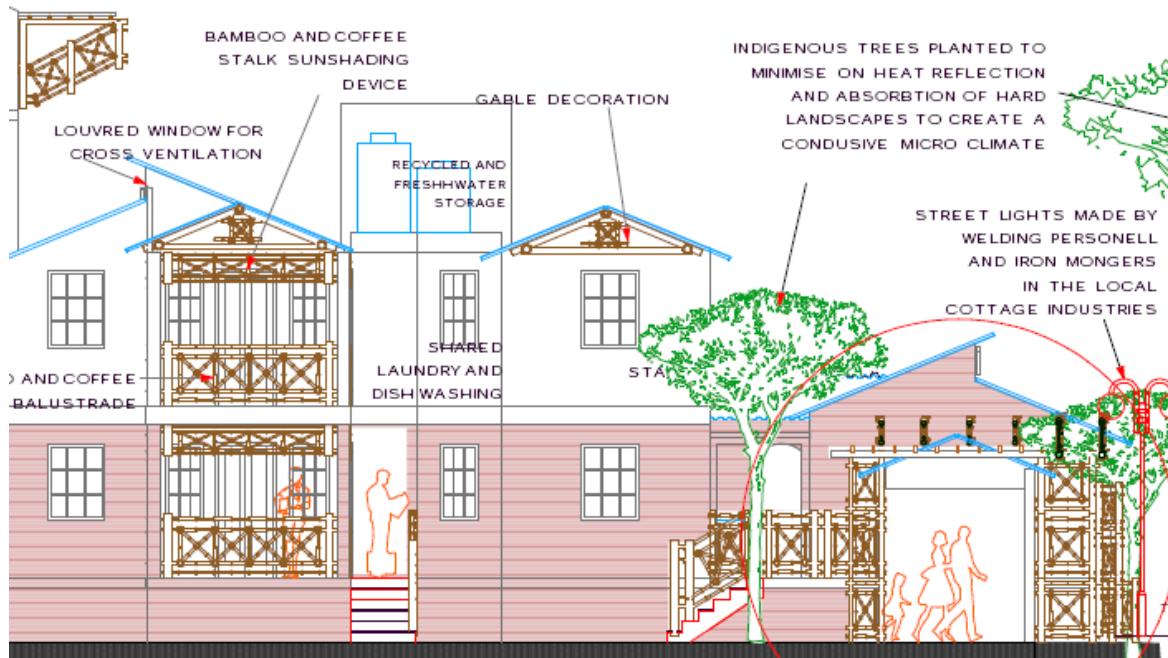


Fig. 2: The Proposal by the Kenyan Student



Fig. 3: The Proposal by the DCP Student

Another apparent difference that could be attributed to their geographical locations was their proposed roofing strategy. The UF student adopted a flat-roof structure while the Kenyan student opted for a pitched roof. It is a known fact among people in Nairobi that flat-roof structures generally end up leaking during the rainy season and have generally not been used since the early 1980s. Had the two students dialogued as they worked, their projects would have benefited greatly from cross-fertilization of ideas. Unfortunately, they had no way of connecting with each other to share knowledge as they worked on their research.

As previously mentioned, the comparative study of the projects was made possible through the donation of project documentations by the students. The students also made themselves available for follow-up discussions. It soon became apparent that a significant amount of knowledge generated during their work was not included in the final thesis submitted to their respective institutions. There are, therefore, concerns about the adequacy of a

thesis or dissertation as an instrument for recording knowledge produced within the course of student research. Under the existing system, after students graduate, the only record of knowledge generated left is the write-up on the “final product.” Although all institutions require students to document the thinking behind their final recommendations (the methodology), the comparative study established that a significant amount of information, especially information on experimental ideas that were eventually discarded, is not published in the final thesis.

There is further knowledge loss during project presentations and oral examinations. Students generally reveal additional information that they had previously perceived as unimportant as they are queried by their academic advisors and examiners. With the exception of issues that result in modifications to the final report, there is no record kept of dialogues that occur during the students’ presentations. It is the contention of this paper that, in addition to the failure to provide opportunities for dialogue with international peers, the current system fails to record a significant volume of research knowledge for future projects. In the proposed Web-based knowledge forums, students will be given a “debriefing” forum where they can reflect on their work with their peers from project inception through to the oral examination phase.

What is evident from this comparative study is the fact that geographically dispersed students can mutually enrich their research through knowledge sharing. However, it is not enough to provide real-time access to peers currently undertaking research; it is equally important to ensure that the knowledge being generated is adequately captured for re-use by subsequent scholars. There is, therefore, a need to define a formal framework for promoting knowledge sharing across space and time to support research on international themes.

2.2 The Social Environment

A survey was designed to determine the graduate students’ attitudes, their willingness to make changes, and their research behaviors, as a way to determine if they will “buy-in” to the idea of using Web-based knowledge sharing to support research on international topics. Out of a total 38 distributed questionnaires, 25 responses were obtained. Given that the aim of conducting the research was to capture information for developing the conceptual framework, a small sample size was deemed adequate. The results, summarized in the subsequent paragraphs, provide the foundational basis used to define the context for using Web-enabled technologies to support graduate research endeavors. One of the primary goals of the survey was to identify graduate students’ level of interest in conducting research on international themes. The basic assumption made before the survey was that there was a high level of demand for global knowledge; thus the need for developing Web-based knowledge forums for these students. Through this survey, it was established that 28% (7 out of 25) of the participants intended to choose an international topic and 12% (3 out of 25) intended to undertake comparative studies of local issues and international issues, as shown in Fig. 4. It was also established that 40% (10 out of 25) of the respondents had an interest in local issues while another 20% (5 out of 25) remained undecided.

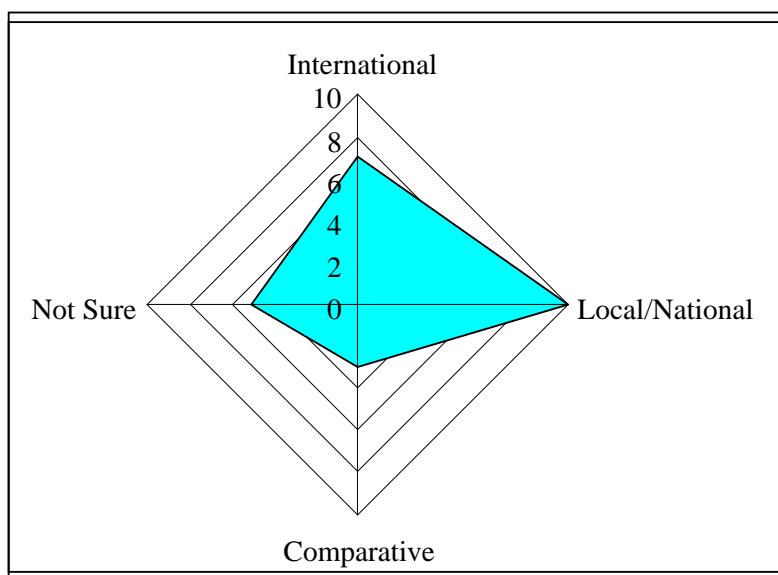


Fig. 4: Focus of Dissertation/Thesis Topics

The survey also identified the underlying factors that influenced students' choice of research topics. Although there was consensus among the participants that it was very important for them to develop an international perspective in their education, they stated that there are other factors that restrict their selection of research topics to local issues. Fig. 5 shows the relative importance of these factors.

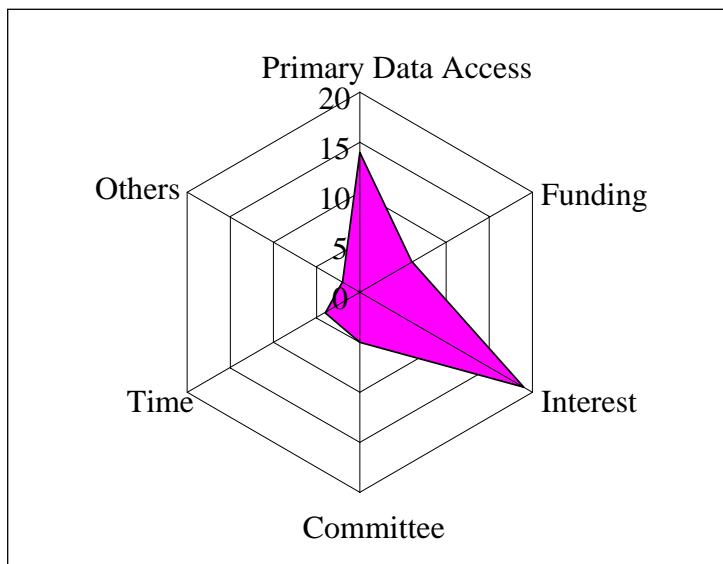


Fig. 5: Factors Influencing Research Topic Selection

The specific factors they cited were the availability of research data, prior study or work experience on their research interests, influence by the academic advisors in their research committee, and the availability of funding. Clearly, most respondents consider the availability of research data and personal research interests as the main factors that influenced their final decision.

The respondents identified the main barriers to conducting research on international themes as limited access to data, insufficient funding, time constraints and language. These barriers to research on international themes have been depicted in Fig. 6. To a large extent, those who avoided international theme were concerned about the difficulties they would face accessing necessary information. Some of the respondents cited language differences as a potential problem that can be encountered when executing research requiring a certain level of interaction with people living in another country. In follow-up deliberations, they clarified that in cases where they would have to collect data through telephone interviews, not being able to converse in local dialects could potentially limit their access to people on the job-site, in different countries, who may not be fluent in English. They further added that working with a local student as a knowledge broker would sufficiently address their concerns. This implies that what they cited as the language problem can actually be perceived as a challenge in accessing data.

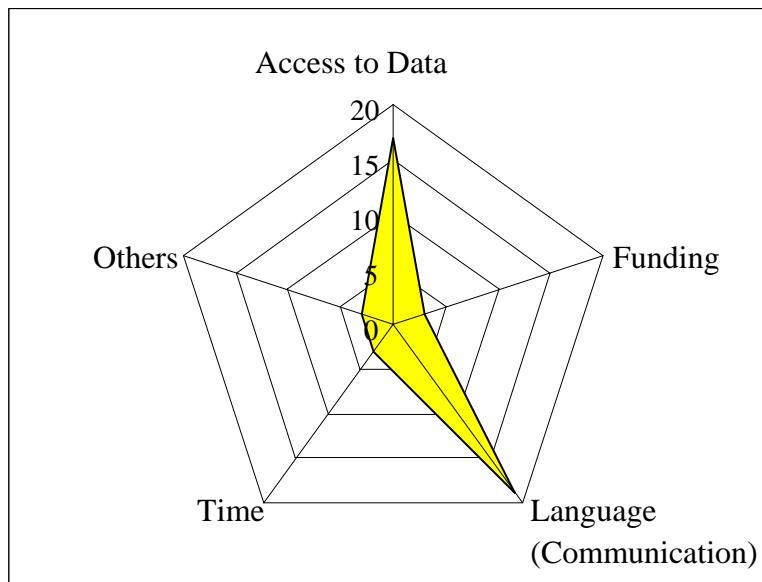


Fig. 6: Main Barriers to Research in International Themes

The respondents were also asked to express their opinions on the potential of using Web-based knowledge forums to support their research. It was important to establish the respondents' current research behaviors and the adequacy of existing knowledge resources to provide additional evidence for the need for a more refined, Web-based, knowledge resource. The survey thus served an additional role of identifying existing gaps in the current knowledge infrastructure supporting student research. The respondents identified the Internet, the university library, field study (conducted by the respondents), and informal dialogues with people in the industry as their primary knowledge resources. Most graduate students rely on the Internet for their research and augment this knowledge mainly through the use of publications in the library and field study.

Although the respondents identified the Internet as their main source of data, they had varying opinions on the quality of the information available on the Internet. Only 8% (2 out of 25) of the respondents believed that the quality of information from Internet-based sources was superior to that obtained from other sources. 36% (9 out of 25) of the respondents expressed dissatisfaction with the quality of Internet-hosted resources, while 40% (10 out of 25) were of the opinion that the two sources were more or less the same.

The respondents were also asked whether or not having a Web-based knowledge forum would increase their interest in international research. Fig. 7 shows that most of the respondents believed that such a system would be either very helpful or fairly helpful in facilitating knowledge sharing between geographically dispersed researchers, thus promoting their interest in international research.

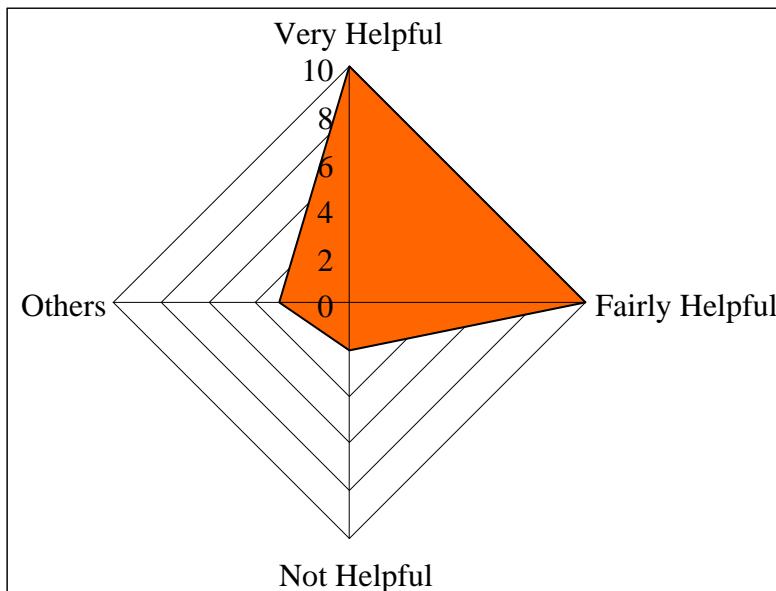


Fig 7: Opinions on Web-based Knowledge Forums

The final section of the survey focused on quantifying the probability of students making a switch from doing research on local issues to international themes should they be guaranteed interaction with geographically dispersed peers through the use of Web-based knowledge forums. 32% of the respondents stated that they had made their final decisions on choice of dissertation topics and having such a forum would not make a difference. The rest expressed an opinion that they would be interested in more “global” topics if there was sufficient access to an international pool of knowledge through Web-based forums.

2.3 The Technological Environment

The Web has drastically transformed the way human societies function, largely because of its capacity to hold immense quantities of information that can be easily accessed in the public domain. In the academic setting, research has become more collaborative, international and dynamic due to the increased opportunities for resource sharing provided by Web-based technologies. Through the Web, scholars can easily access cutting-edge information in their research areas. However, there are some problems with the use of Web-based knowledge systems.

When used within a group-based learning environment, Web-based knowledge systems can address some of the challenges associated with navigating the Internet. Bonk et al (2000) and Lynch (2001) recommended the use of Web-based interactions (WBI) in the educational setting to promote group learning. Hill et al (2000) reported that an increase in the use of Web-based instruction (WBI) for formal and informal learning activities is occurring across subject areas. However, as the use of emerging Web-based technologies for instruction and knowledge sharing grows, the efficiency of WBI and knowledge sharing is determined by the quality of data resources and the distribution mechanism. Furthermore, as DeVries & Wheeler (1996) pointed out, the success of WBI is largely dependant on “interactivity.” They proposed the deployment of “professional communities” to enhance the quality of knowledge sharing within a specific subject domain. Such Web-based professional communities are emerging as a powerful way of gathering, organizing and sharing knowledge within an organization (1999). Professional communities assert themselves using the principle of the whole being much greater than the sum of the parts; they bring together individual “pieces of knowledge” to produce a “pool of knowledge.”

Constructing a Web-based professional community is similar to real-world community building, requiring technology, materials, operation and maintenance. In this sense, learning and sharing knowledge via Web-based professional communities could also be perceived as a social practice that demands the participation of people who are fully engaged in the process of creating, refining, communicating and using knowledge (Wenger, 1998). Participants thus benefit from using such communities as the new medium for social networking, which mirrors

real-world community building. Social networking sites are Web-based forums where communities congregate based on similarities in interests, hobbies, desires and goals (Backstrom et al, 2006). YouTube (URL1), MySpace (URL2) and Friendster (URL3) are some very successful examples of such sites. Social networking has also been used to create professional communities such as the Microsoft Knowledge Network (URL4). In the academic setting, social networking can be used to reinforce communication among scholars and accelerated dissemination of knowledge in specific research domains. CiteSpace (URL5) is an example of a social networking site that supports academic research by allowing users to tag scientific publications with additional information.

Although significant work has been done on creating and designing social networking sites for academic purposes (Khan, 1997), a clear delineation of guidelines and best practices for community building is still lacking (Hill et al, 2000). In order to achieve results equivalent to face-to-face communication or do better, interest in learning and sharing via Web-based professional communities should be encouraged and maintained through well-thought out strategies. The most successful social networking sites depend on users playing a key role in publishing and sharing information. Powerful software is generally used to support the functionality of the sites shifting the target end users away from manual processes of uploading resources to the more dynamic generation of Web forums. Content Management Systems are simple examples of development environment that can be used to deploy these dynamic Web-based knowledge forums.

In order to test the viability of using the professional communities approach to support international research among geographically dispersed students, a simple Web-based knowledge forum was developed using "Joomla," an open source CMS available at URL4. Note that the forum was a mock site created strictly for the purpose of triggering deliberation with students. "Joomla" was chosen largely because it is an easily extensible open-source development environment. The software is packaged into modules that can be easily manipulated by a designated site administrator as shown in Fig. 8. In addition, the end users seeking to publish documents and other media are presented with an interface that is identical to common Microsoft applications as shown in Fig. 9. The philosophy behind the design of this networking site is to have the users create semantic tags for documents that they want to share with other people, to be displayed as summary pages on the homepage. Documents donated by students featured in the case study were used to populate a fictitious Construction Student Research Forum.



Fig. 8: Administrative Control Panel

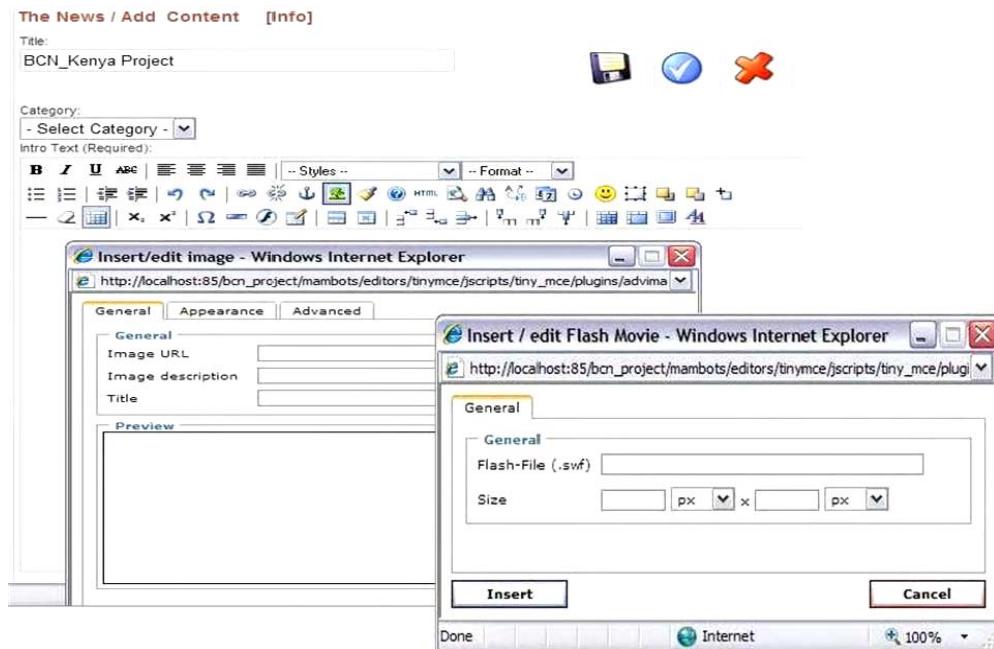


Fig. 9:Inserting Media

A focus group meeting, attended by 9 students, was organized to establish their views on the features essential to a Construction Knowledge Forum, required to support their research endeavors. The focus of this deliberation was to gather preliminary information for the requirements and specifications phase of the proposed forum. Although there was a consensus on the benefits of using the Web to promote sharing of knowledge, the participants were of the view that robust forums specific to their areas of research interest did not exist. They shared a view that the success of such a Web-based knowledge forum would to a great extent depend on the ease and speed with which users would be able to upload and download materials, bearing in mind that in construction research, this would involve managing large image files such as blueprints, CAD drawings, digital photos and videos. They were particularly concerned about ease of navigation, specifying that documents should be cross-referenced as much as possible. The participants also stated that the “Search” facility within a knowledge sharing forum should be personalized as much as possible to reduce the number of hits per query. A more detailed discussion of the specifications for the proposed application will be the subject of a subsequent paper.

3. DISCUSSION AND CONCLUSION

Institutions of higher learning have made substantial investments in various international educational activities to ensure that graduating students can operate in a labor market that is increasingly becoming more global. Traditionally, such educational activities required international mobility, generally putting them out of the reach of the average students. There is an emerging trend focused on developing activities that do not involve mobility under the banner of “Internationalization at Home.” Given that KM and its application within the academic setting is now more clearly defined, this paper adopted a KM approach to demonstrate the potential of Web-based knowledge forums in supporting graduate student research as a part of the “Internationalization at Home” endeavor.

The work reported in this paper focused on what would constitute the first phase of KM implementation, namely, defining the external environment. A number of research activities were designed to map the external knowledge environment for graduate student research. This involved: 1) reviewing published theses and dissertations to establish the extent to which students explored international themes in their research; 2) conducting a comparative study between research by a DCP student and that by a University of Nairobi student in Kenya on a similar problem statement to establish the potential benefits of international knowledge sharing through a Web-based academic forum; 3) administering a survey aimed at establishing the potential effect of implementing a Web-based academic knowledge forum on the selection of dissertation or thesis topics, and; 4) holding an informal workshop based on the use of a conceptual knowledge forum to establish students’ expectations from

such knowledge sharing projects.

The study established that graduate students understand the importance of having an international perspective in their research, and that many of them have an interest in doing research on international themes. However, actual student research on international themes is lower than the expressed level of interest. This is evident from the historical records of published dissertations and theses. Discussions held during the case study with a student who executed his research in an international area, revealed that unless a graduate student possesses background knowledge of the international context when he or she starts research, for example, through having gone on exchange visits, it is difficult for him or her to complete the work within the stipulated time. Through the use of Web-based knowledge forums, graduate students can address any existing knowledge gaps in real-time, by tapping into a global knowledge pool created in collaboration with their geographically-dispersed peers.

Given that graduate students do, in fact, cite access to data as a constraining factor in their research, it can be concluded that the existing knowledge infrastructure for graduate research is not satisfactory. A significant number of students would, in fact, switch to international themes, if there was a robust Web-based knowledge forum that allowed them to exchange ideas and collaborate with their peers across the globe. Their major concerns with the use of such a system appear to revolve around usability issues. This suggests that should a robust system, customized to their information requirements, be developed, more students would do research on international themes. There is, therefore, a need for a proof-of-concept prototype to test this theory. Further work in this research will focus on doing just that.

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