Collaborative Approach in Construction Education: Towards a More Constructivist Experience

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Education of the built environment is moving towards more collaborative practices. The intent behind the collaborative approach of teaching is to encourage students to explore the unknowns and unravel the problems themselves, with the professor acting as the facilitator. This paper presents a collaborative pedagogical approach that was adopted to teach students from two geographically distant universities. The occasion used was preparation of student teams for Associated Schools of Construction (ASC) student competitions. The participants began by engaging online in a virtual environment and later moved to face-to-face collaboration solving an interdisciplinary design build problem as part of the student competition. The authors adopted an action research method to enhance the capabilities of the students to understand and generate constructive behavioral changes. The intention was to empower the students to explore new horizons by 'clarifying and negotiating' ideas and concerns. The authors evaluated the usefulness of this pedagogical approach based on direct and indirect measures. The pedagogical approach presented is a part of an ongoing initiative between two universities that have shown positive results based on the teams' performance in the competition as well as affirmative feedback from the student participants.

Key Words: Collaborative pedagogy, international collaboration, action research, case study

Introduction

The formal education of the construction professional, like many others, has been shaped and nurtured by educators throughout the ages. While there has been much discourse around the theoretical underpinnings of construction education, not much has been focused on collaborative approaches. A sense of wanting to prepare an educational experience that would equip the future leaders in the Architecture-Engineering-Construction (AEC) industry with the knowledge, skills, and competences to perform in a constantly changing industry is the goal of these educators.

Education in the built environment has leaned towards a collaborative approach. One of the ideas behind this methodology is to encourage students to teach each other, to unravel problems themselves, and to explain and share problem solving with their peers (Scott and Fortune 2009, 2013). This process results in a deeper understanding than that can be achieved from the professor(s) simply stating the solution to the problem. There are other advantages of this methodology too. Students develop communication and interpersonal skills, and the collaborative learning environment is a more intense and meaningful experience for students – one that enhances motivation and interest in the subject matters. During the learning sessions, students actively interact with each other and the professors adopt a more passive role than in usual lectures and traditional tutor-driven sessions. This involvement encourages students to feel that they are part of the learning cycle, and that the learning experience is important and worthwhile. This is particularly important in the international student competition teams where students are usually situated at remote locations to each other, particularly before they meet at the competition venue before the event.

In this paper, the authors have documented the evolution of an initiative specific to construction education through sharing the details of initiative and lessons learnt from the process. The paper also explores the discourse from the educational research perspective where the connection between the role of theory and educational practice has been a matter of discourse for many years. The paper presents and discusses the discourse and survey responses to offer some perspective on its importance. It also offers some practical perspective around the development of this type of educational initiative with the added suggestion that the collaborative approach is firmly rooted in the student centered learning paradigm. While much progress has been achieved to date it is now time to offer a possible further step forward and share this important educational initiative.

Collaborative Learning: Reinventing Pedagogy

The current model of pedagogy, which is at the heart of the modern university, is becoming obsolete (Tapscott, and Williams 2010). . In the industrial model of student mass production, the teacher assumed the role of 'the broadcaster.' A broadcast is, by definition, the transmission of information from transmitter to receiver in a one-way, linear fashion. Broadcast learning may have been appropriate for a previous economy and generation, but increasingly it is failing to meet the needs for a new generation of students who are about to enter the global economy and who will be the future leaders in the AEC industry. The notion of collaborative learning has been around for a long time. However with a very limited scope, it was during the early 1990s that Smith and MacGregor (1992) argued for a shift away from the typical teacher-centered or lecture-centered milieu in college classrooms. Their premise was that professors should spend more time in discussion with students. As Golub (1988) pointed out, collaborative learning offers a structure where students discuss and learn from each other and it is in this discussion that much of the learning occurs.

With technology, it is now possible to embrace new collaborative approaches that change the paradigm in more fundamental ways. However, this pedagogical change is not about technology per se and it is certainly not about distance learning. This is not about students being able to access lectures by some of the world's leading professors from free online sites. Rather, this represents a change in the relationship between students and teachers in the learning process. Adler and Brown (2008) have researched collaborative learning and in particular the social learning aspects. They argue that as learning is socially constructed, the focus should be around what the students are learning and not how they are learning. By contrast, instead of starting from the Cartesian premise of 'I think, therefore I am,' the social view of learning says, 'we participate, therefore we are' is to the fore. As Papert (1991), one of the experts on how technology can provide new ways to learn, puts it: "The scandal of education is that every time you teach something, you deprive a [student] of the pleasure and benefit of discovery ". Students need to integrate new information with the information they already have — to "construct" new knowledge structures and meaning.

As learning is the critical aspect of any collaborative approach adopted for teaching, it is vital that all stakeholders subscribe and commit to reflective practices. Reflection, as per Freire (1974), refers to the critical component of education. According to Freire (1974), reflection results in 'critical consciousness in which learners become actors, not observers, and authors of their own decisions.' This certainly is true in terms of all aspects of a person's life and embedding this in a learning project offers the opportunity for the development of lifelong learning skills. The expression below offers a simplistic position as to how learning develops:

Knowledge Acquisition + Action + Reflection = Learning

Learning is both an active and reflective process. Though one learns by doing, constructing, building, discussing, and writing, learning is achieved by thinking about events, activities, and experiences. The quotes from the participants of the ASC student competition show the true learning through action and reflection that has occurred through the learning process. The reflection and application of that process will accompany the participants for years to come with some special memories.

Collaboration among University Partners

Setting up and encouraging collaboration among colleagues outside one's own institution can be difficult. University of Oklahoma and Dublin Institute of Technology joined this particular project following a collegial conversation between one of the authors and a true visionary and scholar, Professor Kenneth Robson. Their vision was not fully realized at the start, however today the educational experience the student engage in goes far beyond the early thoughts. One of the main pedagogical reasons why both academics were interested in joining this collaboration in student competition was to enhance the students' experience through internationalizing their learning - an innovative approach that would be of benefit to students. A key to the success of this project is that the existing partners are keen to share their knowledge and experience of delivering such projects and to provide support through that process.

Like any other pedagogical innovation, the key to success is to provide good guidance and an induction session for students immediately prior to the commencement of the projects. This was a real imperative as three of the team members (consisting of six members in total) were from universities outside US. So, communication and developing understanding among the team members were vital. Despite careful planning, one issue was the effect of highly motivated students on each other in a group learning situation. The students during the process certainly became more self-aware of their actual capabilities and of what they can achieve when they find themselves in a pressured working environment.

Indeed, there are many positives to be highlighted for academics and students in pursuing such an innovative approach to learning and teaching. The structured and applied nature of the work the students are required to undertake in their virtual groups provide an alternative approach to engage them in learning through a flexible method, on an online platform. It is, for students, a rewarding experience that fits with the current trends in curricular development, which seeks to encourage pedagogical models that are innovative, and student-centered. The use of technology, where appropriate, enhances the students' experience encouraging them to be more autonomous in their learning but collaborative with the team members.

Solving a Distinct Problem in Multidisciplinary Education

The action research that is presented in this paper involved cycles of interactions between the authors and participants focusing on two separate objectives:

1. To enhance participants' learning to build capabilities and abilities to understand and generate constructive behavioral change through reflective action on assessment practice
2. To evaluate the usefulness of collaborative learning to enhance such actions by the participants as improving their learning.

Action research was deemed as the ideal methodology when a holistic, in-depth investigation was the goal (Feagin, Orum & Sjoberg 1991). While action research is distinguished by its purpose that is to affect change in the participants, the objective of the ASC student competition (specifically the 'International Design Build' competition) was to enhance the participants' capabilities. The study presented in this paper did not attempt to perform sampling research. Within the premise of the approach adopted in this paper, there is a choice to be made in relation to the number of cases to include and as the initiative will be ongoing it will very much be considered as presenting a number of case studies over time, the occurrence in consideration being the first.

Action Research

The growing use of action research within built environment education research and development initiatives explicitly recognize that collaborative approaches to student learning are not characterized so much by problems for which an answer must be found, but rather by issues which need to be resolved and will inevitably require one or more of the parties to change their views. The underlying assumption of these approaches is that effective social change depends on the commitment and understanding of those involved in the change process. In other

words, if people work together on a common problem 'clarifying and negotiating' ideas and concerns, they will be more likely to change their minds if their 'joint research' indicates such change is necessary. Also, it is suggested that collaboration can provide people with the interactions and support necessary to make fundamental changes in their practice which endure beyond the research process. Action research comprises a family of research methodologies, which aim to pursue action and research outcomes at the same time. It therefore has some components which resemble consultancy or change agency, and some which resemble field research. The focus is action to improve a situation and the research is the conscious effort, as part of the process, to formulate public knowledge that adds to theories of action that promote or inhibit learning in behavioral systems. One of the key characteristics of this approach is collaboration, which enables mutual understanding and consensus, democratic decision making, and common action (Oja & Smulyan 1989).

In this sense the action researcher is a practitioner, an interventionist seeking to help improve client systems. "This help takes the form of creating conditions in the behavioral world of the client system that are conducive to inquiry and learning. Lasting improvement requires that the participatory action researcher help clients to change themselves so that their interactions will create these conditions for inquiry and learning" (Argyris et al. 1985 p.137). Hence to the aims of contributing to the practical improvement of situations and to the goals of developing knowledge we can add a third aim of action research, to develop the self-help competencies of people facing problems. Within this broad definition there are four basic themes: (1) collaboration through participation, (2) acquisition of knowledge, (3) social change, and (4) empowerment of participants. The process that the researcher uses to guide those involved can be seen as a spiral of action research cycles consisting of phases of planning, acting, observing and reflecting (Masters 1995). As Oja and Smulyan (1989) point out, the underlying assumption of this approach, which can be traced back to Lewin's (1948) writing that effective social change depends on the commitment and understanding of those involved in the change process. In other words, if people work together on a common problem 'clarifying and negotiating ideas and concerns,' they will be more likely to change their minds if research indicates such change is necessary. Also, it is suggested that collaboration can provide people with the time and support necessary to make fundamental changes in their practice which extends beyond the research process (Oja & Smulyan 1989).Thus the role of the action researcher is identical to that proposed for contemporary facilitators in helping communities identify and adopt more sustainable natural resource management practices (Pyecha 1988).

Feedback from Participants

The authors have collected initial data from 17 participants of the recently completed ASC student competition (specifically the 'International Design Build' competition) to determine the usefulness of the collaborative pedagogical approach. The authors asked several questions to the participants in the form of an online survey. The summary of the responses are presented below.

The participants were asked to rate the different aspects towards the preparation of the competition in a three point scale (very helpful, neutral, and least helpful). Almost all of the participants (94%) mentioned the support from the coaches was most helpful followed by support from the industry guest speakers (Figure 1). A major portion of the learning of the 'International Design Build' team members entails getting accustomed to the construction and contractual processes of the US construction industry along with their jargons. The authors along with other coaches invited speakers from the industry to bridge this gap. The participants' low agreement on the helpfulness of the other faculty members may be due to preoccupation of the faculty members with other commitments. The virtual team meetings play an important role in the team building process spanning the educational and cultural diversity, and laying the foundation for collaboration. This team cohesiveness and collaboration among the members generate the sense of 'commonness' and the urge to work together for 'clarifying and negotiating' ideas. It has been the experience of the authors that during the week before the actual competition when the team members meet face-to-face, a lot of unlearning and relearning take place. By this time the social change can be seen taking grip on the participants in the form of changing their mind or giving away preconceived notions if their joint research demands so. One of the participants commented:

"*The virtual team meetings are important but there is a significant lack of the subtle communication that makes meetings important. You can handle generic information and technicalities over skype but it is much easier for*

misunderstandings or potential issues regarding "closed" matters to go unnoticed."
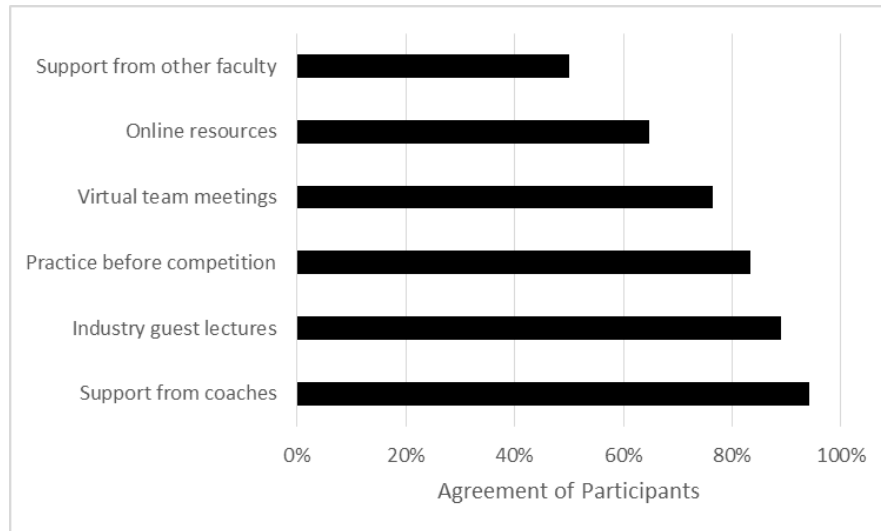

Figure 1: Participants agreement with usefulness of different aspects of preparation

The authors in conjunction with other coaches agree that the ASC competitions demand tremendous amount of effort and superior level of maturity from the participants. Preparing for these type of competitions are always challenging and involves some level of unpredictability. Subsequent to the completion of the competition, when the participants were asked about their level of preparedness going into the competition, a vast majority (76%) answered in affirmative. The factors identified by the participants that facilitated in the preparation process included (but not limited to) the practice sessions with the team, the feedback of the coaches, the online and physical meetings, and so on. Comment by one of the participants highlighted the social change and empowerment of the participants, which was the objective of this ongoing action research.

".... each member had specific strengths and experience in their part of the project. These were identified early in the process so preparation could be maximized."

One of the objectives of the action research was to evaluate the usefulness of the collaborative pedagogical approach. The authors based their conclusions on two measures: the performance of the student teams in the ASC competitions and the individual perceptions of the participants. While the strong performance of the teams provide testimony in favor of the collaborative approach, the indirect measure based on the participants' perceptions were also equally positive. A few comments shown below will demonstrate the positive change in the participants' attitude, knowledge, and competencies.

"The team work was definitively the best aspect. As part of the international team, we met new people of different nationalities and this was extremely interesting."

"...competitive and very challenging competition that strengthens students for a similar real life situation in the student future career."

Lessons Learnt

In terms of offering colleagues in the construction education some words of wisdom from the authors' reflections, the first comment would be there is no manual for finding way through this type of initiative. Despite the previous experience in this collaborative approach to enhance the students' experience both academics are very much of the view that this is the students learning experience and so imposing a pre-prepared structure on the team was not going to work. With the practical aspects and personal interactions that this kind of team experience requires, a loose structure for the teams to consider and reflect upon is proposed. As might be expected, the process will be quite

alien to the teams at the beginning, so it is important to provide as many resources as possible to the team members.

Some of the fundamental points to consider would be:
1. Allow the members of the group to share their knowledge and gain confidence - allow and schedule time for this as this will require more time than you might expect
2. Encourage them to schedule meetings outside of the designated times
3. Do not rely on the online interaction to be the definitive way to communicate
4. Encourage the team members to challenge assumptions
5. Ensure that team members, especially those who will have to travel to the competition acquire as much background knowledge as possible
6. Embrace the student-led collaborative efforts that lead to team success and look for ways to foster it
7. Make expectations clear to the members
8. Be comfortable with the fact that this is the students' experience and so they may encounter some obstacles.

This kind of collaborative approach demands a major time commitment. One cannot assume that the team members know what it is they are going to say and roll with it as easily. Be prepared to have situations that will take more time than you might have scheduled for. The time spent will allow team members to deepen their understanding of the requirements to be successful, improve interactions with each other, develop a capacity to embrace differences, and work toward a more collaborative approach to solving the project. This reflective account of the authors who collaborated in this initiative shows how much educators can learn when they work together. This endeavor will be time-consuming, but it has the potential to provide a commensurate amount of personal growth and development for all concerned.

While English is the common language, there will be some culturally subtle differences among the team members. For example, construction terminology can be quite different across the globe and experience has shown the authors that it is only when the students meet face to face that they really get to understand those differences. This holds true for the measurement systems too, non U.S. students struggle with the imperial system as they are usually conversant with the metric system only. This often provides for a huge learning curve on the students preparing the design and estimate.

Discussion and Future Direction

The authors reflected on a number of advantages in the collaborative learning format - social benefits, learning benefits, and development of skills, knowledge and competences for the students' future careers. The early stage virtual meetings was embedded to reduce the social anxiety of students by providing an instant group of peers with whom they would not feel exposed. Instead they would feel a sense of community through engaging in the common task of grappling with and understanding the competition structure and the material associated with it. Secondly, it was hoped that the method would help to promote deeper understanding, especially for the international students as their knowledge and experience in the US construction processes was very limited. The upskilling and deep learning around US practice of estimating and health & safety regulations challenged the international students but what did emerge was the sharing of best practice from both processes. While the international students certainly had a steeper learning curve the overall emerging theme was one of a deeply constructive learning experience and one that they participants have indicated would be lasting.

Students were exposed to different styles of thinking, and different ways of tackling the problems. Having already thought about the problems, the arguments and comments of the coaches were more meaningful to the students. Thirdly, the authors thought that interacting in small groups would give students practice in communication and interpersonal skills useful in their later careers. Construction professionals often operate in formal or informal small groups, asking questions and advising peers, sometimes accepting and at other times rejecting ideas. Construction professionals also form their own opinions by synthesizing the contributions of others with their own previous experience and knowledge. The authors thought that the competition format would provide valuable practice in these skills.

Changing the model of pedagogy and the model of knowledge production is crucial at program level for the survival of the university and the programs they offer. If students turn away from a traditional university education, this will erode the value of the credentials that universities award, along with the position of these institutions as bastions of learning and research, but more particular as campuses where young people, the future construction professionals, get a chance to 'grow up'. There is an imperative to work more closely and certainly to work toward collaborative learning and collaborative knowledge production. Creating international environment in which this happens is also important.

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