Using Action Research to Refine Demolition Curriculum for Construction Management Students

Mark Shaurette, PhD
Purdue University
West Lafayette, Indiana

Since the fall semester of 2005, Purdue University has been offering courses in demolition and reconstruction management as one of a series of concentrations available to their construction management (CM) students. The content for the initial course offerings was selected to give construction management students an understanding of the unique nature of demolition and reconstruction activities. As the concentration has matured, a greater emphasis has been placed on providing the knowledge and skills required by the demolition industry as they begin hiring CM students for management level positions. This paper describes the action research steps used to begin refinement of the demolition content covered by this area of concentration.

Key Words: Action Research, Demolition, Undergraduate Education, Curriculum Refinement

Introduction

Construction management (CM) education in the United States during the twentieth century was fundamentally concerned with new construction. This concentration was a logical response to the needs of the industry since the majority of work involved vacant sites and all new construction. In recent years, the construction organizations serving on Purdue University's Department of Building Construction Management's Construction Advisory Council have reported increasing activity that involves work on existing structures or infrastructure.

As the built environment within the United States ages, it is anticipated that opportunities in demolition and reconstruction will continue to expand. In a recent survey of owners responsible for facility construction and maintenance, FMI, a management consulting and investment banking firm to the building and construction industry, and the Construction Management Association of America (CMAA) outlined a set of seven challenges they believe will cause construction markets to change direction in the near future. The first challenge outlined indicated that "Aging infrastructure in nearly every market segment is at or beyond its current useful life…represent(ing) trillions of dollars in necessary spending over the next 10 to 20 years to upgrade and replace these assets" (D'Agostino et al., 2007).

The demolition industry through the National Demolition Association (NDA) has also expressed a desire to attract a college educated workforce and to advance professionalism within the demolition industry. It is believed that many misconceptions about the activities of demolition contractors are held by the general public, general contractors, and young construction management professionals. The most frequently cited misconceptions include the belief that demolition contractors primarily "blow-up" buildings, recycle very little, operate unsophisticated businesses, and can successfully complete demolition activities with little knowledge or experience (National Demolition Association, 2007). As a result, the National Demolition Association perceived a need for university construction management programs that include demolition in the undergraduate curriculum. The board of directors of the NDA has expressed a need for courses that will help the general contractors and construction managers of the future better manage the demolition process in addition to providing students with a background appropriate for employment in the demolition industry.

Identification of a need for college level education in demolition is not unique to the United States. In the spring 2008 issue of Demolition Engineer, a publication of the British Institute of Demolition Engineers, it was noted that demolition industry changes in the last 20 years have introduced stringent legislation, greater levels of administration, and increases in the complexity of demolition. These changes have moved the industry toward a

greater level of professionalism with a need for demolition specific college courses. Construction education was suggested as a possible entry to demolition, yet specific challenges encountered in demolition, most notably the complexity of waste management, is not a topic of study in construction programs in the United Kingdom.

Through the encouragement of the National Demolition Association and the perceived need for a college level curriculum that includes the special requirements of reconstruction activities of all types, Purdue University has established an area of concentration in demolition and reconstruction management for its CM students. During the development of the first few years of course offerings in this specialization it became apparent that little study had been done to ascertain the specific knowledge and skills that demolition contractors would require of future demolition project managers. This paper describes the initial action research steps taken to refine the content of the demolition and reconstruction area of concentration to provide relevant demolition content.

Literature Review

Cooperation with industry practitioners can lead to many forms of collaboration with faculty such as curriculum enhancements, identification of potential research direction, and joint educational or research opportunities (Beckman, Coulter & Khajenoori, 1997). Tener (1996) suggests that design and continuous updating of the construction engineering curriculum is a fundamental function that requires the university to collaborate with industry practitioners. Action research was chosen as the model for seeking demolition industry practitioner input in refinement of the demolition content in the demolition and reconstruction concentration. Practitioner action research, modeled after educational action research, has been promoted due to the individual control made available over research processes. Results lead to better understanding and improved practice while providing professional development (Zeichner, 2001). Action research has also been advocated as a non-theoretical model well suited for construction management research in the United Kingdom by Seymour, Crook & Rooke (1997) and in French construction quality management standardization (Henry, 2000).

Action research has been described as a technique characterized by intervention experiments that operate on problems or questions perceived by practitioners within a particular context (Baskerville, 1999). Other descriptions of action research include the concept that knowledge can be created through active experimentation, with results tested in real-life, to provide solutions to real-world problems (Levin & Greenwood, 2001) and activities focused on empirical research, theorizing, learning, and development (Argyris et al., 1985). These brief descriptions help to introduce action research as a systematic, multi-staged, cyclical process that seeks to improve practice through the implementation of informed and incremental change. Action research is not performed in isolation; rather, the researcher seeks out opportunities for collaboration and the participation of other agents.

Action research is characterized by clear stages, which include:

- A consideration of action (reflection and reconnaissance).
- Implementation of an action for improvement to individual practice.
- The use of data collection on the action.
- A review of the action through consideration of data.
- The identification of further opportunities for improving intervention.

In each stage, the researcher's learning is articulated and reinvested into the process. As a result, learning occurs for practice, about practice, and through practice. Contemporary descriptions of action research are an outgrowth of work by Kurt Lewin, a seminal theorist who went on to publish a body of work on applied research in group processes and social change in the 1940s (Bargal, 2006). The formative concepts of systematic study of a problem endeavors to solve problems through a cycle of data collection to determine goals, action to implement goals, and assessment of the results. Action research ultimately demands feedback of results to all involved parties who diagnose the need to repeat the cycle. The cycle of action research activities used to support training and/or change can be described in a cycle diagram shown in Figure 1 (Azhar, 2007, & Baskerville, 1999).

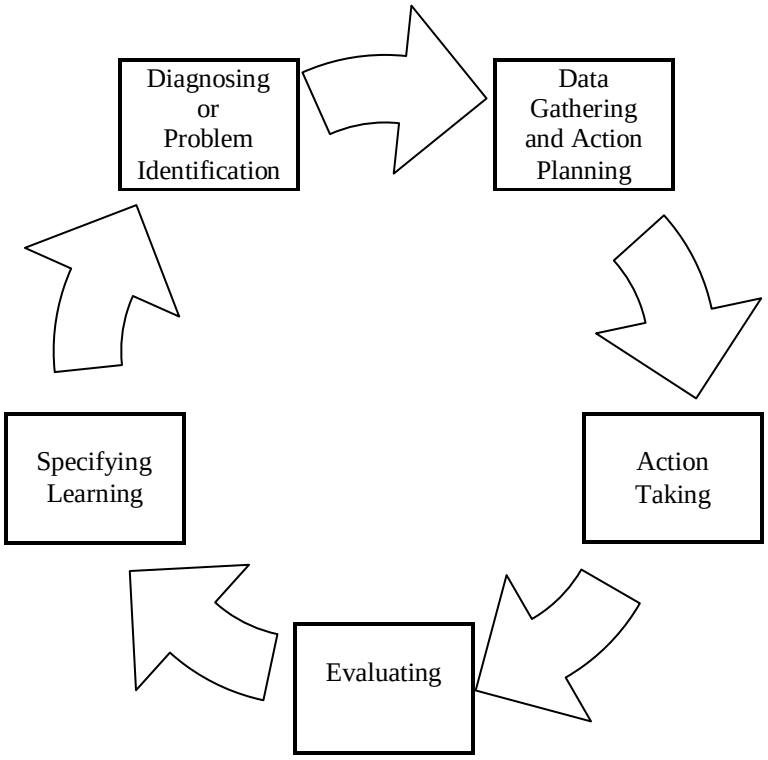

Figure 1: Action Research Cycle

Action research in contrast with theoretical research may produce results limited in replicability and have many extraneous variables. The reduced precision sacrificed is accepted in return for increased usability (Argyris et al., 1985). Other notable challenges include the inability to separate problems into component parts, difficulty specifically defining the hypothesis or question prior to beginning research, inability to prove cause and effect, as well as challenges controlling the environment. To overcome some of these challenges it is necessary to depend on what is valid in the eyes of the people in the research setting or to look for situationally valid measures. In other words, verify hypotheses with those who are going to use them. Legitimacy comes from use of a continuous cycle when the researcher moves from practice to theory, then to improved practice (Cummingham, 1993).

Methodology

The action research in this setting is diagnostic, and is research designed to lead to action. The first step in the action research cycle is diagnosing or identifying a problem. The problem identified for this study was to ascertain the course content required by demolition industry practitioners to prepare CM student for management level employment in the demolition industry. Data gathering, the second step in the cycle, can take many forms. Questionnaires, written or recorded observations, interviews, meetings, and workshops are common forms of data collection. In this case, data collection was accomplished through a meeting of four members of the demolition industry who serve as an education committee of the National Demolition Association Board of Directors. This NDA advisory committee is made up of demolition company owners and senior managers from small, medium, and large firms operating in geographically diverse areas (Pacific Northwest, South, Midwest, and National). The meeting took place in September 2008 on the university campus to assure that business interruptions were kept to a minimum.

The data collection process was a form of group needs assessment specifically designed to identify the course topics that the demolition industry identified as necessary for students who would be hired in entry level management positions by demolition contractors. The group members' knowledge and experience enabled them to identify and rank educational needs. To avoid an unstructured collection of data that could be dominated by high ranking,

outspoken, strong willed or better prepared individuals, the nominal group technique was used to promote active participation by all group members (Bickman, & Rog, 1998). The steps in the nominal group technique process are as follows (Delbecq, Van de Ven, & Gustafson, 1975):

1. Individuals are asked to generate ideas in writing. Each group member works alone, but in view of all other participants to create a constructive tension to encourage serious consideration of the process. The group leader participates in this process to model group behavior. Sufficient time should be allowed to fully develop ideas, and interruptions should be avoided.
2. Ideas are recorded in a round-robin format. By recording each idea one participant at a time, no individual dominates the process and all participate equally in the presentation of ideas. Ideas are separated from individuals by recording a brief description of each idea on a flip chart or other display device. All ideas are visibly presented equally for discussion. Ideas presented may stimulate participants to think of new ideas not previously written on their worksheet.
3. Each item is discussed separately to allow for clarification or logic behind selection of the idea. This step may require the group leader to pace the discussion to avoid undue argumentation or to avoid neglect of some items. It is not necessary for the group leader to ask for clarification or justification of an item if it is not offered.
4. Individual participants should be encouraged to make independent judgments to rank the importance of each item. The feedback should be given in a manner that does not expose the judgment of individuals to the group and will facilitate a numerical rank-ordering or rating of the items. The mean value of the independent judgments of the group is then reported to the group for additional discussion and possible re-vote.

After data collection, the action research cycle specifies that actions steps are to take place. In this case, the action steps that follow are the inclusion of the appropriate course topics in the demolition and reconstruction management concentration plan of study as well as in the demolition textbook currently being written by a retired demolition contractor in cooperation with the author of this paper. The textbook content will be used in part by students beginning in the spring semester of 2009. This initial use of course content will allow an evaluation of the topic list, plan of study, and initial demolition textbook content. Feed back from students, demolition contractors employing student summer interns, and review by the NDA advisory committee will provide lessons learned to begin the action research cycle again for further refinement of the curriculum.

Results

Table 1 includes the results of the nominal group process to identify demolition topics that should be included in the demolition and reconstruction plan of study. Many of the topics are covered in depth in the core CM curriculum at Purdue University. Some of the topics are covered in the CM curriculum, but have specific demolition related content that must be augmented to fully prepare students for work in the demolition industry. There are also topics that are unique to the demolition industry and must be covered in their entirety by the concentration. The list is arranged in the rank order that resulted from the nominal group process with demolition topics that must be covered in their entirety in **bold underlined text** and topic content that needs to be augmented by the demolition and reconstruction concentration shown in **bold text**.

Table 1
Demolition Topics Identified by Advisory Committee

Importance Rank	Topic Description	Construction Mgmt. Topic	Mixed Topic	Demolition Topic
1	Blueprint Reading and Take off	X		
2	**Safety**		X	
3	Measures/Weights/Volumes, etc.	X		
4	**Project Management**			X
5	**Basic Equipment Knowledge**		X	
6	**Estimating**			X
7	Contract and Business Law	X		

8	**Environmental Regulations**			X
9	Negotiation	X		
10	**Truck Haul Complexity**		X	
11	**Proposal Writing**		X	
12	CAD/Computer Skills	X		
13	**Material Disposal**			X
14	**Risk Management and Insurance**		X	
15	**Recycle and Salvage Sales**			X
16	Chemistry and Physics as they apply	X		
17	Document Management	X		
18	Building Types	X		
19	**Schedules**		X	
20	**Methods**			X
21	**Hazardous Materials**			X
22	**Permits and Disconnects**			X
23	Office Technology and Office Management	X		
24	Spanish language	Future?		
25	**Labor: Union vs. Non-Union**		X	
26	Dealing with non-English speaking persons	Future?		
27	**Writing Engineering Survey**			X
28	**Marketing**		X	
29	**Revenue Sources**		X	

Discussion

The identification of necessary demolition course topics to be included in the demolition and reconstruction plan of study by industry practitioners was a valuable first step in the refinement of the curriculum. Although necessary, this process is not sufficient to completely guide the curriculum. Many of the topics identified are specific to a single task such as “writing an engineering survey”. Others, such as “project management” will require additional guidance to assure that course content is sufficient in both breadth and depth of the topic. It is anticipated that many action research cycles will be required to fully develop this new curriculum. The NDA advisory committee will meet twice each year to assist in data gathering and evaluation. Lessons learned from the action research process will be utilized for curriculum improvement. In addition, successful implementation of action research as a curriculum development tool for the demolition and reconstruction concentration will be documented for use by other recently instituted concentrations in construction management at Purdue University.

Conclusion

The initial steps in action research to refine a new curriculum as described in this paper were easily implemented and demonstrate the application of a research process to solve a problem through utilization of a cyclical progression of refinement. Although the cycle is not yet complete, it has been demonstrated that action research has a valuable role to play in problem solving in applications that are complex where theoretical research may not be possible or practical. Action research may also be applicable for problem solving within all types of construction organizations. The cyclical and applied nature of the action research process lends itself to the complex managerial issues common to construction organizations and should be considered where the complexity of the managerial environment renders theoretical research challenging to implement and less rigorous results can be implemented cyclically to test them within the course of daily activities.

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