The Changing Paradigm: Implications for Construction Engineering Education

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Abstract

A paradigm shift is taking place in American higher education such that the focus in higher education is no longer the approach or the process (i.e. instruction/teaching) but the end result or product (i.e. learning). Consequently, a very clear distinction is being drawn between the means and the end so that we do not mistake the means (teaching) for the end (learning). This paper focuses on what the implications of this paradigm shift are for construction engineering education. It presents what needs to be done to align what we are doing with the new paradigm to the benefit of students. It examines in what ways faculty roles in the educational process needs to change in order to ensure and enhance learning efficiency and effectiveness and what changes in educational technologies are more promising in facilitating changes from an Instruction Paradigm to a Learning Paradigm. It also details what we are doing at the Department of Construction Technology at IUPUI along these lines.

Introduction

According to a recent article in the Change magazine¹, "A paradigm shift is taking hold in American higher education. The paradigm that has governed our colleges is this: A college is an institution that exists to provide instruction. Subtly but profoundly we are shifting to a new paradigm: A college is an institution that exists to produce learning. This shift changes everything. It is both needed and wanted."

The new paradigm recognizes that the traditional paradigm of "instruction/teaching" is just a means for the ultimate end of "learning", and does not mistake the approach for the desired result. According to the new Learning Paradigm gradually taking shape in our curricula and classrooms success of all students is the target goal. This ultimate goal of success is defined not only by staying in school and earning a degree but by attaining of the right knowledge and skills that the students will need in their personal lives as well as in today's workplace.

This shift in paradigm, however, will inevitably bring with itself profound changes in the roles faculty will play and methods they will use to ascertain learning. In the Instruction/Teaching paradigm faculty undertake the role of knowledge experts in their specific disciplines who convey knowledge by lecturing. The Learning Paradigm, on the other hand, requires that faculty design the appropriate learning environments and employ the appropriate tools/techniques for ensuring success of learning on the part of all students. The Learning Paradigm's framework encompasses all approaches that enhance learning rather than simply focusing on lecturing which has been the cornerstone of the traditional Instruction Paradigm.
It is to be understood that as opposed to the Instruction Paradigm, the Learning Paradigm emphasizes production(creation) of knowledge by students rather than delivery by the faculty; it is student centered and controlled rather than teacher centered and controlled; it thrives in learning environments that are cooperative, collaborative, and supportive rather than competitive and individualistic; it requires demonstration and assessment of knowledge and skills rather than presentation of a diploma.

**Major Characteristics of the New Paradigm and Implications for Construction Engineering Education**

In the new paradigm a higher education institution and its parts exist to produce learning as opposed to providing instruction. Since only maybe a minor percentage of engineering faculty go through a formal training to learn how to teach, most teach the way they were taught, which basically and most probably is a mode that emphasizes instruction/teaching rather than learning. So a starting good point is motivating the new as well as the old faculty to understand and become a believer in the new paradigm and undertake what it requires of faculty, be it in construction engineering, or any other discipline.

In their new role according to the new paradigm, faculty are no longer the domain experts who convey information to the students by instruction usually in a passive environment but "designers" of the environment in which learning can take place. They are the facilitators in this redesigned environment to ensure efficient and effective learning. From this point of view all engineering faculty as well as construction engineering faculty are at an advantage since, by training, design is an integral part of their endeavor in their professional disciplines. Design being an open ended process, the way faculty go about designing the learning environment will inevitably be as varied as the faculty themselves, at least as a starting point. However, faculty can take advantage of the design approaches that have been already tried with positive results. Research as well as practice have provided solid guidelines as to what this learning environment conducive to learning should entail:

1. First and foremost one should not get the impression that instruction/teaching is being abandoned in lieu of other approaches that produce learning. Quite the contrary, good teaching is still an important piece in the production process, however, a piece among many required for ensuring a good product.

2. One of the main requisites of the new paradigm is that the whole process of learning should be an active one. The only way this can be ascertained is if students take active responsibility for their own learning. Consequently, learning must be student centered, student driven and student controlled. Faculty responsibility then is to produce the framework in which this student initiative can flourish and to act as a coach in directing the process to its ultimate goal.

3. Students should be given sufficient time and opportunity to practice what they learn so that they can discover and create their own knowledge, where knowledge is defined as that which results from use of information for a particular application. To this end students must be engaging in activities similar to the ones they will be faced with in their professional careers. For a discipline like construction engineering this is especially challenging in view of the difficulty of the scale of things that go on in this industry and bringing them into the classroom. However, new technologies as well as new approaches have helped significantly in addressing this challenge as will be detailed later on in this paper.
4. Collaboration between the students is another focus point in the new approach. Collaboration not only gets the students acclaimed to the way they will most probably will be working in the industry, it also promotes several other worthwhile objectives such as improved communication and leadership skills, accountability, responsibility, understanding and appreciating diversity. In the new paradigm collaboration takes on a wider perspective in terms of collaboration not only between students in a specific discipline but collaboration between students from diverse disciplines, collaboration between students and faculty, as well as collaboration between faculty to prepare students for an increasingly multidisciplinary and multinational construction industry.

5. Design of the learning environment is like any other design process, a trial and error procedure to a large degree until it is shown to work. Consequently, after designing the learning environment one must make sure that it is achieving the purpose for which it was designed. This is where the next crucial aspect of the new paradigm, namely, assessment, comes in. One must continuously assess and obtain feedback to evaluate whether the design works and what improvements can be made to make it even better.

What are we doing?

At the Department of Construction Technology at IUPUI, the above five issues of the new paradigm, namely, good teaching, active learning, ensuring opportunity to practice, facilitating collaboration and assessment are being approached on several fronts:

1. Despite an overall push by the mother institution towards research, the department has managed to keep teaching as its primary mission. Faculty who inevitably had to conform to the bigger research picture due to tenure and promotion requirements have been able to keep the teaching side going as well by concentrating on practical research or education-based research which can be brought into the classroom and which involves the students in the process so that there is an opportunity to practice on the part of the students. 3,4,19

2. Accepting the reality that no matter what the opportunities are for practicing in terms of computer-based simulations, multimedia, and similar undertakings, there is no substitute for the real thing. Thus, the department is active in all areas of co-operative education, enrichment, and internships to expose the students first hand to their fields and allow them gain on the job experience. Along the same line "service learning" in terms of engaging a diverse group of students in practical undertakings to serve the community as well as the industry have been undertaken.

3. Despite their limitations in realistically reflecting the actual industrial picture, new technologies in terms of computer-aided instruction and tutoring, simulations, and multimedia have been utilized to their maximum benefit in an effort to bring the industry into the classroom in construction engineering education. Along these lines knowledge-based expert systems have been used to engage students individually or in groups in undertakings that involve critical thinking and problem solving and computer-based learning have been promoted in terms of custom authored multimedia materials as well as use of the internet. 6,8,9,10,11,14,16,17,18
One of the principal arguments of the learning paradigm is that learning be held constant while letting the time vary. This means students must achieve a certain predefined competency without any sacrifices for quality while allowing each and every student to learn at their own pace. Computer-based approaches readily address this requisite.5,13,15

4. Collaborations of different formats such as formal, informal, ad-hoc are being employed in the classroom between students for diverse purposes including but not limited to; writing of collaborative reports to service learning undertakings, group presentations, team homework and quiz assignments, and the possibilities seem endless.2 Collaborations between the students and the faculty have been utilized for service to the industry as well for producing computer-aided tutorial work.3,19 Collaborations between the faculty members have been used for team teaching in areas where students can benefit from the expertise of another faculty member(ex. technical communications).12 as well as addressing problems common to all faculty that benefit students.7

5. Our latest endeavor in parallel with the learning paradigm is assessing student learning routinely and constantly. Even though as an ABET accredited institution offering accredited programs we are no strangers to being assessed and evaluated. However, we are now doing this in a more focused manner not purely geared to the demands and requirements of an accrediting agency but in terms of defining the student success outcomes both quantitatively and qualitatively and for both the exiting students as well as for the continuing students. As part of the institutional assessment effort we are assessing the degree to which critical thinking and writing is being incorporated into the learning process and to what degree we are serving our students in terms of general educational requirements.

Conclusions

In my opinion no discipline is better suited to taking advantage of the new paradigm change that is going on than engineering and technology. Even though at times we may be losing focus and seeing the means (teaching) as the end (learning), few other disciplines come close to attributing the importance we do to practicing what is being taught, doing so in a collaborative manner in teams and assessing the consequences in terms of accreditation. The new paradigm shift gives us an opportunity to change the culture for the establishments we may have been housed in as particular schools or departments and strive to change the system for the better.

Bibliography

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