Experiences Using Undergraduate Students to Develop Information Technology Course Curriculum

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Abstract

Undergraduate students have been used to help develop the course curriculum in various Information Technology courses ranging from beginning digital electronics to networking. This development has taken various forms including directed production of lab modules, production of supplemental material, and researching an in-depth subject then teaching it to peers.

The curriculum development experiences are shown from three perspectives; first from the perspective of the faculty member advising the development, second from the perspective of the student developing the material, and third from the perspective of students using the material for learning.

The actual curriculum developed from these experiences contributes well to the learning environments but the major learning is taking place by the students doing the development.
It is well known that teaching is one of the most powerful learning mechanisms. Mentoring environments facilitate the learner as a teacher. Future work of using undergraduate students to develop curriculum suggest a move towards a faculty and peer mentoring environment.

I. Introduction

The use of graduate students to teach a class or help develop course curriculum is very commonly done but the use of undergraduate students for this purpose is rarely done. The Information Technology (IT) program at Brigham Young University has been developed over the past three years and was opened as a major in fall 2001. It was recognized that many of the undergraduate students were transferring into IT with experience from Computer Science, Computer Engineering, and Information Systems. Further it was realized that this experience could be used to build superior curriculum in IT based much on the problems these students have seen in the programs they transferred from. If similar problems existed in the IT program the students with experience would recognize and identify them if asked.

Through interviews it has been found that students are very perceptive as to what they don't like in a program and deem this as what is wrong with a program. "Although opinions on these

matters are not direct measures of the performance of the teacher or content learned, they are legitimate indicators of student satisfaction; there is a substantial research base linking this satisfaction to effective teaching and learning."[1] When given the chance to provide input for the development of a curriculum they will be very quick to tell what is wrong but slow to tell how it may be fixed. By getting undergraduate students involved in all stages of the curriculum development insights are gained by both students and faculty. Students gain insights into teaching and learning environments as well as new learning and career opportunities. Faculty also gain insights into collaborating on curriculum development with undergraduates that may have very diverse viewpoints.

Curriculum developed through the collaboration of faculty and undergraduate students gains the advantage of both points of view. Faculty contribute experiences in both the subject matter and in teaching. Undergraduate students contribute experiences of using similar materials within the IT program as well as being able to easily see omissions in existing curricula based on current or very recent past experiences as a student.

II. Justification

Within academia there is a false stereotype that undergraduate students in technology programs are all aiming for jobs in the particular field of study. There are actually many undergraduate technology students that are considering graduate schools in varied fields of study but have a false perception that advanced studies are beyond their capabilities. These students also assume that development of course curriculum is somehow magic and demands a higher level thinking process that is beyond their capabilities. "Cognitive research has discredited the notion that basic skills must be learned before higher-level thinking, reasoning, and problem-solving skills can be learned. According to cognitive research and theory, effective learning even at the most elementary levels of reading and arithmetic requires the active involvement of students in constructing meaning by thinking and reasoning."[2]

University level faculty have an often unspoken responsibility to help undergraduate students find a career fit that will serve the student for a long period of time. It has been observed that many faculty in technology programs assume that their only purpose is to teach the particular subject matter of the program. When it is considered that these are the same faculty that will spend the major portion of contact hours with the students in this field of study, it can be easily seen that they will have more influence upon these students than general education faculty. It thus becomes the responsibility of the faculty within the technology program to give the students opportunities for exercising knowledge and skills that may have been learned from outside of that particular technology program. This includes skills in standard academic subjects such as math, English, and science, as well as skills that are developing such as social, leadership, and teaching. "It requires significant discipline to acquire the scientific and reasoning skills necessary to make sense out a chaotic world. … One also needs to use creativity and vision to avoid the intellectual trap of being paralyzed by too much knowledge: that is, knowing enough theories that one continually strives to apply the laws and equations to the observed phenomena but never actually manages to solve the problem."[4]

The assumption that students need to have reached at least graduate level before they can meaningfully contribute to course development abounds. Normally only graduate level students become involved in course development and teaching. Involving undergraduate students in curriculum development becomes a learning experience for both the faculty and students that can surprise and delight both of them. Faculty come to realize that the students have widely varied background and interests as well as high degrees of motivation and intelligence. Students come to realize that curriculum development is within their capabilities and that it will exercise knowledge from both the program of study as well as skills acquired from general education classes and other sources.

Many students in technology programs feel that college is a necessary evil that will allow them into a career in an area that they believe is of personal interest. A small experience with developing curriculum and teaching others seems to open the minds of students to many other possibilities including graduate school, academia, other fields of study as undergraduates, and varied career opportunities.

III. Perspectives

Faculty:

The expectations of the faculty member both towards the developed course curriculum and towards the undergraduate students doing the development, will dictate if the experience has been a success. Faculty should not expect undergraduate student to produce curriculum or materials that are fully ready to deliver to other students. Many times the materials developed by the students will not be immediately usable within the class but can be easily adopted. Even if the curriculum is not usable at all the experience may still have been a success based upon the learning that has taken place in the students doing the development.

If the development efforts are aimed at a currently existing course it may force a faculty member to face up to the possibility that there are many problems through a course. It can be a threatening experience if the faculty member is not prepared to accept criticism. Undergraduate students may not present as many reasons for the changes they deem necessary in the course and thus these changes seem unfounded from the faculty's point of view. The students at this level are working more from a "feeling" perspective and normally can't give a learning theory, or other reason for the curriculum decision. It is left up to the faculty member to determine if the curriculum developed is well founded within a learning theory or not. The faculty member must be careful to not let bias get in the way of this judgment.

The undergraduate student has a reason for creating the curriculum in a particular manner. This reason is not always communicated and discussions with the student are usually needed to find the motivations. Normally these turn out to be founded in good learning theory because the student is working from the thought "If I were learning this how would I like to have it presented?". The undergraduate is much closer to those that will be learning the material and are constantly placing

themselves in the shoes of the learner. This is a perspective that is usually harder for faculty to see since they are now far distant from it in terms of age and experience. Faculty will sometimes unintentionally omit important topics from a curriculum because to them many items seem trivial. Undergraduate students will usually not omit these topics because these same items are essential for the understanding and don't seem trivial at all.

Depending on what type of development environment is provided for the undergraduates the faculty may provide more or less details on what is to be included as content in the curriculum. It has been a very useful exercise to provide only the instructional objectives and allow the undergraduate students freedom in constructing the entire content and teaching methods that meets these objectives. When this is done the productivity seems somewhat low from the faculty point of view but the content is usually very well thought out and works well in practice. If more of the content or teaching methods are dictated to the students then they will produce more of the curriculum but the result is usually done in a cookie cutter approach. It seems that in this situation much less thinking and innovation goes into the creation of the material and they just want to get it done.

Undergraduate students do need guidance in creating curriculum but minimum guidance has been found to produce better results. An understanding of instructional objectives and learning outcomes is given upfront in the development process. This is an extremely important step in the curriculum development process and without it the students will not understand the goals for the curriculum and will thus drift. "Instructional goals and objectives play a key role in both the instructional process and the assessment process. They serve as guides for both teaching and learning, communicate the intent of the instruction to others, and provide guidelines for assessing student learning." [3] "In education, objectives indicate what we want students to learn; they are explicit formulations of the ways in which students are expected to be changed by the educative process"[5]

After the objectives are agreed upon almost all the remaining time during the development process is left to the undergraduate students. Check points are used to make sure work is progressing but careful attention is only paid to the progression and not to the teaching methods or the content at this point. This is specifically to keep the bias of the faculty from influencing the curriculum development. As the students are finishing usually a presentation is in order to show the product and to explain why it was designed in this manner. The outcome for the faculty can be very useful in seeing new ways for teaching. Of course with this open environment sometimes the curriculum is very useful and sometimes it is not useful or will not fit with the environment at the institution. In almost all cases something from the new curriculum is of use even if it is only extracted and used as a small piece of a standard course.

Student Curriculum Developer:

When undergraduate students become involved in the development of course curriculum they begin to see knowledge in a new way. Many undergraduates normally feel that they are in competition with peers and thus feel that knowledge is something not to be shared because it will

give them an edge over peers. After an experience in developing curriculum they almost always feel that knowledge becomes something to share with others. This result is most likely based upon the clarity found in the subject matter after becoming the teacher. Learning theory for describing this has been referred to as the well known "learn, expand, teach" or as the "three person model"[6] where the student becomes the teacher. Comments from students such as, "As a student, trying to develop course material has helped me to understand how a professor deems a subject matter important." show this theory in practice. "… a subject is truly mastered only when a learner is able to teach it to someone else. Peer teaching gives students the opportunity to learn something well and, at the same time, become a resource to each other." [7]

Understanding the course objectives is essential in the learning process. A critical question all students ask themselves, whether they know it or not is, "What does this have to do with me?" and "Will I ever use this again?" A student trying to evaluate and develop the course is able to see the veracity of the information better through the eye of the teacher trying to improve upon an unclear concept or instruction.
The following comment from an undergraduate student is illustrative of their reactions after developing course curriculum.

> "As I thought about how I would teach the labs and the chapters from the text, I found myself out of the "tunnel vision" that one tends to get into by merely completing assignments. Many times students are not exposed to a great deal of creative thought until upper division courses, possibly not even until actual on-the-job experience. However, one thing that I was forced to do is to come up with developmental ideas – things that I had never seen done before. … As it has been my experience, a student is more effective when he teaches other students."

Students in technology programs are not known for their writing abilities and generally shy away from authoring situations. After an experience in developing course curriculum most students realize that they can indeed write and thus a new opportunity is opened. Many also realize that teaching is a viable option as well since comments like "this is not as hard as I thought" show up near the end of the development cycle. Students that develop curriculum also have a heightened motivation for learning as shown in comments like "As I was faced with new experiences and design, I quickly gained an appreciation for what the text was attempting to teach."

Student Learners:

Students that are using the curriculum for learning have no idea if it was designed and developed by a faculty or peers and usually don't care. They are in the course to learn the content usually in order to graduate from the major. Most college level students have a high degree of self motivation for "making it though the course" but will not normally go beyond the content presented. The undergraduate students that helped develop the course materials usually understand this attitude and automatically take it into account.

Students using the peer developed materials for learning many times make comments about how easy it was to understand the material or that the lab was a "piece of cake". These same students

are initially surprised when told that this learning material was produced by a peer undergraduate student but then make statements like "well no wonder I could understand it". This is a similar situation to the reason why study groups work well for many students.

Currently within the IT program at BYU curriculum created by undergraduate students has been used within lectures, homework, and lab settings as parts of a faculty generated curriculum. No formal measurement method has been put in place to determine if the undergraduate students' curriculum produces different outcome results for the learners than faculty generated materials. Through informal interviews by both faculty and teaching assistants there is a general consensus that materials produced by undergraduate students seem easier for the learner. Observations of learners working on labs generated by undergraduate students show that fewer questions are asked to the lab teaching assistants indicating fewer weaknesses in the materials.

The general feeling from the learners is that peer generated curriculum is easier to understand and leaves fewer gaps. The course objectives haven't changed for any of the affected courses and thus the assessment for these courses has not changed. There haven't been any observable changes in the assessment scores. On the other hand, based on informal interviews and observations, the students seem to feel better about their personal performance in these courses.

IV. Mentored Environments

BYU has a current program for expanding faculty and peer mentoring environments throughout the university. Having undergraduate students work on curriculum development facilitates a mentoring environment in several ways. Normally there are the weekly meetings with faculty as the curriculum is worked out. This one on one with faculty becomes a mentoring relationship between the faculty and student that facilitates learning both the subject matter of the course as well as curriculum development methods. When an undergraduate student is placed in a position of developing course curriculum it forces them into the position of teacher and thus changes the way they think about the course material and the learners. They gain experience working in the mentor positions by acting as a teaching assistant when the curriculum is first used by learners. Teaching assistants are normally recognized as the best and brightest students but it has been found that they are usually built into these positions through various experiences. By using curriculum development and subsequent teacher assistant positions students gain opportunities beyond a normal undergraduate education.

The mentored environment starts with faculty mentoring the student through a curriculum development experience. These same students will usually become teaching assistants for the classes in which they helped to develop the curriculum. In this position or just as a peer in the program they help other students to understand the material and thus also become mentors. This is not a new environment and has been done for years as informally formed groups. By placing undergraduate students into a teaching role the mentoring process is given a formal beginning.

V. Conclusion

By using undergraduate students to help in the development of course curriculum advantages are found for both the faculty and students involved as well as the learners. For the faculty there are aspects of the curriculum that are hard to relate to that undergraduate students are currently close to. For the student developers the experience is usually a mind opener to new opportunities in varied fields of study including teaching and authoring. For the student learners anecdotal evidence indicates that the material authored by peer students is better suited to the learners' environment. Continuing in this manner suggests a mentoring relationship between the faculty, teaching assistants, and student learners that will allow the curriculum to evolve into a learning environment that fits both the student's needs and the instructional objectives of the program. Continued research that will yield evidence that students are performing better using this curriculum is warranted.

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