AC 2011-1432: A SUCCESSFUL PLAN FOR FACULTY DEVELOPMENT THAT HAS A LASTING IMPACT

Stephen W. Crown, University of Texas, Pan American

Dr. Crown is a professor of mechanical engineering in south Texas. He has been actively involved in a number of grants supporting innovative and effective teaching methods for engineering education. Dr. Crown is director of the faculty development component of a large Department of Education grant that supports Challenge Based Instruction and is the director of the Texas Pre-Freshman Engineering Program in Edinburg.

Arturo A Fuentes, University of Texas, Pan American
Robert A. Freeman, University of Texas-Pan American

Dr. Robert A. Freeman has been on the faculty of The University of Texas System for over 25 years and is currently Professor and Chair of the Department of Mechanical Engineering at UTPA. His research interests include; Kinematic and dynamic modeling, analysis, design and control of multi-rigid-body linkage systems; Robotics; Biomechanics; and Engineering education.

A Successful Plan for Faculty Development that has a Lasting Impact

Abstract

A broad plan for faculty development has been instituted as part of a large two-year Department of Education CCRAA grant. The grant has provided funding for over twenty hours of training and mentoring of one hundred STEM (science, technology, engineering, and mathematics) faculty from a comprehensive university and a local community college. The objective of the project is to introduce a large percentage of faculty at two different institutions to some of the latest educational research and related pedagogical methods in an effort to create a lasting positive change in student learning. The grant provides for training of about 30% of the university STEM faculty in a pedagogical approach called Challenge Based Instruction (CBI) based on the principles of "How People Learn" and the STAR Legacy cycle. Faculty involvement begins with an afternoon pre-workshop introductory meeting that introduces the faculty to CBI and how it has been successfully used in science and engineering. A local two-day workshop led by a team with years of experience in developing curriculum using CBI follows. The following semester faculty attend two workdays to implement what they have learned in the CBI workshop by developing content for delivery of a single lecture using CBI which they will use to access the impact of CBI on student learning. The first group of twenty faculty who completed the training in the Spring 2009 semester were employed in the summer to develop five courses in STEM that are to be fully taught using CBI. The final group of 20 completed the training in the Fall 2010 semester. This paper describes the details of the faculty development plan, the keys to its successful implementation, and assessment of the initial impact on faculty and their perspectives on teaching.

Introduction

Learning and implementation of the latest research-based teaching methods requires training, mentoring, support and time. These new teaching methods are important because of the changes in what students need to learn, how the students learn, who the students are, when the students can learn, where the students can learn, and what students can access while they learn[1]. However, nowadays there are few mechanisms in place in the university environment for coordinated faculty development. Financial pressures from the state on the institution have led to smaller faculty development and travel budgets, larger classes and labs. The pressures have resulted in heavier teaching loads, high student to faculty ratios, and less individual interaction between students and their faculty mentors. The expectations on faculty have also increased as some of the institutions move towards a greater emphasis on research. The combined effect is that faculty members are not able to make significant advances in their pedagogical methods even though tremendous advances have been made in educational research.

Faculty development activities are accepted as a structured vehicle for higher education faculty for learning pedagogical methods to enhance student learning[2]. An effective faculty development program can be a win-win for the university and the faculty[3]. Different arguments for and examples of developmental activities for science and engineering faculty can be found in the literature[1-10] including multi-campus faculty development programs. However, designing and implementing an effective faculty development program for science and engineering faculty from different institutions that has a lasting effect is not trivial. The faculty development programs should help faculty members to evolve, unfold, mature, grow, cultivate, produce, and otherwise develop as individuals and as contributors to the academy's vision [11]. They have to address important issues including faculty attraction and buy in. For example, "expecting faculty to attend training on their time means that only those who are truly motivated and have an interest will pursue training"[12]. Furthermore, studies have also pointed out that due to the potential to lower standards and inflate grades, faculty in science and engineering tend to be more resistant to engage in learner-centered methods in their classrooms[2].

A Successful Faculty Development Plan

A comprehensive plan for faculty development has been instituted as part of a large two-year Department of Education College Cost Reduction and Access Act (CCRAA) grant. This initiative is a collaboration between The University of Texas-Pan American (UTPA) and South Texas College (STC), a two-year community college, to facilitate student engagement and success in STEM areas. Both UTPA and STC are Hispanic Serving Institutions (HSIs). The activities and results of the CCRAA grant have been described in previous papers in the proceeding of ASEE National Conferences[1,2]. The faculty development plan includes a series of training workshops and mentoring workdays that is bringing the latest research in effective educational methods to a large number of Hispanic and low-income students in South Texas.

The elements that contributed to the success of the faculty development plan warrants a closer look. Several key elements were identified that played a significant role in the accomplishment of the objectives. The plan incorporated a proven pedagogical approach to increase participation and address sustainability. The activities were built on an effective and well defined structure. Faculty were deliberately prepared for each series of activities. Workshops were carefully structured to meet specific learning objectives. An online system was developed to provide continued faculty motivation and engagement. Structured workdays were developed to help faculty satisfy deliverables. Promotion of the program relied on both formal and informal (word of mouth) advertising to attract appropriate participants. Participants were given the challenge of making their work public and "Leaving Legacies" for others to benefit from. Each element contributing to the success of the faculty development plan are explained in detail with specific examples of how they were implemented.

A Proven Pedagogical Approach (Challenge Based Instruction)

The objective of the project was to introduce a large percentage of faculty (e.g. ~30% of STEM Faculty) at two different institutions to some of the latest educational research and related pedagogical methods in an effort to create a lasting positive change in student learning. In order to attract faculty and produce sustained positive impact on pedagogy, a proven and adaptable pedagogical approach was needed. It would be difficult to engage a large group of faculty without sufficient evidence that the method would produce positive results in their courses. The selected pedagogical approach was Challenge Based Instruction (CBI) based on the principles of "How People Learn" and the STAR Legacy cycle. CBI is a form of inductive learning, which has been shown to be a more effective approach to the learning process than the traditional deductive pedagogy[10,13,14] and incorporates cognitive and affective elements recommended for retaining underrepresented students[15-17]. CBI provides a real life learning environment where the problem/challenge is introduced first and the supporting theory/principles second (i.e. traditional teaching backwards). CBI is not only an effective strategy for university students; it is an effective learning strategy for faculty who are exploring and implementing a new pedagogy into the curriculum. By conducting the faculty development activity within the framework of the pedagogy being promoted faculty are able to experience the learning environment from a student's perspective.

Challenge based Instruction (CBI) is implemented in the form of a slightly modified STAR Legacy Cycle[19]. This cycle "is an exemplar of an inductive approach to teaching and learning"[20] and contains a directed sequence of steps that immerses the learner in the four dimensions of the How People Learn (HPL) effective learning environment and provides a framework for CBI and the design of associated learning activities[21]. The cycle is illustrated in figure 1 and it is briefly described next[18]. The legacy cycle contains steps or activities that appeal to different learning styles[20] and most of those activities align themselves nicely with key phases of the engineering design process[22] also shown in figure 1.

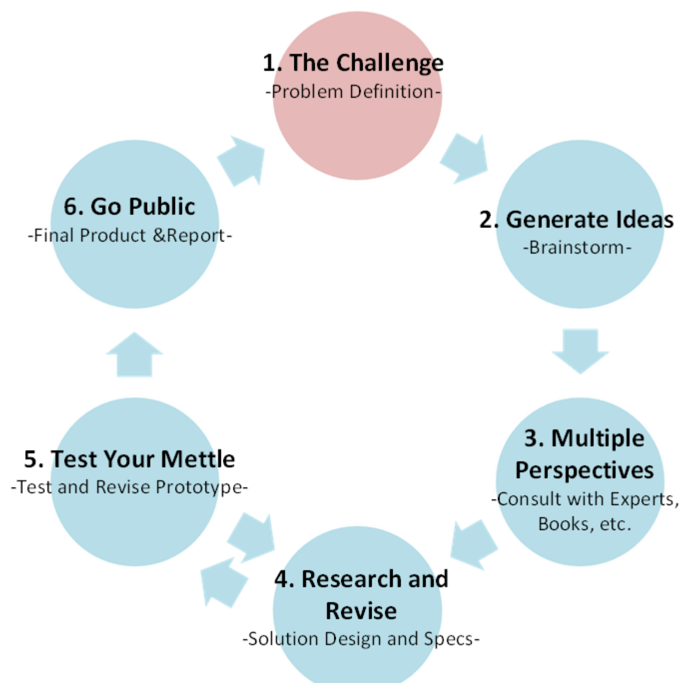

Figure 1. Legacy Cycle and Engineering Design Process

The Legacy Cycle consists of the process followed to solve challenges that are designed to motivate and engage faculty/students in learning activities. In the Legacy Cycle, the following steps are performed and repeated:

- *<u>Look Ahead</u> (Not shown in the Figure)*: The learning task and desired knowledge outcomes are described here. This step also allows for pre-assessment and serves as a benchmark for self-assessment in the Reflect Back step.
- <u>The Challenge:</u> The challenge is a question or task carefully designed to focus the learner on the learning objectives. The challenge provides context to the learning objectives and motivation as at least one practical application is evident.
- <u>Generate ideas:</u> Faculty/Students are asked to generate a list of issues and answers that they think are relevant to the challenge; to share ideas with fellow students; and to appreciate which ideas are "new" and to revise their list. *Learner and community centered.*
- <u>Multiple perspectives:</u> The faculty/student is asked to elicit ideas and approaches concerning this challenge from "experts." *Community and knowledge centered.*
- <u>Research and revise:</u> Reference materials to help the student reach the goals of exploring the challenge and to revise their original ideas are introduced here. Formative instructional events can and probably should occur in each step of the cycle but are of primary usefulness in this step. *Knowledge and learner centered.*
- <u>Test your mettle:</u> Summative instructional events are now presented. *Knowledge and learner centered.*
- <u>Go public</u>: This is a high stakes motivating component introduced to motivate the faculty/student to do well. This step is where the faculty/student is asked to provide solutions and insights for learning to the next cohort of faculty/students, as well as to the instructor(s) and is termed "Leaving Legacies" and hence the name of the cycle. *Learner and community centered.*
- *Reflect Back (Not shown in the Figure)* This gives faculty/student the opportunity for self-assessment. *Learner centered.*

A cycle is a series of event or processes that repeat in the same fashion. Throughout a course or faculty development program the faculty/student will be exposed to new challenge questions. The progressively more ambitious challenges enable the faculty/student to increasingly deepen their knowledge of the topic being explored. The complete legacy cycle is repeated for each challenge.

An Effective and Well Developed Faculty Development Structure

A faculty development program was developed to train instructors in the techniques and methodology of CBI. With the goal of increasing student academic and professional success, the faculty development program supported faculty workshops on CBI techniques and other locally developed teaching tools. The faculty development program provided for a series of 5two-day workshops along with associated work days for some 20 faculty each. The project goal was a total of 100 faculty members trained in CBI instruction in the 2 years of the grant. As of the time of this paper, we have completed all workshops with associated workdays and have trained slightly over 100 faculty members. A pre-workshop training was led by Dr. Stephen Crown, the activity director, and experienced faculty who have implemented CBI. At the pre-workshop meeting, faculty were introduced to examples of CBI used in various courses at UTPA and other institutions. The participants were presented with instructional content using CBI to get a hands-on experience with CBI. Finally, the materials for the two-day workshop were given to faculty including a pre-workshop section that was be assigned as homework. The pre-workshop activity relates to the "Look Ahead" step of the legacy cycle. Connection between each step of the development plan and the Legacy Cycle provides an explanation for the plans effectiveness. The links between the Legacy Cycle and the development plan are outlined in Table 1 below.

Table 2. Linking The Legacy Cycle with the Development Plan

Legacy Cycle	**Development Plan**	**Activity**
Look Ahead	Pre-Workshop	Present Legacy Cycle
Generate Ideas	Pre-Workshop / Workshop Day 1	Develop CBI Challenge
Multiple Perspectives	Workshop Day 2	Explore CBI Examples
Research and Revise	Workshop Day 2 / Workday Day 1	Learn Details of CBI Begin Development of Cycle
Test your Mettle	Workday Day 1/ Workday Day 2	CBI Review Test Feedback from Faculty
Go Public/ Leaving Legacies	Workday Day 2	Challenges Posted on Wikiversity Web Site
Reflect Back	Follow-up	Assessment Surveys

The workshop presenters were a team of faculty and staff from Vanderbilt University or their designees. The team of CBI specialists were led by T. Harris, Ph.D., Professor, Department of Biomedical Engineering and/or A. H. Harris, Ph.D., the director of Educational Programs of VaNTH ERC at Vanderbilt University. The workshops included individual and group activities on developing all stages of the Legacy Cycle through the creation of CBI challenges. Following the workshop, the participating faculty members returned for one or two days of faculty workdays. The objective of the workdays were to provide faculty with resources to implement CBI in the construction of challenges, as well as, with the opportunity to reflect on their own practice through analyzing and evaluating story- cases of CBI development and implementation. Specifically, faculty began the development of CBI lecture content built on the Legacy Cycle for at least one STEM course they teach. The CBI lecture content exposed the faculty and students to CBI and provided data to the faculty on the effectiveness and efficiency of the pedagogical method. Several CBI examples were presented to faculty from former participants who served as mentors during the workdays. One of the resources provided to the faculty was a CBI development template, which also will serve as the template for the CBI "Teaching Toolbox" online repository. Among other things, the template supports the clear identification of the course objectives as well as foreseen difficulties and the real-world context. The CBI "Teaching Toolbox" was posted online to allow faculty easy public access to the content.

Preparedness of the Faculty for the Workshops

A deliberate effort was made to attract faculty members from STC and UTPA with different backgrounds and to prepare faculty to take full advantage of the wokshop. Specifically, from the first group of faculty participating in the workshop consisting of 20 STEM faculty, 25% of the faculty were associated with STC and 75% with UTPA. The faculty from STC represented three different STEM fields (Math, Physics, and Engineering). The faculty from UTPA represented six different STEM fields (Chemistry, Electrical Engineering, Manufacturing Engineering, Math, and Mechanical Engineering). The two hour pre-workshop training was offered February 27th, 2009 at UTPA and was led by Dr. Crown (the director of Faculty Development Program) and Ms. Austin (a graduate student supported by the grant). Several examples of CBI as used in various courses at UTPA and other institutions were introduced to the faculty during the pre-workshop meeting. The faculty members were also presented with instructional content using CBI to get a hands-on experience with CBI. Finally, the materials for the two-day workshop were given to faculty including a pre-workshop section that was assigned as homework. The workshop presenters commented repeatedly in subsequent workshops that the preparedness of the faculty for the workshops was noticed and had a positive impact on the overall effectiveness of the workshops[10].

Structured Workshops

The faculty workshops were structured to support the faculty's efforts in developing their own CBI materials. The first of four two-day workshops was offered on March 6th and 7th, 2009. STEM faculty attended the workshop led by a team of faculty and staff from Vanderbilt University. As previously mentioned, the team of CBI specialists were led by A. H. Harris, Ph.D. the director of Educational Programs of VaNTH ERC at Vanderbilt University. The agenda of the two-day workshop is shown in the Table 2 below.

Table 2. CBI Workshop Agenda

"How People Learn" Engineering / CBI Workshop / Day 1	
Morning Session	Afternoon Session
▪ Introduce ourselves and discover in-workshop collaboration opportunities ▪ Examine personal goals for the workshop ▪ Review the history of HPL Legacy Cycle (LC) modules in VaNTH courses ▪ Examine the component parts of HPL learning theory and LC lesson design ▪ Work through an abbreviated bioengineering-based LC module ▪ Review more examples of LC modules	▪ Apply HPL design to selected course ▪ Revisit/refine course objectives to determine acceptable evidence and plan assessments to be used ▪ Design effective, real-world challenges to engage students with content ▪ Identify appropriate learning activities incorporating HPL elements ▪ Review LC lesson design for course ▪ Share some initial module ideas with fellow workshop participants for feedback
"How People Learn" Engineering / CBI Workshop / Day 2	
Morning Session	Afternoon Session
▪ Understand how on-line courseware differs from a website ▪ Introduce the basic elements of CAPE - concepts and vocabulary ▪ Use existing web materials with CAPE ▪ Design activity flows in CAPE ▪ Author and use formative assessments in CAPE ▪ Represent knowledge in CAPE	▪ Apply HPL design/CAPE technology to course ▪ Review LC lesson design for the selected course with CAPE in mind ▪ Revisit appropriate learning activities incorporating HPL elements with CAPE in mind ▪ Collaborate, design, and develop an LC module ▪ Present lesson module ideas to fellow workshop participants for feedback ▪ Make brief written commitments for module implementation and follow-up activities

Continuous Faculty Motivation and Engagement

During the course of the pre-workshop training and the workshop days, faculty were presented with numerous examples of CBI used in STEM courses and how it had positively impacted student learning. Data was presented showing the correlation between CBI implementation and improved student performance on measured learning outcomes. In addition, faculty were actively engaged in a number of CBI learning exercises where they could observe CBI from a student's perspective. The interactive small group setting of the workshop gave faculty a platform for expressing their concerns and questions about the pedagogy and the presenters a platform to address those questions and concerns. The objective of these activities was to show the faculty that a change in pedagogy was not only advantageous to student learning but that such a change was both possible and in many ways practical. In an effort to engage the faculty they were tasked with identifying a single topic in one of their STEM courses that could be taught using CBI. Early in the training faculty worked on a CBI content design template, shown in Figure 1, in preparation for testing it in the classroom. Faculty were motivated by the opportunity to evaluate and assess in their own classrooms the effectiveness of CBI.

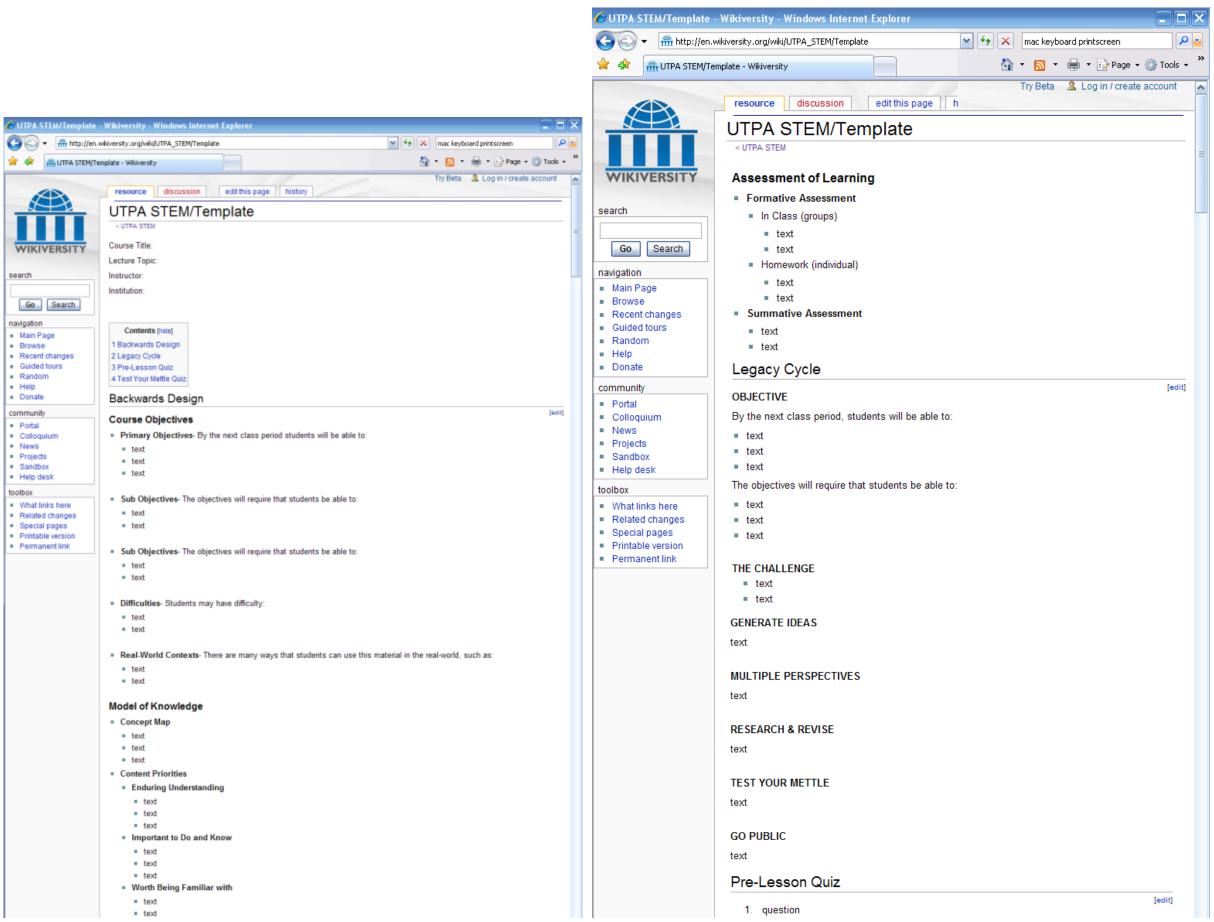

Figure 1 CBI Development Template for the CBI "Teaching Toolbox" Online Repository

Formal and Informal Advertising

Involvement of subsequent groups of faculty was opened to all STEM faculty at the two partner institutions through emails to faculty and by word of mouth from former participants. The second group of 19 STEM faculty attended the pre-workshop meeting on April 17th 2009. To date all of the faculty development workshops outlined in the proposal have been offered including with the final group beginning in February 2010 and finishing in May 2010 as scheduled. An additional eight STEM faculty were included in the final group. The schedule and attendance at completed workshops and workdays is given in the table below. The second and third columns represent numbers of faculty who attended some portion of the training. The final column of Table 3 represents the total number of STEM faculty (108) who have completed the workshops to date. In the fall of 2010 an additional workshop cycle was offered to serve another group of 20 bringing the total well above the original target of 80 STEM faculty.

Table 3. CBI Workshop Attendance

Group #	UTPA Faculty	STC Faculty	Pre-Workshop	Workshop	Workday #1	Workday #2	Completed Workshops
1	15	5	Feb. 2009	Mar. 2009	Apr. 2009	May 2009	18
2	17	3	Apr. 2009	Apr. 2009	Nov. 2009	Nov. 2009	36
3	22	2	Nov. 2009	Nov. 2009	Feb. 2010	Feb. 2010	59
4	24	5	Mar. 2010	Mar. 2010	Apr. 2010	Apr. 2010	88
5	14	6	Sept. 2010	Sept. 2010	Sept. 2010	Sept. 2010	108

Provide Support to Meet Expectations and Satisfy Deliverables

The objective of the pre-workshop training and the CBI workshop was to motivate faculty regarding the promise of CBI and to prepare faculty for successful implementation. The reality however is that there is a great gap between motivation and implementation. The objective of the two workdays was to close that gap through structured support activities that encouraged and facilitated implementation of CBI in the classroom. Most importantly, the workdays provided faculty with the time needed to develop new curriculum for one class lecture that incorporated CBI. The group setting was critical to this curriculum development task as the faculty encountered many questions in the process. Each workday was led by the Faculty Development Program director, his graduate assistant, several undergraduate STEM majors, and several faculty who themselves been through the program and implemented CBI. Faculty worked in groups often across STEM disciplines providing valuable feedback to one another particularly about the lack of clarity of presented concepts that experts often miss. A template, shown in Figure 1, was developed that provided faculty with an outline of the framework of backwards design, the method presented as a structure for the development of effective CBI content. The template which focuses on learning objectives and assessment was completed by faculty during the first workday and assessed by the group. Building on the design template, faculty worked in groups on the second workday, under the supervision of program staff, to structure lecture content around the Legacy Cycle. The goal was that by the end of the second workday each faculty member would have developed and documented a lesson plan for CBI in one of their

STEM courses. These completed templates have served as a valuable resource for other faculty in subsequent workdays and for faculty who are experimenting with or investigating CBI.

Faculty that participated in the program understood the expectation that they would implement CBI in at least one of their STEM courses and assess the outcome. As of September 2010, all groups (108 faculty) have completed the workshop and CBI course development workdays. Each faculty participant is at a different stage of implementation ranging from those who still only have a rough outline of their CBI content to those who have posted and implemented content in several STEM courses. Activities are continuing under the program to encourage continued faculty participation in the implementation of CBI. A number of faculty and student surveys have been used to assess the level of implementation and identify where continued support is needed. The surveys also provide additional data to support the effectiveness of the pedagogy across several STEM disciplines and faculty demographics including experience, age, gender, and nationality. The long term expectation is that faculty who have embraced this pedagogy because of its' effectiveness will encourage other faculty to consider CBI.

Go Public and Leaving Legacies

STEM courses that have implemented CBI include those listed in Table 3 below. Detailed information for each of these courses on the development and implementation of specific CBI content is found on the CBI web site, http://en.wikiversity.org/wiki/UTPA_STEM. To date the site includes CBI content covering approximately 40 STEM courses developed by over 100 STEM faculty from two institutions. Several of the courses on the web site include multiple CBI challenges that cover several content areas. An example of a course listed on the web site that covers a variety of course content with multiple challenges the Introduction to STEM course. The design and implementation template for one of the CBI challenges (DNA Extraction) for this course is shown in Figure 2. The site can be searched by course, topic, instructor, or institution as shown in Figures 3-5 and has a common structure making it a useful tool for CBI developers especially in related STEM disciplines. For example, compiling a list of challenge questions or formative assessment methods is simplified as the content is organized according to the essential elements of CBI. Faculty who had difficulty posting content were assisted by students during the workdays and whose services were made available throughout the duration of the grant. Several faculty have posted additional courses and lectures on the CBI web site following the completion of the workdays illustrating the effectiveness of providing learning communities a public forum where new ideas are shared and evaluated.

Table 3. Courses Content Posted on CBI Website

Animal Parasitology Biology II Biomedical Calculus II CAM Environmental Chemistry Geometry and Measurement	Graduate Seminar Engineering Graphics Introduction to Mechanical Engineering Introduction to STEM Manufacturing Processes Lab Computer Networks	Measurements Mechatronics Numerical Methods and Statistics Organic Chemistry Physics I Precalculus Statics

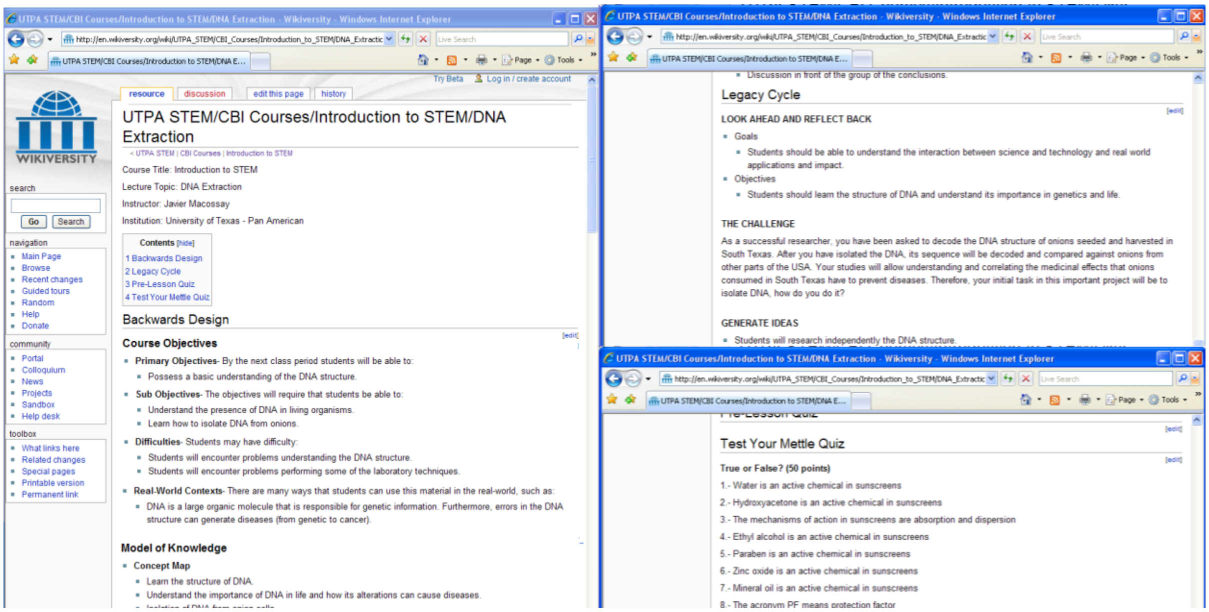

Figure 2. Example of CBI Design and Lecture Content Posted on CBI Website.

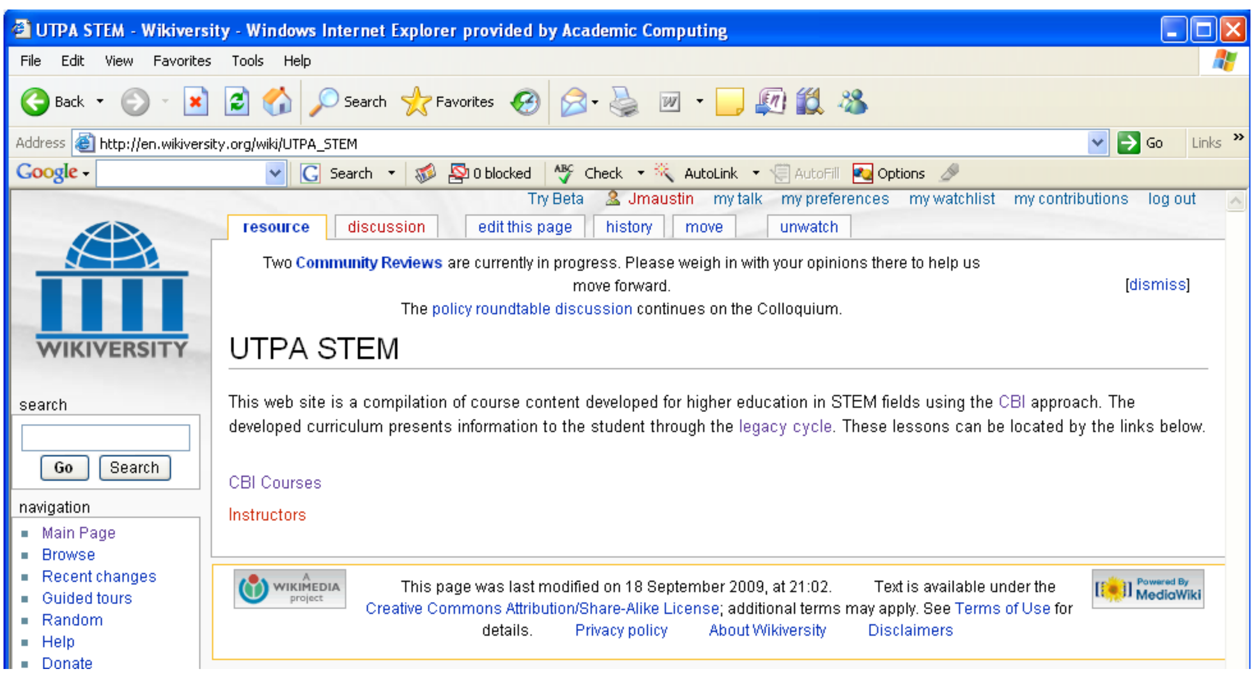

Figure 3 UTPA STEM Website using Wiki-Media Platform

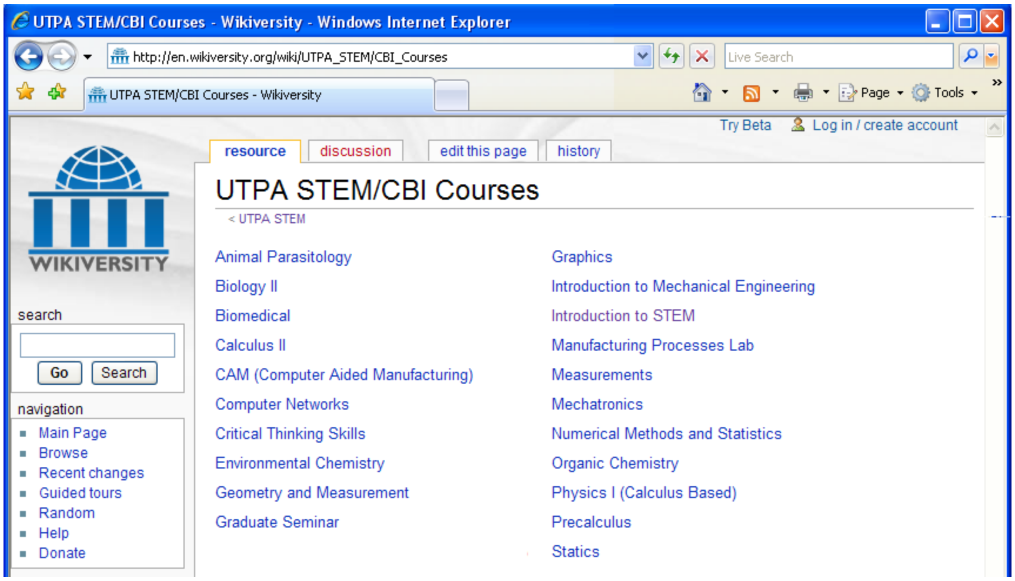

Figure 4 Example of CBI Courses in UTPA STEM Website

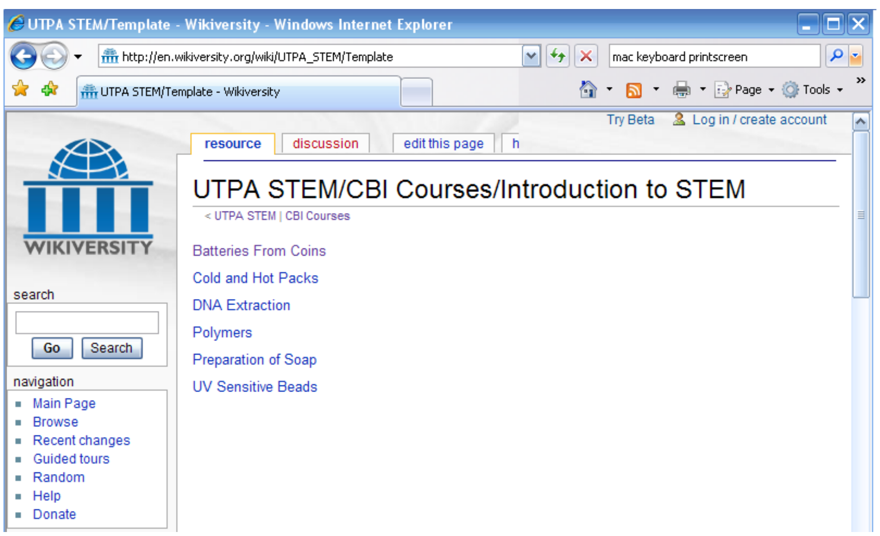

Figure 5 Examples of Challenges in Introduction to STEM Course

Faculty Development Plan Results and Assessment

Each of the five faculty development groups in the faculty development program was composed of a mix of faculty from the two and four year institutions. In the first group 25% of the participants were from the two-year partner institution. A total of 21 faculty from STC have participated in the workshops representing a number of STEM disciplines (Math, Physics, Engineering, and Biology). In each of the groups the faculty from both institutions were mixed during interactive activities and provided many opportunities for collaboration. A majority of the faculty have collaborated on other activities outside of the faculty development workshops following their participation especially in other activities funded by the grant. There has been a recent increase in the matriculation of students from the two-year to the four-year institution which may have in part been due to the relationships developed among faculty and the increased faculty awareness of each other's programs. An emphasis was placed on greater recruitment of STC faculty for the final two groups of participants in the Spring and Fall 2010 semesters. Contacts through the president's office and former participants assisted in increasing participation.

The response of faculty and students to CBI has been positive and is being quantified through results of faculty and student surveys. The recent growth in STEM enrollment is encouraging and may in some ways reflect the activities of the grant. Surveys have been developed and administered in various courses in the Spring 2010 semester to assess the local impact of CBI on individual courses. The surveys address the impact on both students and faculty. The results of the surveys are currently being reviewed however early results show that the faculty are implementing CBI in the classroom and that students provided positive feedback about CBI implementations and are requesting that more content be delivered using CBI.

The success of a faculty development program that included approximately 30% of the STEM faculty required enthusiastic participation. One factor that led to such participation was financial compensation. Participants were given a substantial stipend in consideration of their investment of over 20 hours in training activities. Participants were also given the opportunity to receive additional summer support for their involvement in CBI curriculum development on full course implementations. All of the participants of the first group of twenty faculty received summer support for full course implementations. Knowing that they would be intensely applying what they had learned added to the success of the first group. The success of the first group created a positive expectation for the four groups that followed over the next 18 months. Aside from financial incentives, many participants recruited faculty from their departments motivated by the quality of the workshops and pedagogical methods presented.

As the CBI STEM website nears completion both faculty who participated in the faculty development activities and those who simply heard about CBI are browsing the CBI lecture content on the website. Many of the faculty rotate the teaching of various STEM courses and this online resource of pedagogical improvements specific to individual courses will likely be an asset to many faculty. The structure of the website is easy to browse by instructor, course name, lecture topic. Additionally, the current wiki-media platform allows for the growth of the site as instructors add new content and comment or add to existing content. An example of some of the content already posted on the website is shown in the figures 3, 4, and 5 below. As the grant nears completion a number of the forty examples will be highlighted as exemplars of CBI course content.

The first group of participants in the faculty development workshops and workdays were all members of curriculum development teams for the summer of 2009 satisfying the training objective for the first phase of full course development. By the end of the workshop and two workdays the first group of participants were both well informed about CBI and had some initial experience with developing CBI content. Additionally, the group was divided into course development teams during the faculty development activities. This allowed for the building of relationships prior to the summer work. The result was that the teams began the summer course development as a functioning group with a clear vision of what needed to be accomplished.

Following the first group, an additional 39 faculty have attended the faculty development workshops and an additional group of approximately 49 faculty who completed the cycle by May 2010. This provided a group of approximately 88 faculty to draw from for the second stage of full course development which helped in the success of the second wave of curriculum intervention. The group of STEM faculty who understand CBI and have begun implementing CBI in their courses represents a significant percentage of the total STEM faculty population. This group is well equipped to continue in curriculum development efforts in the future.

Conclusions

The issue of faculty development in CBI was addressed at UTPA and South Texas College (STC) in a recently awarded U.S. Department of Education grant. Reports from faculty on the student response to CBI have been positive and consistent with the results of previous studies on the student impact of CBI[14]. At UTPA, faculty response to the announcement of faculty development workshops was very positive and led to full enrollment for each workshop offered. The quality of the workshops, faculty interest in improving pedagogical methods, workshop stipend, the possibility of summer support to develop CBI courses, and recommendations by former participants have all been factors in the full enrollment. The success of the previous grant has stirred faculty interest in and illustrated the need for continued on-campus faculty development training, mentoring, and support.

This project is building a faculty development model that will have a significant impact on the number of STEM graduates and that will be simple to replicate in other geographical areas. This project intends to increase the number of students successfully engaged in STEM fields which is a national priority.

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