In the name of God

Creative Strategies and Methods of Teaching

Message from the University Rector

All praise is to Allah alone, and His peace and blessings be upon His messenger and bondman our Prophet Muhammad, his family and his companions..

Innovation in university teaching has become one of the important and vital issues and one of the main pillars of university teaching and learning development.

Since Imam Muhammad bin Saud Islamic University (IMSIU) realizes their duty toward the development of higher education in Saudi Kingdom and toward the activation of their role locally and internationally and since they aspire to achieve the mission of excellence in university teaching and to activate communication and experience sharing amongst faculty members of all scientific disciplines at national and international universities, University vice presidency of Studies, Development and Academic Accreditation, represented by the Deanship for Development of University Education has worked on organizing the International Forum for Innovators in University Teaching (IFIUT) at IMSIU campus.

IFIUT is based on a pioneering idea; to attract outstanding experiences in university teaching locally and globally then to present these experiences to recipient faculty members and likewise in universities in which they can develop their teaching skills and then improvement of Higher Education outcomes. Therefore, they can keep pace with the practical and scientific ambitions of our society.

This Forum and all university initiatives come to coincide with the recognition given by the Custodian of the Two Holy Mosques, King Abdullah Bin Abdul-Aziz, and his Crown Prince, Salman Bin Abdul-Aziz to the development of education, particularly university and higher education. Also, it comes as a result of the continuous support of his Excellency, the Minister of Higher Education and the Chairperson of the University Council, Professor Khalid bin Muhammad Al Ankari.

Message of Vice- Rector of University for Studies, Development and Academic Accreditation

All praise is to Allah alone, and His peace and blessings be upon His messenger and bondman our Prophet Muhammad, his family and his companions..

The International Forum for Innovators in University Teaching (IFIUT) at Imam Muhammad bin Saud Islamic University is one of the most significant events the university organizes. Its importance appears clearly when we consider the Forum's role in developing university education in creative ways that focus on outstanding teaching experiences of innovators from inside and outside the Kingdom. The goal is to present their experiences of different disciplines; thus, faculty members in Saudi universities, in particular and in International, Arab and Gulf universities, in general can get benefits in a way that reflects on their teaching performance at their classrooms with their students.

Accordingly, the scopes include: planning innovative university teaching, creative strategies and methods of teaching, modern technologies in university education, methods and means of creative evaluation, excellent activities and practices of university teaching, excellence in managing university teaching and others.

This leading Forum and all developing efforts exerted by the university in order to promote university teaching and learning at Imam University come with the recognition given by the Custodian of the Two Holy Mosques, King Abdullah Bin Abdul-Aziz, and his Crown Prince, Salman Bin Abdul-Aziz to the development of education, particularly university and higher education. It is under the supervision of his Excellency, the Minister of Higher Education and the Chairperson of the University Council, Professor Khalid bin Muhammad Al Ankari, and the continual support of the University Rector, Professor Sulaiman bin Abdullah Abalkhail whose efforts are endless in developing the educational process and promoting the university and the staff to the highest standards locally and globally.

Creative Strategies and Methods of Teaching

Message of Dean of Development of University Education

All praise is to Allah alone, and His peace and blessings be upon His messenger and bondman our Prophet Muhammad, his family and his companions.

The idea of IFIUT has emerged to achieve the mission of excellence and leadership in IMSIU teaching and learning through enriching and encouraging creativity and keeping pace with modern approaches of higher education.

Therefore, the Forum aims to provide innovative, realistic and distinguished experiences in university teaching which are presented by faculty members of different specialties. The experiences include introduction of excellent and creative strategies and methods of university teaching and discussions of teaching and learning related experiments. They focus on excellence in teaching and the most recent approaches in university teaching; in addition to, providing opportunities for (academic) educational and scientific meetings and exchanging creative realistic experiences among faculty members and those who are concerned about developing university teaching and learning nationally and internationally.

In brief, IFIUT is "from and for faculty members". It is all about realistic and excellent experiences in university teaching that are applicable and that are presented, so instructors get benefits in a way that reflects positively on their teaching performance and learning outcomes in all different scientific, humanity and applied majors. In addition to the previously mentioned scopes, the Forum will involve other events; such as, model lectures, workshops, discussion sessions, an exhibition relevant to the Forum in which our associates in success and innovation present examples of their educational and technological products and modern strategies for development in university teaching and learning sectors.

In conclusion, I am always thankful to Allah the Almighty for his blessings then to the Custodian of the Two Holy Mosques, and his Crown Prince for the endless support they give to higher education development in our beloved country. Also, my sincere appreciation is to his Excellency, Minister of Higher Education, Professor Khalid bin Muhammad Al Ankari, for his efforts and

sincere support for IMSIU and to the University Rector, Professor Sulaiman bin Abdullah Abalkhail, for his continues support to the deanship and his assistance to all its developing activities and programs and for his guidance that has encouraged us to work and reach creativity that our country, society and university look for. Finally, my sincere thanks are for Prof. Khaled Al Abdurrahman, Vice- Rector of University for Studies, Development and Academic Accreditation, and the Director of the Forum's Organizational Committee, for his efforts, constant supervision, his leading role in the deanship's achievements, and for his efforts toward the success and excellence of this Forum.

Creative Strategies and Methods of Teaching

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English papers

Critical Thinking in Medical Humanities: A Sequenced Lesson

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Abstract
This paper will describe a unit in my curriculum for a writing-intensive humanities seminar for pre-medical students taught at Weill Cornell Medical School – Qatar. In this course, students practice critical inquiry as a first step to entering a full medical program. Detailing specifics of the teaching and learning process through sequenced assignments within the theme of how doctors reason, this paper will describe, through the assigned readings, why doctors might error in their diagnoses premised on social, emotional and personal misjudgment. The unit sequence will demonstrate how students learn to analyze the critical thinking underlying several medical misjudgments from a humanistic, qualitative perspective, a learning experience that complements the empirical inquiry in their science courses. It will summarize the triangulation of assessment instruments of teaching and learning for this unit for both students and the professor. These rubrics include a Cornell-Ithaca set of questions, WCMC-Q Student Perception Instrument; Middle States Assessment Review, and primary evidence of student learning through student writing.

Keywords: *critical inquiry; critical thinking; learning sequence; writing to learn; medical reasoning*

Introduction

According to Dr. Peter Pronovost, an anesthesiologist from John Hopkins, medical errors in the United States kill more than 250,00 people a year, which we could calculate statistically as the third major cause of death in the US, after heart attacks and cancer. Given this disturbing fact, CNN's Senior Medical Correspondent Elizabeth Cohen and CNN Correspondent John Bonifield have issued a special report which cites the most common medical mistakes as follows: treating the wrong patient; failure to remove all surgical instruments from inside the patient's body after surgery; operating on the wrong part of the body, such as a wrong amputation, among many others[1].

If we acknowledge the commitment by the profession to the highest standards in the Medical Oath, then we must ask why doctors continue to make errors. Errors by well-trained and ethical doctors and medical staff are not intentional. And for higher education, how can we teach our students—in my case, my pre-medical students at Weill Cornell Medical College-Qatar--to understand the reasons and context for medical errors with the goal of preventing them?

This paper will offer a sequenced lesson for critical thinking in the medical humanities with these objectives in mind, and summarize the teaching and learning instruments at WCMC-Q used to assess learning for this unit. This unit comprises one of five units in my fifteen-week required course, First-Year Writing Seminar1111– *The Heart of a Doctor*. Class size is between twelve and sixteen, and the class is taught exclusively in English, as students are expected to enter with good to excellent English skills. The writing seminar, one of approximately 120 writing seminars taught each term at the Cornell-Ithaca campus, fulfills the recommendations for the seminars as outlined in the Cornell-Ithaca catalogue, that is, between five and twelve

essays for the fifteen-week course, with an emphasis on writing. Each has the option of offering a different course theme. Typical writing assignments for my class include the following: journal entries, in-class three-minute responses, thought papers, and an academic essay. My course culminates in one field trip. This seminar is intended to guide students to write with increasing eloquence, confidence and complexity. In addition, through extensive reading and writing as sequence, this unit invites students to explore the reasoning and the extenuating circumstances which shape how doctors think and why they might error.

Teaching Experience

With modifications each term, this course was taught at WCMC-Q eighteen times over a nine-year period, 2004-2012, eight times under the theme "The Heart of a Doctor."

Goals

- To assist students in writing well-considered, coherent academic essays in response to a number of academic sources
- To guide students in developing clear, comprehensive thesis statements providing a conceptual framework necessary for logical, thoughtful treatments of ideas
- To enhance critical thinking and reasoning skills
- To explore social and cultural issues relevant to medicine
- To reinforce conventions of standard written English
- To show evidence of understanding the multiple factors that contribute to how doctors think and why errors can happen even by honorable, committed doctors.

Learning Objectives: The learning objectives for this spring course were those set forth in the March 2004 proposal for this curriculum and in guidelines from the John S. Knight Institute for Writing in the Disciplines, Cornell-Ithaca. Its basic template followed two sets of principles, one from Cornell-Ithaca as outlined in the course catalogue (thirty pages of revised writing through sequenced assignments leading to a portfolio) and one that I initially established for this seminar, "The Heart of a Doctor," which proposed readings in Standard English fiction and non-fiction readings that foreground medical culture.

Thesis Question: What are the psychological, personal, and social conditions within the humanistic arena that may cause mistakes in medical reasoning?

Importance

A pre-medical curriculum in critical thinking within a medical humanities arena can provide students with qualitative and multi-dimensional practice for their own reasoning to complement empirical reasoning used in the sciences. Triangulation assessment can provide a more complex measurement of sophistication in student thought.

Relation to educational theories and research

The relation of this lesson to education theories and research includes Bloom's teaching and learning taxonomy and critical thinking in sequenced assignments in the book, *Local Knowledges; Local Practices* by Jonathan Monroe and Katy Gottschalk[2]. Bloom's taxonomy has provided the scaffolding for assignments in this course, modified over the years by Anderson and Krathwohl, among others [3]. This taxonomy can be hierarchical, multifaceted and recursive; its parts can diverge and converge. This course advances Bloom's highest level of critical thinking by extending "evaluation" to include MA Rishel's addition of "theorize/conceptualize." Conceptualizing is defined as the ability to

apply a theory to a narrative, argument or idea; interpret, analyze or evaluate a theory; theorize about theory; or create a theory. Triangulation in assessment can be explored more fully in the book, *Educative Assessment* by Grant Wiggins [4].

Detailed explanation of the experience

To begin this unit, students composed a list of values and assumptions associated with the medical profession, which they sketched on the board into a continuum, dividing them into personal beliefs and society's beliefs. These formed the basis of our discussion and writing. This segued into a blindfold exercise where students were blindfolded and led by a student partner through hallways and then asked to record the experience. For this assignment, students wrote a three-page personal essay describing and analyzing their experience and the effect this dramatized disability had on their emotions, space orientation and perceptions of self. The class discussed the challenges in analyzing a disability they themselves had not directly experienced.

From a personal, direct experience, the class segued to the knowledge or information level of Bloom's taxonomy, where we began our readings and class discussions of these works with the focus on errors in reasoning. The nineteenth-century short story, "The Yellow Wallpaper," by Charlotte Perkins Gilman, illustrates how anger can be misdiagnosed through a false generalization of mental illness when in fact it is driven by female hysteria gender bias [5]. Another story that strengthened student background knowledge was Bharati Mukerjee's, "The Management of Grief," which portrays how the characters misread different individual and cultural grieving processes [6].In "A District Doctor," a story by the nineteenth century Russian writer-physician, Ivan Turgenev, our class discussed the medical error of over-compensating empathy for a dying patient, which results in the doctor's over-identification with the patient's death [7]. In addition to this fiction, we read non-fiction essays written by doctors. In one favorite essay, "Death by Chocolate," by Dr. Hamish MacLauren, a young emergency room doctor makes the error of assuming that patients always tell the truth. Treating a teenage girl for attempting suicide by poison, he is distracted by her noisy friends and their playful youth, and he makes the error of assuming the patient has indeed poisoned herself, failing to realize that patients with addictions and compulsive behaviors often lie to hide their disorders. The patient is, in fact, anorexic, and after eating enormous quantities of chocolate she tricks Dr. MacLaureninto pumping her stomach [8].

Cognitive Fallacies: Error Identification Theory

Class Brainstorming Notes

During class discussion of the readings, we identify and compile multiple errors in reasoning as we discover them, with the class brainstorming ideas on the chalkboard as a recursive exercise through the unit. Everyone contributes, sometimes working in teams. As practice in concept learning, this list will become the theoretical foundation for their concluding major paper. Thus, as the class coalesces the errors into behavioral concepts, it moves into theory.

Representative Error

- When thinking is overly influenced by what is typically true; failing to consider possibilities that contradict their mental templates of a disease; be prepared in your mind for the atypical
- Relying on hunches-Developing hunches from very incomplete information – relying on shortcuts and rules of thumb, known in psychology as "heuristics" = method or template to solve problem

Availability

- Influenced by patients you have just seen

Confirmation Bias:

- Confirming what you expect to find by selectively accepting or ignoring information
- Refers to tendency to judge the likelihood of an event by the ease with which relevant examples come to mind
- Experiences most familiar to him can bias his assessment of chances for success
- Dismissing data that contradicted his diagnosis.

Affective (emotional) Errors

- Protecting a patient doctor likes or admires can adversely affect judgment
- Unconscious emotions

Association Errors

- Associating patient with an ideal image doctor has of that patient, like patient and soccer player

Other possibilities

- Jumping to conclusions without further tests
- Emotional attachment to patient – reduces objectivity – being susceptible to personal emotions – emotionally biased
- Egocentric – overconfidence in one's ability and knowledge
- Stopping gathering evidence too soon
- Overdependence on some tests
- Relying on only one test, depending on possibilities, not facts
- Not knowing enough
- Carelessness due to work pressure (failure of will)
- Suppressing mistakes instead of learning from them
- Making unsure presumptions based on previous knowledge
- Bias – common vs. uncommon illnesses – focus is distorted

EXAMPLE OF STUDENT PAPER

An extended illustration of student work can demonstrate how a student explores high value thinking by threading concepts within an analytical paper. This paper discusses one of the most complex and important essays written on the subject, Dr. David Hilfiker's "Mistakes" [9].This paper will discuss how this student discovers then expresses significant conceptual learning, the major course objective.

In his essay, Hilfiker examines the psychological distress he undergoes when he fails to reason logically and when he fails society's expectations of perfection. His essay narrates the guilt, shame, diminishing confidence and frustration over human frailty—a post-traumatic stress factor—in a doctor.

The student begins, as the course suggested, with a brief summary of Hilfiker's essay, then she provides a discussion of the psychological effect the tragic medical mistake has had on the doctor. Carefully assembling the evidence from the reading, she builds to her thesis, which contains the major concepts she hopes to expressing her writing. She demonstrates that she has not just read the assignment, but more importantly, she also offers a sophisticated understanding of why doctors make mistakes by interpreting that evidence and placing it in a theoretical and conceptual arena. Herhigh value thinking indicates; even as a first-year student, that she is embedding thought processes that converge on the higher levels of Bloom's taxonomy. This is a representative paper from a student with English as a second language.

Student Paper

(Numbers in parentheses come from the student's original source.)

"Mistakes" is narrated by the American medical practitioner David Hilfiker. David Hilfiker encounters a patient who thinks she's pregnant but her hormonal levels show

that she's not. Hilfiker therefore decides that she must have had a missed abortion and performs a dilation and curettage procedure to remove the dead embryo from the uterus. He later runs tests and finds out that the parts he cleaned out of her uterus were not dead. He learns that he has mistakenly killed a living embryo.

The moment Hilfiker realizes that he has done something wrong during the procedure, he is washed by immediate terror: "These are parts of a body that was recently alive…I do my best to suppress by rising panic and try to complete the procedure" (327). Even though Hilfiker still isn't sure that he aborted a living child, he starts undergoing psychological trauma. Then, after running tests and placing several "frantic" calls to other doctors, Hilfiker is sure that he killed a living baby. This amplifies the psychological trauma within him, and he declares that his "worst fears" (328) were confirmed. Hilfiker then starts traumatizing himself even more as he let the guilt wash over him. Using the harshest of words he tells himself: "Nothing can obscure the hard reality: I killed their baby" (328). Furthermore, Hilfiker undergoes a trial in which he is the judge and the prosecuted. He starts questioning himself, going back in time, reevaluating every decision he made since he started seeing the patient and regretting his wrong judgments: "I had relied too heavily on one test…I should have ordered the ultrasound before proceeding to the procedure…" (329). Hilfiker is not only feeling guilty but he's also "angry" (329) at himself. Placing himself under a personal trial is his way of learning from his mistakes. By giving himself a hard time, he makes sure that the mistake won't be repeated because he will, for sure; remember the trauma he underwent after such an incident.

David Hilfiker even takes his guilt to the next level and decides to tell the mother and father that he has aborted their living child. Not only does he confess that the aborted child was alive but he fully declares every wrong step he took that might have lead to the big mistake of aborting the child (329).***Hilfiker takes full responsibility and chooses to confess his mistakes. He, as a consequence, transcends the sacredness of science when he*** **chooses to** ***takes his responsibility beyond doctoring and treating patients. Hilfiker also jeopardizes his career during his personal trial because he believes that when he gets through this trial, even if with penalty, he will become a better doctor. "[He] never [asks] for their forgiveness" and decides that it's "[his] responsibility to deal with the guilt alone" (329), also as part of his lawsuit against himself. Taking the blame and this additional responsibility leads him to excel as a doctor, by transcending science into more cherished definitions*** **[**my italics and bold].

Note: Hilfiker writes of several other incidents where he has made medical errors: his ego and over-confidence causes him to hesitate in a referral to another doctor; another error is attributed to simple lack of knowledge; another result of simple carelessness. At the end of the essay, he confesses that a patient died because of his "failure of will." He was just too busy, tired and frustrated that day to give this elderly patient the extra attention she needed. This admission raises these questions to philosophy and to the ethics that underlie frail humanity and the humanistic tradition.

In this student paper, we can through the student's thinking not just causes of medical errors but the ethical and humanistic implications of them. This reasoning, through the writing, takes the student through all levels of Bloom's critical thinking taxonomy.

This unit sequence concludes with a field trip either to Hamad Hospital, observations of USMLE practice sessions, or a visit to the Al Shafallah Artistic Center for Autistic Children. The objective is not to seek out errors, as my pre-medical students are still novices, but to observe the challenges of a medical setting.

Outcomes
Summarizing assessment requirements by the Cornell-Ithaca main campus, the US Middle States Review Committee, and the pre-medical humanities faculty, this paper addresses the results of student self-reports and statistical data of rubrics (secondary evidence) and compare these data with student papers (primary evidence), to demonstrate the complexities of qualitative learning and assessment.

While all the instruments used provide excellent data for measuring student learning, none offers evidence for measurement for the most sophisticated learning in this unit: theoretical and conceptual causes for medical errors. The best instrument for this has been the qualitative assessment embedded in student writing, which is signaled through the thesis as demonstrated by the student paper.

Evidence of effective teaching and learning
Result: The teaching and learning of this course are measured by three instruments, and what we have discovered is that qualitative learning is elusive and, therefore, not easily measured by quantitative methods. Further, many categories required by the university have degrees of relevancy, and none directly addresses, through primary evidence, the teaching and learning of the most complex, most sophisticated concepts. For this latter, we suggest qualitative analysis of student performance in essay writing.

Student assessment of course, learning and professor
Cornell-Ithaca Instrument
Student perceptions of learning experience were statistically rated among highest satisfaction compared with all seminars at the main campus. This instrument, required by both Cornell-Ithaca and WCMC-Q, provides data of student satisfaction through student perception of their experience. Its advantage is that it compares my students with student satisfaction from the main campus. See Attachment A.

WCMC-Q Short Answer Instrument
Student perceptions on WCMC-Q form, which is optional but used by most faculty, describe the course as very good to excellent. See Attachment B for representative remarks.
Assessment of student performance by professor and colleagues

Middle States Review
The Middle States Review by the humanities/writing faculty indicates that student performance predictions for writing skills and concept learning are as predicted or better. Note: Differences are taken into account. Students entering WCMC-Q with only a year or two of English may need additional tutoring the second year. Students entering with excellent English skills almost always fulfill expectations comparable to those at the main campus. See Attachment C.

Recommendations
Further study on multi-faceted assessment instruments that offer complementary quantitative and qualitative perspectives would strengthen our understanding of teaching practice and student learning for complex humanistic critical thinking. Courses in critical thinking through analysis and meta-analysis would strengthen the skills of students as they enter advanced courses. Evidence suggests, however, that the assessment of teaching and learning for high-level conceptual thought requires careful, work-intensive qualitative analysis. It cannot be limited to simple quantitative self-reporting. Higher education must be willing to invest the time and effort for substantive reviews of deep learning if it is to well serve our students.

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جامعة الإمام محمد بن سعود الإسلامية
AL Imam Muhammad Ibn Saud Islamic University

International Forum of Innovators in University Teaching

Innovation in University Teaching Using Online Forums

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Abstract

The current paper is about bringing innovation in teaching by using online forums. The author was assigned a course of English for Specific Purpose (ESP) for a MA (Master of Arts) level program at a public sector university in Pakistan. The students were in their final semester and they were expected to be joining various educational institutions as a faculty after completing the Masters program. Thus ESP course was very significant as most of them would be teaching ESP after graduation. The author turned this course into a project and divided students into group of three to four. Each group was assigned to develop an ESP course related to Medicine, Engineering, Business etc. They were given input session and then they joined online groups for course development.

The outcomes of the project were quite remarkable as students' developed ESP courses were quite organized, professional to a great extent and far better than existing courses. Online forums can contribute in teaching through self directed learning approach.

Keywords: *Innovation, Self Directed Learning, Online Forums*

Introduction:

Innovation is "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" [1]. Wu believes that innovation is there when teachers use multi-faceted teaching methods with a variety of content to stimulate students' inner interest in learning, which in turn develops students' positive attitudes toward proactive learning and enhances students' learning ability [2]. Innovation in teaching and learning is imbedded in an effective teacher as his urge to do the best in his teaching for the benefit of the students lead him experience many teaching strategies and approaches . This search or desire for change in teaching makes him a role model for the students who later remember their teachers in their professional life. The teacher stays at his own place and keeps generating educated masses for the general good of the society. The responsibility of a faculty in higher education is little more than other levels of education as they educate and fine tune the students in the final stages of their academic life. Thus innovation becomes more necessary at this stage as the teachers have to present to the students several dimensions of learning which would help them not only in their professional life but would also make them a better member of the society. However, innovative teaching depends upon many factors such as context, faculty and students. Thus, what a teacher does for students as innovation may be a regular practice at some other place. Even within the same context, one faculty may choose to introduce a unique teaching strategy based on the learners' needs which may not be of significance for other faculty members. [3]

The current paper attempts to unfold a unique teaching methodology that was used for graduating students of Master of English program in a public sector university in Pakistan. They were enrolled for a course on English for Specific Purpose (ESP) and they

were supposed to be aware of how ESP curriculum is developed and implemented. It was a traditional classroom set up with students being taught through lecture technique. There were no audio visual aids available except chalk and a board. The course aimed at preparing students for designing and teaching English for Specific courses in different disciplines i.e. Engineering, Medicine, and Business etc. Traditionally, teachers of this course choose a book and or few chapters of a book and give knowledge about what is ESP and how it is different from Academic English. The teachers of this course also use some available courses of ESP and discuss in the class. However, this is mostly limited to knowledge and transfer. The actual practice comes when the graduates join any university for teaching such a course.

The author who was the teacher of this course decided to make it a practical oriented course asking students to develop a course of ESP for any discipline of their choice i.e. English for Engineers, English for Medical professionals, English for Business etc. At the same time, they were asked to join any online forum of their choice dealing in ESP. This was all done during initial teaching sessions that were designed to give them theoretical input as well. This innovation was one because with the advancement in technology, innovation would be more effective if supported by information technology [4]

Teaching Experience:

Teaching Goals:

The goals of this project were two folded:

1. At first, it aimed at self-directed learning for the students.
2. Secondly, the author wanted to do an experiment as to how online forums may help students in their learning.

The experience was very significant as it promoted self directed learning among students and made them very confident in implementation of their learning into real life situation.

Relation to educational theories & research:

Knowles defined Self Directed Learning as:

'a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies and evaluating learning outcomes' [5] .

Self Directed learning is significant area of education and researchers have found very positive outcomes of using self directed learning. In order to engage learners in autonomous, self-directed learning, the teacher's role had to change from the one frequently envisioned in traditional conceptions of teaching. Effective teachers take time in the instructional process to get learners to actively engage in learning activities and start using different techniques and methods to become self-directed learners [6]. The teaching strategy used for promoting self directed learning has provided students ample opportunity to work at their own and could claim the ownership of their work output.

Detailed explanation of the experience:

The author was assigned a course of English for Specific Purpose (ESP) for a MA (Master of Arts) level program at a public sector university in Pakistan. The students were in their final semester and they were expected to be joining various educational institutions

as a faculty after completing the Masters program. A graduate with major in English is expected to be able to teach any English course being taught. There are two kinds of courses in higher education i.e. English for Academic Purpose (EAP) and English for Specific Purpose (ESP). All professional degree programs have ESP for their graduates in order to prepare them for job market. Thus ESP course plays a significant role for a graduate with major in English.

The author turned this course into a project so that students could be prepared through self directed learning as to how ESP courses are designed and implemented with a feedback from international experts.

There were 15 sessions allocated for this course each of 3 hours duration. So it was a 3 credit hour course which was conducted in the following way.

1. At first, they were given few theory sessions on course development including need assessment.

2. Later, they were divided into group of 4 and each group was assigned a category of ESP for course preparation e.g. English for Nursing, English for Business, English for Engineers etc.

3. They collected the existing course outlines from the institute which they had chosen for developing the course. For example, students who chose English for Business contacted business school and collected courses being taught to undergraduate business students. They reviewed the courses and also conducted Need Assessment through questionnaires and informal interviews from the faculty.

4. They also collected course outlines of few international universities for the same subjects they were assigned for benchmarking through the online forums which they had joined.

5. Finally, they prepared a course outcomes and course contents along with assessment tools

6. Next stage was significant as all the students were asked to JOIN online discussion group of ESP. They were also asked to use these ONLINE discussion groups for getting feedback on their courses. All the students joined different groups such as MEDICAL ESL, BESIG etc.

7. Students posted their request and got enormous feedback from list members.

Outcomes:

The outcomes of this project were remarkable which have been listed below.

1. Students were involved in real life application of a course which they may be teaching after graduation.

2. Students experienced various stages of course development which they would be required to do in their work situation.

3. Students joined online forums related to English for specific purpose and contacted members for their help. (appendix A&B).

4. Students learnt about how online forums may be used in their professional career.

5. Students' projects, in the form of a complete course, were quite organized, professional to a great extent and far better than existing courses.

Final projects which were submitted contained the old course outlines and the course outlines of the students. They also had the record of online help and the strategy they used for developing course. Thus, this

innovative strategy using online forums helped students develop courses in a real life context which would help them in their professional life.

Evidence and proof of success and effectiveness:

At the end of the course and after award of marks, students were asked two questions. Some of the evidences are appended below.

Question-1. How was your experience of interaction with online groups. Was it helpful and you got support. if so, what was it?
Hatesh Kumar (A student of the Course):
"*It was a my great experience to share things through on line groups without any fear. I got huge support and guidance in designing my draft curriculum of English language for the students of Medical Technology of DIMT. Different people helped me a lot especially in conducting need analysis as well as designing activities for particular students. In addition, these on line groups also suggested some pertinent websites to my work which saved my precious time and energy. Moreover, anyone can ask any question anytime and gets immediate response from seniors and experts without any hesitation. Therefore, these groups helped me a lot in many things. "*

Question-2. How did you find my teaching strategy of making projects and contacting online discussion groups.
Ms Nadia (Another student of the course)

"I found your teaching strategy very impressive and your suggestion to join any online group was also helpful for many students .your were very much planned. the project you gave us was very much based on practical work and we enjoyed doing it a lot but the credit goes to you. you made the way easier for us. it was good that you gave the project before Ramadan that was the good time to work on it. We moved throughout the project step by step that you gave us and succeed. You were the first teacher who gave us exposure to the practical life. Thanks a lot sir for being so sincere with us."

Not only this, students also showed great enthusiasm and zeal during this project and got benefited from their experience of self directed learning through online forums (appendix-c)

Recommendations:
Using online forum in making teaching more effective is a very effective strategy. Self Directed learning takes place and students learn in their own way. Those who are interested in using online forum may consider the following steps.

A. Identify few online forums available in yahoo, Google groups or listserve being operated by different universities.

B. Start your course, give a quick overall review of your course and ask the students to join those groups.

C. Make it mandatory for the students to participate in discussion and respond to queries.

D. Encourage the students to bring their projects before the forum with a request for the feedback.

E. The end results would be positive in many cases and even if students do not find much help, it will give them a forum for networking and getting benefit of recent changes in their field of learning.

Important Note: It is suggested to introduce this teaching strategy either in the middle or one year before the end of their degree program as most of the student would be

tuned up to their major program and would be able to meet the level of online forums.

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Creative Strategies and Methods of Teaching

Concept mapping

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Abstract

In this paper, I introduced Concept mapping which is one of the tools that is used for teaching technique which enhances self-driven knowledge acquisition. Concept mapping developed by Prof. Joseph D. Novak at Cornell University in the 1960s. A concept map is a special form of a web diagram for exploring knowledge and gathering and sharing information.
Concept maps develop student abilities in certain critical areas, such as the ability to draw reasonable inferences from observations, and the ability to synthesize and integrate information and ideas.To construct a concept map, it is important to begin with a domain of knowledge that is very familiar to the person constructing the map.

- Determining the Context: A Focus Question
- Identify Key Concepts
- Rank order the Concepts
- Construct an Initial Concept Map

Using concept maps in planning a curriculum or instruction on a specific topic helps to make the instruction "conceptually transparent" to students. Using techniques like concept mapping can help students build a skill they can use throughout their academic career to help them understand concepts.

Key words
Concept maps, Diagram, Constructing a map, curriculum, Summative Assessments, Formative Assessments

Introduction

As learning becomes more and more a self-directed experience, the community of learners and educators is looking for tools that enhance self-driven knowledge acquisition. In the traditional taxonomy of learning (Bloom, 1956), the cognitive domain, which is considered the core of learning experiences, includes these stages:

1. Knowledge; where the learner is engaged in activities like remembering, memorising, recognising, recalling identification and recall of information;
2. Comprehension; with activities like interpreting, translating from one medium to another, describing in one's own words, organisation and selection of facts and ideas;
3. Application; which includes problem solving; applying information to produce some result; use of facts, rules and principles;
4. Analysis; which looks at understanding how something has been put together; finding the underlying structure of a communication; identifying motives; separation of a whole into component parts;
5. Synthesis; a process that aims to create an original product, and to form a new ensemble using ideas that come from the analysis process;
6. Evaluation; in this phase, a learner makes value decisions about issues; develops opinions and judges decisions, and resolves ambiguity regarding a certain problem.

These stages generally occur in this sequence, and, according to Bloom, they are

achieved in a progression, from the simplest to the most difficult. In traditional learning techniques, each phase is approached using educational material in the form of written text and exercises. At times, exercises are done in a more manual way, by manipulating objects and observing effects.

Concept mapping can be described as a process through which one or more participants, using brainstorming techniques, create a map using keywords that are representative of a specific concept. The result of a concept mapping session is a concept map: a series of words laid out in a graphical representation, with reciprocal connections and links. The information collected in the map is easily accessed by looking at how the relationships between words or concepts have been outlined. Concept maps are most useful for visual learners, who can memorise information contained in a picture, and for learners who have good synthesis skills.

Concept mapping has been used in the training of teachers to increase their awareness of the subject taught (Ferry et al., 1998), and by students to reach a better understanding of certain information (Downing and Morris, 1984). By summarising the subject using keywords and linking these keywords to create a map of relationships, individuals are able to clarify for themselves what is involved in a certain subject or communication, and be more effective in using that information. Literature reports on the benefits of concept mapping for organising information, assisting in learning, comprehension of particularly complex communications, refining meaning and literary framework, improved clarity, and successful understanding of the text (Novak, 1984; Novak et al., 1983; Ruddell and Boyle, 1984).

History OF concept mapping

The technique of concept mapping was developed by Joseph D. Novak and his research team at Cornell University in the 1970s as a means of representing the emerging science knowledge of students. It has subsequently been used as a tool to increase meaningful learning in the sciences and other subjects as well as to represent the expert knowledge of individuals and teams in education, government and business. Novak's work is based on the cognitive theories of David Ausubel (assimilation theory), who stressed the importance of prior knowledge in being able to learn new concepts: "The most important single factor influencing learning is what the learner already knows. Ascertain this and teach accordingly." Novak taught students as young as six years old to make concept maps to represent their response to focus questions such as "What is water?" "What causes the seasons?" In his book *Learning How to Learn*, Novak states that a "meaningful learning involves the assimilation of new concepts and propositions into existing cognitive structures."

The meaning of concept mapping

A concept map is a special form of a web diagram for exploring knowledge and gathering and sharing information. Concept mapping is the strategy employed to develop a concept map. A concept map consists of nodes or cells that contain a concept, item or question and links. The links are labelled and denote direction with an arrow symbol. The labelled links explain the relationship between the nodes. The arrow describes the direction of the relationship and reads like a sentence.

As a learning technique, concept mapping is an overt way of representing meaningful relationships between concepts in the form

of propositions, that is, two or more concept labels linked by clarifying words. As such, they are a representation of concepts in the form of a picture or map, with interrelations between ideas clearly articulated. They tend to be hierarchical in structure, with the more general and inclusive concepts at the top of the map with progressively more specific, less inclusive concepts arranged below them. (Novak & Gowin, 1984; Stice & Alvarez, 1987)

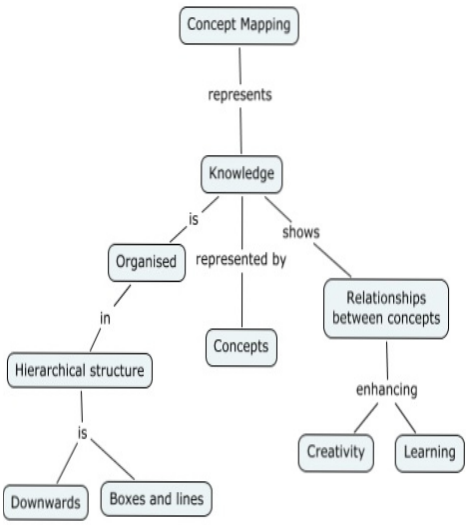


Figure: 1 concept mapping

using graphic organizers improves student performance in the following areas:

- ✓ Retention: Students remember information better and can better recall it when it is represented and learned both visually and verbally.
- ✓ Reading comprehension: The use of graphic organizers helps improving the reading comprehension of students.
- ✓ Student achievement :Students with and without learning disabilities improve achievement across content areas and grade levels.
- ✓ Thinking and learning skills; critical thinking: When students develop and use a graphic organizer their higher order thinking and critical thinking skills are enhanced

Key Elements of Concept Maps

1. Concept maps must have a firm grounding in assimilation learning theory and constructivism- that new knowledge is related to old knowledge and that learners actively construct knowledge by building on what they already know.
2. Concept maps have some degree of hierarchical organization. Generally concept maps are more general or abstract at the top and become more specific as one reads "down" the branches. Very specific details and examples are at the very bottom.
3. Links between concepts are meaningfully labelled so that propositions, or statements, can be read from one end of a branch to the other end the branch.

Purposes of concept mapping:

Concept maps have been shown to support struggling readers (Lovitt & Horton, 1994) by building off of students' prior knowledge and asking them to reflect on their understanding while reading. They are easy to construct and can be used across all content areas

- to generate ideas (brain storming, etc.);
- to design a complex structure (long texts, hypermedia, large web sites, etc.);
- to communicate complex ideas;
- to aid learning by explicitly integrating new and old knowledge;

- to assess understanding or diagnose misunderstanding.

Angelo and Cross (1993) indicate that concept maps develop student abilities in certain critical areas. Among these are:

- The ability to draw reasonable inferences from observations.
- The ability to synthesize and integrate information and ideas.
- The ability to learn concepts and theories in the subject area.

Building concept mapping

In learning to construct a concept map, it is important to begin with a domain of knowledge that is very familiar to the person constructing the map. Since concept map structures are dependent on the context in which they will be used, it is best to identify a segment of a text, a laboratory or field activity, or a particular problem or question that one is trying to understand. This creates a *context* that will help to determine the hierarchical structure of the concept map. It is also helpful to select a limited domain of knowledge for the first concept maps**.**

There is no simple recipe or set of steps for constructing a concept map. When writing, whether a novel, a poem, or a research paper, every author has their own style. Similarly, experienced concept mappers use different strategies when building their maps. Some start by listing a set of concepts, others go directly to placing a root concept and start linking other concepts from it. In this document we present a few steps that users can take when constructing their first concept map that we have found useful throughout the years while helping many people to build concept maps.

- **Determining the Context: A Focus Question**

In learning to construct a concept map, it is important to begin with a domain of knowledge that is very familiar to the person constructing the map. Since concept map structures are dependent on the context in which they will be used, it is best to identify a segment of a text, a laboratory or field activity, or a particular problem or question that one is trying to understand. This creates a context that will help to determine the hierarchical structure of the concept map. It is also helpful to select a limited domain of knowledge for the first concept maps.

A good way to define the context for a concept map is to construct a *Focus Question*, that is, a question that clearly specifies the problem or issue the concept map should help to resolve. Every concept map responds to a focus question, and a good focus question can lead to a much richer concept map. When learning to construct concept maps, learners tend to deviate from the focus question and build a concept map that may be related to the domain, but which does not answer the question. It is often stated that the first step to learning about something is to ask the right questions.

- **Identify Key Concepts**

Given a selected domain and a defined question or problem in this domain, the next step is to identify the key concepts that apply to this domain .Usually 15 to 25 concepts will suffice.. Figure 2 is an example of an initial set of concepts for a concept map about Birds.

Figure 2. of concepts for a concept map about Birds.

Rank order the Concepts

Concept maps tend to be hierarchical in nature, with more general concepts at top and more specific concepts to the bottom. However, the hierarchical nature does not necessarily imply a physically hierarchical structure, as concept maps can just as well be cyclical (Safayeni *et al*., 2006) or have more than one root concept. However, our experience teaching concept mapping has shown us that it is much easier to begin by building hierarchical concept maps, with a single root concept.

Concepts can be easily moved around with Campstools, so this placement is just a way to get started.

Figure 3. Rank order the Concepts

- **Construct an Initial Concept Map**

The next step is to construct a preliminary concept map. This involves starting to connect concepts, using linking words, to create propositions .For every two concepts that are linked, great care must taken to assign linking words that clearly define the resulting proposition. In concept mapping there is no predetermined list of linking words. We consider that this would limit the express ability of the user. However, linking words usually consist of, or include, a verb, and we recommend that they be as specific as possible in expressing the relationship between the two concepts. As the concept map is created, concepts are moved around, added, removed, and

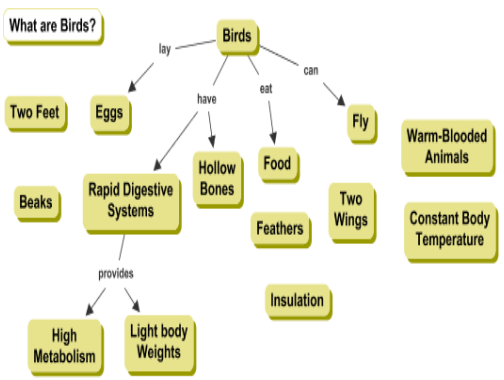


Figure 4 **Construct an Initial Concept Map**

redefined. It is common to try several possible linking words when linking two concepts, in an attempt to construct the clearest, most easily understood proposition in each case.

The process of constructing the concept map continues by linking the rest of the concepts, revisiting the linking words, adding other concepts, etc. Care must be given to making sure that every two concepts with their corresponding linking phrases form a proposition that makes sense, that it is a unit of meaning, and that long sentences are not included in the concept map spanning through several concepts and linking phrases.

Once the preliminary map is built, cross-links should be sought. These are links between concepts in different segments or domains of knowledge on the map that help to illustrate how these domains are related to one another. Cross-links are important in order to show that the learner understands the relationships between the sub-domains in the map. For example, "High Metabolism provides Energy" is a cross-link that joins the subdominant that contains the concept "Rapid Digestive Systems" with that of the concept "Food". "Warm-Blooded Animals produce heat from Food" is also a crosslink.

It is important to recognize that all concepts are in some way related to one another. Therefore, it is necessary to be selective in identifying cross-links, and to be as precise as possible in selecting the linking words that connect concepts. In addition, one should avoid “sentences in the boxes”, that is, full sentences used as concepts, since this usually indicates that a whole subsection of the map could be constructed from the statement in the box.

A concept map is seldom "finished". There are always more concepts that could be added and refinements that could be made. Figure 5 shows a completed (never finished) version of the concept map. Notice that, compared to Figure 4, some more concepts have been added, others have been moved around, linking phrases have been rethought, and crosslink have been added.

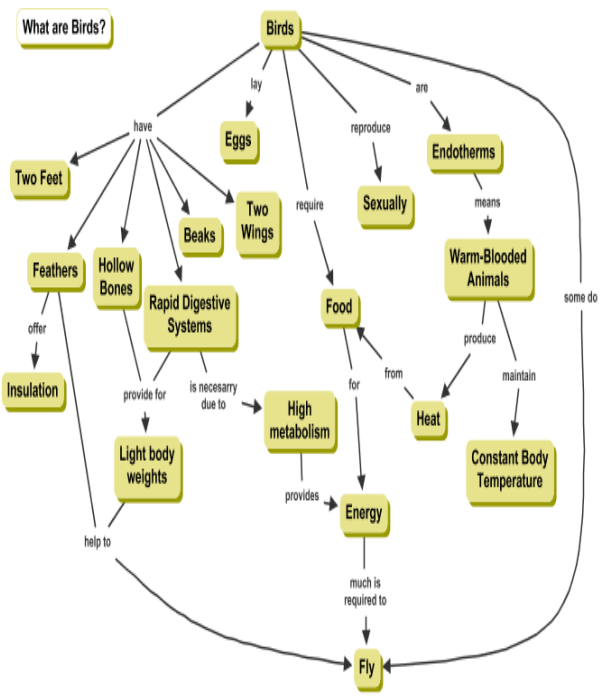


figure.5never finished concept tmap

Final Comments Students often comment that it is hard to add linking words onto the “lines” of their concept map. This is because they poorly understand the relationship between the concepts, or the meanings of the concepts, and it is the linking words that specify this relationship. Once students begin to focus-in on good linking words, and on the identification of good cross-links, they can see that every concept could be related to every other concept. This also produces some frustration, and they must choose to identify the most prominent and most useful cross-links. This process

involves what Bloom (1956) identified as high levels of cognitive performance, namely evaluation and synthesis of knowledge. Concept mapping is an easy way to encourage very high levels of cognitive performance, when the process is done well. This is one reason concept mapping can also be a very powerful evaluation tool (Edmondson, 2000).

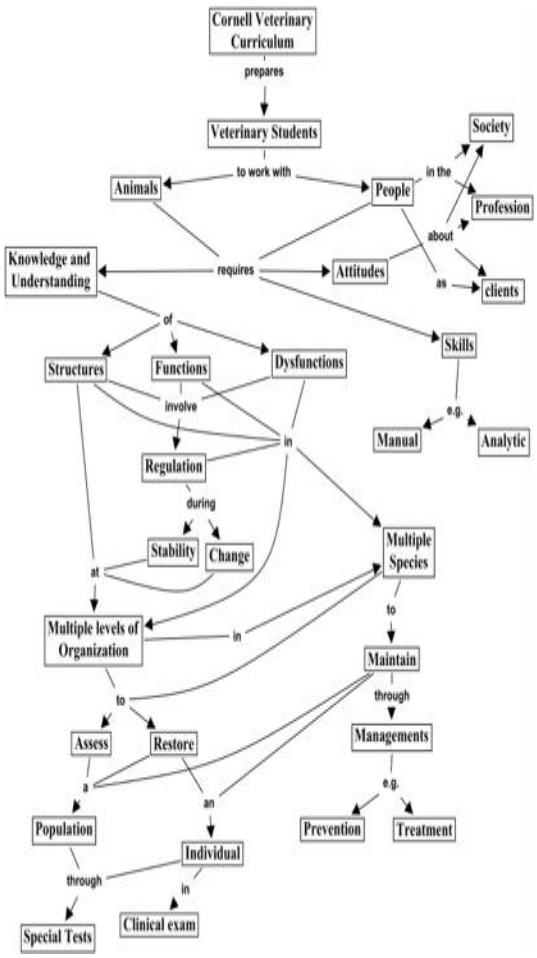
Finally, the map should be revised, concepts re-positioned in ways that lend to clarity and better over-all structure, and a "final" map prepared.

Concept Maps and Curriculum Planning

In curriculum planning, concept maps can be enormously useful. They present in a highly concise manner the key concepts and principles to be taught. The hierarchical organization of concept maps suggests more optimal sequencing of instructional material. Since the fundamental characteristic of meaningful learning is integration of new knowledge with the learners' previous concept and propositional frameworks, proceeding from the more general, more inclusive concepts to the more specific information usually serves to encourage and enhance meaningful learning. Thus, in curriculum planning, we need to construct a global "macro map" showing the major ideas we plan to present in the whole course, or in a whole curriculum, and also more specific "micro maps" to show the knowledge structure for a very specific segment of the instructional program.

Using concept maps in planning a curriculum or instruction on a specific topic helps to make the instruction "conceptually transparent" to students. Many students have difficulty identifying the important concepts in a text, lecture or other form of presentation. Part of the problem stems from a pattern of learning that simply requires memorization of information, and no evaluation of the information is required. Such students fail to construct powerful concept and propositional frameworks, leading them to see learning as a blur of myriad facts, dates, names, equations, or procedural rules to be memorized. For these students, the subject matter of most disciplines, and especially science, mathematics, and history, is a cacophony of information to memorize, and they usually find this boring. Many feel they cannot master knowledge in the field. If concept maps are used in planning instruction and students are required to construct concept maps as they are learning, previously unsuccessful students can become successful in making sense out of science and any other discipline, acquiring a feeling of control over the subject matter (Bascones & Novak, 1985; Novak, 1991, 1998).

Figure 6. structure for a revised curriculum.



Assessing & Evaluating Concept Maps

- **Summative Assessments**

These are assessments that are given periodically to determine what students do and do not know.

Examples: Standardized exams, end-of-unit exams, formal essays, analysis papers, graded homework problem sets, midterms, finals, etc. These assessments are usually graded or evaluated formally in some way.

- Instead (or in addition to) essay questions on exams, try a mapping exercise. Present students with a set of concepts. Ask students to select a focus and construct a map: for example, "Below are seven concepts associated with [insert topic]. Use them to construct a concept map." The following is such a map from a college-level midterm in a Theory and Methods of Education course:

1. Alternatively, you could have students create a map without a given set of concepts. This will allow you to see what students thought was most important
2. You could also give students a map of what you would like to assess and have them write an essay "telling the story" of the given map
3. Note that it is important that students not be asked to recall concepts or labels from a memorized map- such an exercise will not promote meaningful learning!

(Novak, J. D. (1998). Learning, creating, and using knowledge: Concept maps as facilitative tools in schools and corporations. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.) Centre for Teaching 310 Calvin Hall centeach.uiowa.edu

- **Formative Assessments**

These assessments are an informal, but important, part of instruction. Often these assessments are thought of as "practice" or "classroom participation" assignments. These may or may not be graded or formally evaluated and can take a wide variety of forms. Instructors often use formative assessments observing students as they work, asking discussion questions to check student understanding, having students turn in reflection papers or practice problems. The purpose of these assessments is to get a sense of students' understanding.

Any mapping exercise can be used as a formative assessment. The following, however, work particularly well:

1. Have students map previously assigned readings
2. Have students map their small-group discussions of a given topic
3. Have students map a summary of a given set of class periods
4. Have students map topics that they don't quite understand or would like to know more about (these maps should be addressed in small- or large-group discussions.

Conclusion

Many people do not know how to learn effectively. The result is that they too often resort to rote memorization. Although this type of learning might lead to temporary reward, most information is forgotten within 4-6 weeks and is often accompanied by negative feelings. Conversely, positive feelings often accompany the experience of connecting new information to existing knowledge in a meaningful way. Concept mapping can help teachers to teach and students to learn more meaningfully.

Concepts are one of the hardest things for an educator to teach and for students to learn. Using techniques like concept mapping can help students build a skill they can use throughout their academic career to help them understand concepts. Concept mapping is a valuable theory of learning that teachers can use to evaluate a student's level of understanding .Concept mapping is used to organize related information in a visual manner. Study maps clearly and concisely demonstrate hierarchical relationships among the topic, main ideas, and supporting details or pertinent course material**.**

The ideas and materials presented in this paper are intended to stimulate further reflection

and experimentation on the value of concept mapping as a meaningful learning tool in the classroom.

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International Forum of Innovators in University Teaching

Problem-Based Learning in Higher Education of Architecture

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Abstract
In architectural design pedagogy, there is a serious search for new approaches and practices to improve communication and understanding of architectural knowledge and practice. Similarly, there is a continuous search for innovative teaching techniques in higher education of practice-oriented professions in order to make learning easier, faster and more involving for students. The problem-based learning approach presents an alternative solution for effective learning and teaching in practice-oriented professions. There is not enough research about the effectiveness of the problem-based learning approach in higher education of architecture and how to employ and optimize it in teaching architectural design praxis. Furthermore, little is known about how the approach guidelines can be explicitly articulated and systematically applied to creatively and effectively solve practical design problems. The project described and discussed in this paper is set out to fill this particular void. It is an experimental collaborative pilot project that incorporates emergent design concepts about animated four-dimensional design and visualization into a problem-based learning approach to determine whether or not this method of learning is more effective for design knowledge building and application than the traditional methods. The pilot employs computer aids not only to integrate different data and to communicate online, but also to emphasize concepts that are typically considered difficult to visualize in design generation and representation such as responsive metamorphosis of architecture. Findings about the project application encourage its incorporation in design pedagogy.

Keywords
Problem-Based Learning, Kinetic Design, Architectural Design Pedagogy, Innovative Higher Education, Responsive Architecture, Digital Studio, Collaborative Design, Computer-Aided Education

Introduction

Design represents a focal component of architectural education. However, both sides of design education suffer from the ill-structured nature of design problem solutions. Educators of design generally observe difficulties in knowledge building for design processes and methods. Similarly, students of architectural design have difficulties in decoding a clear methodology for design derivation, and in integrating knowledge from the different classes they attend with design studios. The conventional architectural design teaching approach is based primarily on long studio sessions and supported by relevant lecture classes and labs, each taught separately. The principles and practices of architectural design are based on complex multi/inter-disciplinary and multi-layered knowledge areas. Managing knowledge from the various fields requires a complicated balance that is difficult to learn because many aspects of it are based on substantial tacit knowledge.

Knowledge from the author's previous design teaching experience suggests that architectural design students were not approaching their educational program holistically. Consequently, students were not always successful in linking information delivered in lecture and lab classes with their

design projects. A questionnaire completed by a sample of students prior to the pilot reported in this paper revealed this weakness. The majority of students in the sample expressed three weaknesses in the current design pedagogy:

1. The students participated in the questionnaire approached their design projects independent of what they are delivered in other supportive courses.
2. Most students found it difficult to visualize emergent concepts of design such as dynamic, flexible and responsive architecture which assume that buildings should grow over their life cycle to interact with and respond to some environmental or functional changes.
3. Design processes were not easy to be externalized and demonstrated explicitly in lectures.

As a result, it seems important that students are encouraged to access further knowledge resources and to experiment with new approaches and methods of learning. In this regard, Bowden and Marton [1] suggest that teaching and assessment methods that foster active and long-term engagement with the learning tasks are major factors that encourage a deep approach to learning. One of the theories about effective approaches to learning is the constructivist theory.

The Constructivist Theory of Learning

This theory offers a view about the way knowledge and understanding are developed [2]. Explaining this theory, Savery and Duffy [3] suggest that constructivism is associated with three propositions. These are:

1. Understanding is inextricably connected with the interaction between learner and learning environment.
2. The cognitive conflict, ambiguity and puzzlement introduce a stimulus for learning.
3. Knowledge evolves through social negotiation.

Pedagogical methods which are based on constructivist principles are likely to be more suitable for learning in domains involving 'ill-structured' problems [4].

Most of the principles which emerge from the constructivist propositions are represented in new approaches for learning. Three examples of these are:

1. Resource-Based Learning (e.g. Reece and Walker [5])
2. Project-Based Learning (e.g. Blumenfeld et al. [6])
3. Problem-Based Learning (e.g. De Lowerntal [7]).

These approaches share the advantage that they all encourage integration of different knowledge areas and active student participation. They also shift the focus from the teacher to the student. They place the student at the centre of the learning environment.

The constructivist principles are encapsulated almost perfectly in the problem-based learning (PBL) approach. The emphasis of this research is on applying a PBL model on design knowledge building to foster a more independent and holistic student-centered approach to architectural design education.

Problem-Based Learning in Higher Education

PBL has become a common way of instruction since its beginning in higher education in the 1960s (Albanese and Mitchell [8]; Barrows [9]; Boud and Feletti [10]). It has become widely used across some areas such as medicine, languages and engineering. It was initially developed in response to concerns that the conventional subject-based approaches to teaching did not provide the most effective training for future professionals who needed to access knowledge across a range of disciplines and in challenging and realistic settings [11]

PBL can be described as an educational format that attempts to simulate real life practice settings through pre-defined problem scenarios to encourage the

discussion and learning of the experiences that emanate from practice-based problems. It is a method that fosters independent learning, encourages students to practically tackle confounding situations, and actively define their own gaps in understanding the problems in their realistic contexts, and enhances a more comprehensive as well as deeper understanding of the material rather than superficial coverage.

The PBL approach can be characterized by the attributes illustrated in Figure 1 (Eilouti, 2007).

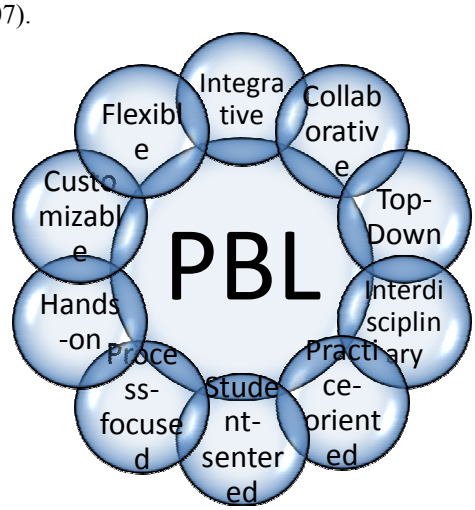

Figure 1: PBL approach attributes

In addition, it encourages independency, creativity, and self-initiation, and strengthens problem-solving and active learning skills.

PBL reverses the traditional approach to teaching and learning which is bottom-up or part-to-whole where learning starts with different subjects, knowledge components or puzzle pieces to incrementally arrive at the final products, experiences or assembled puzzles. In contrast, PBL starts with whole cases or problem scenarios that stimulate real life practice settings. In studying these settings, students arrive at basic principles and concepts underlying the cases or scenarios which they then generalize to other situations.

A desirable attribute of problems used in PBL, as in constructivist applications, is that they are preferred to be 'ill-structured' [12]. In this regard, Jonassen [13] distinguished between ill-structured and well-structured problem applications. The settings of well-structured problem, which may have 'right' and 'wrong' answers, can be introduced to guide students to demonstrate simple rules, concepts and procedures with information gained from direct sources. In contrast, ill-structured problems pose messy and real life problems and their solutions cannot be found in direct resources [14].

PBL and Architecture

All the aforementioned characteristics and attributes of PBL qualify it to fit in strongly with the goals of architectural design communication and education. Most design problems are known to be ill-structured and are based on multi-disciplinary knowledge and multiple information resources. As such, design problems are suitable for the multifaceted PBL model application. Furthermore, students in architectural design tend to be visual and kinesthetic learners who learn by demonstrations and hands-on experiences. These learning styles are supported by PBL models. It is hypothesized in this paper that the PBL approach can improve the quality of architectural design pedagogy. The area of the application of PBL approach into architectural education is still seriously under-researched. Few examples of this area include pedagogical approaches in architectural education [15], PBL in responsive design [16], PBL in digital studio [17] and PBL in architectural knowledge networking [18].

Typical Design Instruction Methodology

The reference scenario of this paper is taken in the department of architecture of Jordan University of Science and Technology (JUST). In this scenario, architectural design is taught formally to first through fifth year architecture students, one design studio per term twice a year. Students attend formal theoretical lecture courses, design and

graphic communication studios and supportive workshops and laboratories. In design studios, the students undertake multiple practical design projects that vary in scale, function and scope. As architecture is multi-disciplinary by nature, its teaching presents unique challenges to both teachers and learners. Students are expected to build a knowledge base in drafting, model-making, science, arts, computer applications and humanities. Through this process they are delivered design theory, history, urban planning, landscape design, environmental control, behavior, human factors, graphic communication and engineering courses and are expected to use these areas of knowledge to produce creative and original designs. Design problems are usually assigned to students without providing them with an explicitly structured methodology and in settings where a trial and error approaches for solving the problem at hand prevail. Personal observations by the author and colleagues from the academic staff members have shown that students find design a difficult subject to learn and master.

PBL and Architectural Education

As already established earlier in this paper, the correlation between the effectiveness of learning for individuals and matching the teaching methods to their particular styles of learning is obvious. Similar to the aforementioned suggestions made by Bowden and Marton (1998) [1], results from Honey and Mumford's 'Learning Styles Questionnaire' (1992) showed that students tend to learn better if they are active learners and when they involve themselves fully and without prior bias in new experiences. These results support the constructivist conception of learning which is described above and which Fry et al. [19] describes as a process of individual transformation, in which people actively construct a customized knowledge on the grounds of their preexisting knowledge base. Dochy et al. [20] also emphasize the connection between the constructivist view of effective learning and the PBL approach. These findings support the idea that a traditional approach to teaching is not the most efficient in teaching innovative design. In addition to acquiring technical knowledge, students of design must develop high imagination to visualize qualities of full-scale spatial organizations and massing configurations. Imagination and creativity development require active participation and deep involvement of students in design knowledge building which are personalized and mapped to their learning styles.

As PBL tends to enhance active learning, problem solving and multidisciplinary skills through well-designed problem scenarios, it allows students to acquire and build basic design knowledge by themselves. It reflects the way practitioners learn in real life, allowing students to solve problems using all the possible resources they can access. In this paper, the framework offered by PBL is considered potentially suitable for design teaching as it allows students to learn actively. As students work through tasks in groups, it also encourages team-working management skills. Within this framework, a design project is organized.

Intended learning outcomes from this project include the consolidation and extension of the PBL approach application findings to the student learning experiences in different contextual frameworks and situations of the architectural prospectus both within and beyond the design studio contexts. To achieve an effective approach to learning, Biggs [21] recommends mapping the curriculum objectives to compatible teaching and assessment methods. Moreover, one of the PBL goals is to identify and translate appropriate topics which are typically taught through formal lectures into its format. The topics taught within the architectural design curriculum were analyzed to identify whether they would benefit from delivery through PBL. For each of these topics, the main questions asked were:

1. Do the theory lectures currently contain any relevant design methodology or process issues?
2. Could this topic be learnt through manual drafting, theory, hands on or practice?
3. Could this topic be learnt through computer-aided design models?
4. Could this topic be enhance by a model building activity?
5. Could this topic be facilitated by teamwork collaboration?
6. Could this topic become more efficient if integrated with the other topics?
7. What parts of this topic will be faced in practice and in which settings?
8. What parts of this topic can be used to enhance problem-solving skills?
9. What parts of this topic can be fostered to increase creativity and strengthen imagination?
10. What parts of this topic can be transformed from teacher-centered to student-centered?
11. What parts of this topic can benefit from a shift of a product-oriented to a process-oriented approach?

The questions asked above highlight some of the major characteristics of PBL. These include the integrative, top-down, collaborative, whole-to-part, practice-oriented, student-centered, and process-focused and the problem-focused characteristics of learning styles.

The PBL-Based Pilot Design Project

Emerging issues such as responsive, interactive, kinetic, dynamic and growing architecture are relatively new areas of focus within architectural design education. The skills needed to generate dynamic designs must be enhanced by high imagination, creativity and technical knowledge as well as the tools to communicate morphing shapes and their transformations. Such design poses challenging design problems and puzzling settings. Computer hardware and advanced animation software are now available to facilitate the production of virtually transformable and alive designs. Current design pedagogy in JUST does not focus on such a complex design concept. What is clear so far is that for students to understand the principles of movable structures an element of active hands-on learning is essential, and a traditional lecture-based approach is not the best way to enable students to visualize animated three-dimensional morphing designs. A pilot four-week project that addresses the dynamic architecture concepts was devised to eighteen third-year design students from the department of architecture in JUST. The students were asked to work in groups of three under the same working conditions and time frame and to the same brief and design requirements to keep the parameters of the task constant. Other parameters were formed as constraints and limitations to the design problem. It was decided that one of the main objectives of the pilot was to introduce students to the idea of working through unfamiliar technical problems in collaborative teams. The design problem situation each group faces is complex and reflective of real life settings.

The main goal of the project is to design a house that grows and shrinks in size and furniture to accommodate a changing family that lives in it. The family starts as a young couple, extends with time to a large family of three boys and three girls in addition to the grandparents who move in to live with them. Gradually, the family size decreases when some members move out for education or marriage or when the elderly grandparents die. The family ends up with an elderly couple with limited physical capabilities and more sensitive psychological needs. In all growth phases, the house is supposed to respond in function, size, settings and accommodations with dynamic structures that are easy to modify, assemble and dissemble. Solutions should consider issues

such as dynamic new structural systems, flexible furniture design with multi-use settings, and dynamic supportive environmental control systems.

The PBL Project Management

Participant students were divided into groups of three to four-dimensionally design a growing house and present it animated to illustrate all growing phases of its life cycle. Parameters regarding size, style, structural and technical solutions are free. However, some restrictions were required to be adhered to. These include:

1. Space size should be kept to optimum for each stage
2. All structures should be integrated and move in accordance with each other
3. All furniture pieces should be dynamic and flexible to fit into different scenarios, functions and phases
4. Transition from a phase into another should be accomplished with minimal destroying or rebuilding of structural elements
5. Mantling and dismantling should be made as easy and quick as possible
6. The amount of change that responds to a change in the family size or needs should be kept to minimum
7. Cost efficiency is not critical in this project. However, economy should be considered when choosing from various alternatives
8. The color scheme and signage system should respond to the psychological changes of the family members
9. Foundation system should respond to the changing structural system above
10. A realistic physical model with movable and expandable parts is required
11. An animated presentation is required choosing any media. Multimedia presentation is encouraged.

The project setting follows the typical format of the PBL process. A modified nine-step version of the formal seven-step structure that is usually associated with PBL1 [22] was used for this project processing, with evaluation and representation-related steps added to the basic seven steps. The steps for the design processing of the pilot project were:

1. Eighteen third-year architectural design students divided into six groups were involved in the PBL-based project. In the first session of the project, the studio supervisor (the author) introduced the design problem and explained its vocabulary. The student teams were formed and they were required to meet frequently to discuss the aforementioned design problem situation that was selected to be unfamiliar and not having an easy or straight-forward answer.
2. The studio supervisor checked how each group understood the problem and asked the students to identify its statement and to explore the multiple issues relating to the problem definition and interpretation.
3. The groups were asked to treat the problem as if they were personally asked to solve it in a real life practice setting. At this stage, a brainstorming session was held to reveal what the groups know about the problem subject matters and their possible interpretations.
4. Upon the identification of what was known and what was not about the problem and its possible solutions, the groups were asked to research the unknown areas and propose a number of potential problem interpretations and come up with alternative proposals that were likely to explain and solve the problem situation. Once basic alternatives had been proposed each group then negotiated an area of exploration for each member to independently carry out his/her portion of the research.
5. As a result of the previous step, a specific assignment was designated for each member of the group.
6. After the individual research and after a sufficient time has elapsed to allow the research to be completed, the group was asked to meet again to discuss members' individual contributions and findings about the problem in light of the information discovered by the group members.

7. Depending on a list of objectives, restrictions and design criteria that each group was asked to define, students were expected to come up with alternative solutions.
8. The groups were asked to evaluate the proposed solutions against the preset criteria and objectives and to select the best fit solution.
9. Finally, the groups were required to make a professional presentation of their problem interpretation, research, team management, proposals as well as their final solution and its consequences using different media.

Each member of a group was responsible for modeling one phase of the house growth process. The representation should include an animated computer model, a physical model with transformable and movable parts, and animated details and supportive systems. In addition, for each stage in the process, design development steps were required to be documented to clearly show the design derivation sequence as well as the impressions about this experience. All group members helped in the animation of the three phases and the in-between steps. Each group discussed their problem interpretations, solutions and new learning experiences.

The students were also asked to evaluate their experiences and communicate their reflections and feedback about them to others.

The first four steps focus on the team formation issues, the comprehension and interpretation of the problem and the realization of the gaps of knowledge and the potential areas of research as well as on job allocation and assignment for team members. The fifth and sixth steps are related to data collection and analysis. The focus of the seventh step is on the proposal of solution alternatives. The eighth step is concerned with the evaluation of the findings and solutions. The concern of the final step is centered on communicating and presenting the experience to peers, supervisor and jury members.

An Example of the generated houses is illustrated in Figure 2. The design quality was evaluated based on the hard and soft presentations made by students, and on the process followed to develop the design. In addition, semi-structured interviews were held between students, supervisor and other academic staff members to clarify students' thoughts and experiences. Furthermore, a regular design jury was organized to evaluate the projects.

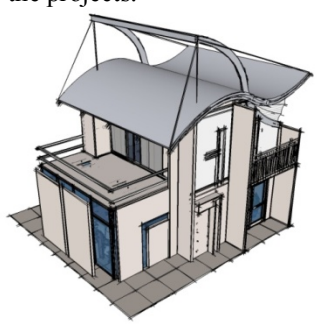

Figure 2: Project example

Students who participated in the PBL-based project were asked to rate the appropriateness of PBL characteristics to various design areas. Figure 3 demonstrates a three-dimensional chart that attempts to map these characteristics to the main topics of architectural design pedagogy.

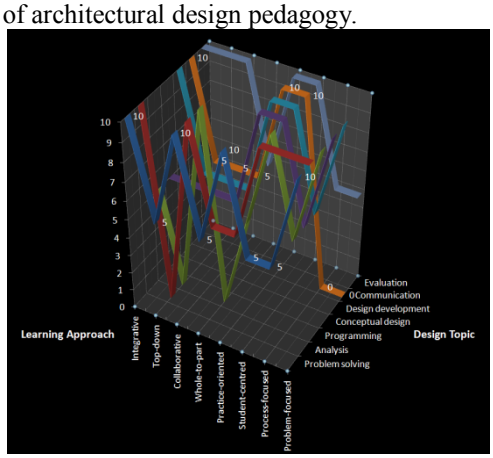

Figure 3: Participant feedback

The *x*-axis of the chart represents the learning approach characteristics. The *y*-axis

represents the major design areas. The *z*-axis of the chart represents the level to which a design area would benefit from shifting its learning style from the traditional to the PBL approach. For example, a zero value indicates that keeping an attribute from the traditional level would be more beneficial than that of a PBL; a 10 value indicates that such a shift is in favor of the PBL-related attribute; and a 5 indicates that both are expected to function indifferently. The shift from 0 (that favors the first) to 10 (that favors the second) and 5 for both functioning equivalently are for attributes that are illustrated in Figure 4.

Although the *z*-value for each pair's (topic-attribute) intersection is discrete, it is illustrated as a continuous curve for each design topic to facilitate the association of the topic with its learning attributes.

All the values in the *z*-axis are estimated by the author based on previous academic and practical experience. As the chart illustrates, most topics would benefit from an integrative, collaborative, top-down, whole-to-part, practice-oriented, process-focused and student-centered approach such as the PBL approach. This is especially true for the pre-design reasoning activities (problem solving, data analysis and interpretation, and design programming) as well as for post-design activities (presentation, communication and evaluation). Less clear benefits seem to be gained in the core design activities (such as conceptual formation and design development).

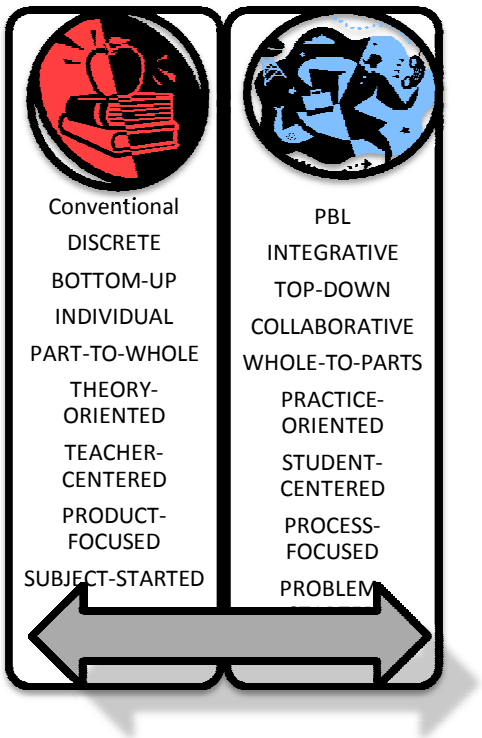

Figure 4: Shift from conventional to PBL approach

A possible explanation for this is that while the pre- and post-design activities tend to require divergent thinking, some of the architectural design tasks, especially those that overlap with engineering and applied science solutions, require more convergent thinking. The creative and artistic aspects of designing, however, call for divergent learning styles [23] [24]. Unlike design in the convergent style of thinking which tends to evolve through individualistic tasks, the problem-based design learning style calls for more team-oriented coordination. However, even in the core designing part each student in a team may propose a concept or a solution, and all proposals can later be evaluated and developed by all team members.

Findings and Discussion

Based on the author's observations, jury members' feedback, semi-structured

interviews with the students and short questionnaire forms before and after the project as well as on students' documentation of all the stages of this experience, the pilot project produced some noteworthy findings. The major questions asked in the different evaluation methods were centered on three major subjects. These are the students' interaction and reaction to the new PBL learning method, their cognition to the new design concepts and challenges, and the effectiveness of computer aids and multimedia employment in understanding the problem and its visualization and representation.

The findings are mainly related to the exploration and understanding of new concepts, the significance of the problem interpretations to its potential solutions, the emphasis on the different problem solving skills and on the integration of multiple areas of knowledge and on the power of applying different media, presentation techniques and multiple communication methods. They are also related to the higher level of enthusiasm when the focus is on students' active involvement in the learning process, the discovery of explicit design process guidelines, and the enhancement of team work management skills. They are summarized in the following nine findings.

1. The finished products demonstrated that each student group had understood the basics of dynamic and flexible designing in four-dimensions. The students came up with different solutions based on different concepts of flexibility and mobility and different structural and supportive technical solutions. They proposed solutions that are based on folded, telescopic, sliding, hydraulic, expandable or pneumatic structures.

Their understanding of the multi-layered problem and its potential solutions were revealed in the questionnaire before and after the project, and in the jury discussions that were held to evaluate their design processing and products. Their feedback indicated that the integration of the theoretical knowledge from different resources with design processing was improved.

2. The experiment showed that the problem interpretation is very important to its potential solutions. Students' reflections as communicated by their experience documentations and discussions reveal that they had to reinterpret the problem to their understanding and restructure it many times before they propose solutions or even research relevant data.

3. The students used different media to communicate their projects and experiences. They had composed small sketchbooks, reports and study models of their ideas before their final presentation. Some sets of students enhanced their presentation with familiar movable structures such as a match box, a sliding window, a telescopic antenna or an umbrella from which they took inspiration for their dynamic solutions. Since the project was conducted in the context of digital studio, students were encouraged to put the computer aids to a maximum use. They used multiple graphic software programs such as the latest versions of AutoCAD, Photoshop, Macromedia Flash, Illustrator, FrontPage and 3D MAX. Using these software packages, the animation programs in particular was essential to illustrate some concepts that were difficult to communicate in other ways. All scenarios about motion-related transitions in the expected post occupancy life cycle of the house were represented using 3D Max and Flash. Other software also facilitated the working of different students on the same issue simultaneously using referencing systems in software and integrative systems in hardware. Each set of students had considered a number of different options before choosing their final outputs.

4. The studio tutor noted unusual high levels of concentration by student participants. The enthusiasm and excitement generated by this project was also high, with students proudly showing their operable mock-ups to peers

upon completion. Anonymous questionnaire forms were given out to the students after the presentation day to gauge their reaction to the PBL project. The feedback data show that all students enjoyed the task and found that building their own design knowledge in teams was a motivating approach. The students also indicated that they understood the complicated principles of flexibility and mobility much better than when it had been taught formally.

5. The designing process was different for each group. While some focused on the structural and constructional aspects as design generators, others highlighted the solutions offered by smart buildings or systems inspired by other creatures.

6. The ambiguity and difficulty of the design problem posed a challenge that encouraged students to keep trying new solutions. As a measure of feedback, the semi-structured interviews with the students after finishing their designs expressed that they had to overcome a number of previously unforeseen barriers posed by the construction technology and structural solutions as they progressed with their hard and soft presentations. Issues such as movable structures and correspondent foundation system had to be considered many times and in some cases the development stages were rethought in order to properly fulfill the brief.

7. The design method or process was cleared and could be stated more explicitly than in the traditional design studio methods. Through the documentation and later presentation of all pre-design and design steps, the students were able to formulate a designing strategy and design process guidelines that can help them to inform their future designs.

8. There were two areas in the PBL-process in which a moderation or supervision of students was very important. These included the organizational phase, where objectives are defined and tasks had to be distributed, and the final reflection and discussion phase. In both phases, in order to guide students and optimize their progress it was necessary to support them by tutor intervention when needed.

9. The use of online tools was very helpful in this project. Students were encouraged to use synchronous chat-tools throughout all the phases when physical meeting was difficult. Enhanced by the digital studio settings, this kind of computer-mediated communication allowed for direct interventions or reactions on both, students' and tutors' sides. In addition, asynchronous communication was facilitated by internet applications. It allowed the possibilities to reflect the progress of a discussion, to work without any time pressure, to integrate recently acquired knowledge to exchange ideas, and to use a more structured way of discussion than in alive or synchronous discussions.

The computer applications supported this experience in many ways. They facilitated the understanding of the problem, the visualization of its solutions and motion-related aspects, the representation of the animated responsive metamorphosis aspects of architectural design, and the inter-group synchronous and asynchronous communication when physical collaboration was difficult to achieve. The computer aids used in this project may be developed into a future E-PBL project, where physical team management tasks can be replaced by cyber collaboration.

The majority of students stated in the questionnaire and interviews that they have learnt a lot more about the design methodology and process as well as about dynamic architecture than they have had in lectures, and that they would like more PBL projects within the design studio context. They also felt that they had improved their team-working and graphic and verbal communication skills and, although the task was perceived to be difficult, it had proved to be rewarding. The few negative responses, to the proposal of rolling out more PBL-based projects into the future design education formally, focused on the difficulty

of the task and the students' concerns about the increased workloads placed on them.

Because the project reported in this research was the first PBL application in the school, the students who participated in it showed enthusiasm and none of them expressed boredom throughout the different stages of the experiment.

Conclusion

The pilot project discussed in this paper seems to support the initial hypothesis of this research that the PBL approach is effective for teaching systematic architectural design in higher education. The major outcomes of the PBL approach as discussed in this paper showed that it is a more student-centered education method than conventional ones. It also represents a better fit for inter-disciplinary integrative networking strategies, practice-oriented pedagogy, as well as applied and action research that links theory to practice. The pilot findings show that this student-centered learning approach not only maintains students' interest, but raises levels of enthusiasm and commitment significantly. The approach seems to help shift the focus of teaching from instructors to students. A PBL approach to design education appears to require significant input from studio tutors in areas that are different from the traditional, such as team administration and orientation. It reduces the need for a structured instruction format from the tutors and dependency of students witnessed in traditional settings. There are real benefits for students in becoming active seekers of knowledge where they build their own design knowledge based on their own defined gaps and in their personalized comprehension pace. The whole design teaching experience changes from generalized frameworks into customized versions that fit individual students.

In terms of design quality, visualizing emergent four-dimensional morphing compositions, in which transformational motion-related considerations are added to the typical three-dimensional topological and spatial dimensions. Through the framework of PBL, all students managed to create virtually finished computerized and physical presentations with very little prior knowledge of dynamic structures. The project described in this paper indicates that the PBL approach can foster critical thinking, and to keep up a high level of enthusiasm to explore new concepts such as those of dynamic architecture, changing structures and flexible furniture.

The PBL approach seems to fit higher education where values such as independency, teamwork, and initiation and student active involvement are desired. It also fits design teaching that focuses on creativity, imagination, self-knowledge building, self-evaluation and informed decision making. The major concern of the students was that of increasing workloads on them because of the shift of focus from teachers to them.

As a result of this successful pilot study, it was decided to apply more PBL design problems to the future design studios as well as to other courses such as computer-aided design and environmental design. Additionally, PBL was suggested to be used within basic design courses to introduce students to the processes of critical thinking and to underline the importance of team working, different communication techniques and enquiry-based learning approaches. In addition, the success of computer employment in this project's visualization, collaboration and communication suggests a future extension that develops an E-PBL version that uses synchronous and asynchronous collaboration between students of different schools.

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