



"Self Learning needs for 21st Century Engineers"

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ABSTRACT

The term 'Self Learning' requires that students take the responsibility for their own learning process, including acquiring the material and monitoring their own progress. It is a collaborative process, the student must have the initiative to learn the material and the teacher must provide support and resources for learning. Self learning is challenging, even for the brightest and most motivated students. Various skills and attitudes towards learning are required for successful independent study. Self learning requires a deep approach to studying, in which students must understand ideas and be able to apply knowledge to new situations. Students need to generate their own connections and be their own motivators. This paper focuses on need of 21st Century Skills for Engineers. The professional development of our nation's workforce must be a top priority and teachers will need to become 21st century learners themselves. Self-learning helps students develop the confidence they need to tackle challenging problems and obstacles in the future.

KEYWORDS

Self learning, project-based learning, design-based learning, problem-based learning, collaborative and inquiry-based learning, multimedia based learning.

INTRODUCTION

The benefits of learning that we can explore different ways of thinking, and can go through difficult concepts on own without help of others. Students have the potential to solve problems self regardless of their age and abilities. Self-learning allows each student to tackle problems based on their own capabilities. In that sense, students own their knowledge as opposed to relying on external devices such as calculators or tutors. For example, a student who understands multiplication extremely well is able to solve multiplication and division problems much faster than a student who relies on a calculator. Self-learning helps students develop the confidence they need to tackle challenging problems and obstacles in the future. In self learning, student essentially creates his/her own course on a topic of devising, working in concert with a faculty mentor. In format, self learning is like the tutorials system in which student meets individually with the faculty member on a regular basis and discuss a set of readings as well as writing assignments.

PLANNING THE SELF LEARNING

Start thinking early about what he/she might want to learn. Student have to start thinking at least a semester in advance so that he can find a suitable faculty mentor whose expertise matches his/her topic. Student will generally have to write up a proposal, which can include the proposed learning topic, a rationale for the focus, a preliminary reading list, and a description of the learning documents that he/she will produce. These documents have traditionally been informal and formal papers, but are creative. Self learning puts much of the responsibility for learning on your shoulders. Don't wait around for faculty mentor to tell what to do. Do seek her or his advice, though. If he/she find themselves lost in the material or at a loss for how to proceed, don't be afraid to say so. Learning always takes commitment and self discipline as well as conscious practice. Learning only happens as a direct result of his/her own efforts.

Processing information and learning something new go hand in hand. New information will remain in your memory if it is in some way significant to you. Getting acquainted with books and other learning materials, applying your own reading technique can help you get the most out of books and other reading materials. Read the book slowly and thoroughly. Examine the graphs and figures. Underline keywords and central points as it will help you review and summarize. Think about how you can apply the information

you are learning from the book/other material and also how you can use it in relation to what you have learnt previously. Make notes. The purpose of taking notes is to clarify what you are learning and support your memory and the learning process. Making notes helps you to gain an overview of what you are learning. Only write down what is important. Use exclamation marks to highlight something as important and question marks to show that you did not quite understand something. Go ahead and ask the teacher if something is not clear to you. Take the plunge and discuss the subject with other students. Working through questions and ideas together is both pleasant and useful from the perspective of learning. Examples of group learn exercises: Come up with questions about the subject and ask the group for answers. Each person in the group comes up with questions and gets answers from the rest of the group.

SELF LEARNING OF ORAL SKILLS

In the development of learnable skills and experiential methods generally gives better results. Many students dislike giving presentations. It is observed that 70% of sampled practicing engineers were required to give oral presentations as part of their work. Group projects and presentations encourage and enhance the interpersonal skills of the students and should be emphasized early in the education curricula. Advantages of peer assessment include getting students to think about the exercise more deeply, recognize others' viewpoints and how to give constructive criticism to peers. Disadvantages include potential bias, reluctance to give low marks for poor work from their peers and the need for clearer guidelines. As knowledge of communication theory does not necessarily parallel skills in practice, it is important to immerse students in similar work environments. To create a positive atmosphere in the learning, speaking is one of the skills. Making speaking easier seems to have more to do with the affective side of the learning process than cognitive. Along with linguistic content it is more important to focus on attitudes.

COMPUTER-ASSISTED LEARNING

Computer Assisted Learning provides a wide range of applications such as web-based distance learning, virtual learning environment and mobile-assisted language learning (MALL). Vocabulary acquisition using flash cards is the basic use of Computer Assisted Learning. Preparation of CALL software deserves a careful consideration of ped-agogy. With the advent of internet, a significant change occurred in the use of communication

technology in language teaching. Teachers in classrooms could display the full text in a full page and could make comparisons with other texts in a different web site. With internet and the establishment of many new web sites, the learners could involve themselves directly in the language learning processes individually or with online support. The teacher's role remains to be a role of a facilitator.

SELF LEARNING AND 21ST CENTURY

Emerging research encourages teachers and other educational stakeholders to focus on real world problems and processes, support inquiry-based learning experiences, provide opportunities for collaborative project approaches to learning and focus on teaching students how to learn. The elements of Self Learning needs for 21st century engineers are shown in Fig. 1



Fig.1 Elements of Self Learning

A. Project-based learning

A project should give students opportunities to build 21st century skills as collaboration, communication, critical thinking, and the use of technology, which will serve them well in the workplace and life. A teacher in a project-based learning environment explicitly teaches and assesses these skills and provides frequent opportunities for students to assess themselves. The project-based learning has illustrated significant benefits for students who work collaboratively on learning activities in contrast with students who work alone. An additional research finding was that students who have difficulties with traditional classroom/ textbook/lecture learning benefit significantly from a project-based learning experience which more closely aligns with their learning style and preference. Best practices for project-based learning include student responsibility for designing and managing their learning projects based on real-world problems.

Projects provide students with empowering opportunities to make a difference, by solving real problems and addressing real issues. Students learn how to interact with adults and organizations, are exposed to workplaces and jobs, and can develop career interests. Parents and community members can be involved in projects. Students are familiar with and enjoy using a variety of technical tools that are a perfect fit with PBL. With technology, teachers and students can not only find resources and information and create products, but also collaborate more effectively, and connect with experts, partners, and audiences around the world. After completing a project, students understand content more deeply, remember what they learn and retain it longer than is often the case with traditional instruction. Because of this, students who gain content knowledge with PBL are better able to apply what they know and can do to new situations.

B. Problem-based Learning

Problem-based learning is form of project-based learning that allows teachers to develop, and students to focus, on complex, real-world problems using a case learn approach. When students work in small groups to research and pose solutions to problems, both a collaborative and multifaceted environment is created. Within this environment, students can explore multiple solutions and best practices for tackling projects. In order to stimulate students' learning, students in PBL are confronted with problems.

These problems consist of a description of some phenomena that need to be explained. When trying to explain the phenomena in the problem students discover what they already know about the problem, but they also discover what they do not yet know or which questions still need to be answered and require study. Problems are the driving force behind students' learning in PBL and are used to engage students actively in their own learning. Problems are used in PBL to stimulate students to construct new knowledge actively that is linked strongly with their previous knowledge. The problem is the focus for acquiring knowledge and fosters flexible thinking. Problems used in PBL are often realistic problems. The use of problems in PBL makes learning in PBL a constructive and contextual process. A general structure for PBL involves the following steps:

- Explore the problem, create hypotheses, and identify issues. Elaborate.
- What is the problem, the factors that are important, what is your hypothesis about what is happening?
- Identify what you know already that is pertinent.
- Identify what you do not know.
- What new information do you need to know?
- Prioritize the learning needs, set learning goals and objectives, and allocate resources.
- Members identify which tasks they will do. Contract to teach each other.
- Individual self-study and preparation how best to teach others.
- Return to group; share the new knowledge effectively so that the entire group learns the information.
- Apply the knowledge to solve the problem.
- Assess the new knowledge, the problem solution and the effectiveness of the process used.
- Reflect on the process. Elaborate on the problem.
- Working in groups, students identify what they already know, what they need to know, and how and where to access new information that may lead to the resolution of the problem. The constructs for teaching PBL are very different from traditional classroom/ lecture teaching.

C. Design-based Learning

Design-based learning has been shown to have the most impact in the areas of math and science. Popular design-based learning activities include robotics competitions wherein student teams design, build and then pilot their robots in a series of competitive challenges. Research has found that students who participate in learning by design projects have a more systematic understanding of a system's parts and functions than control groups (Apedoe and Schunn, 2013). Design based learning is a self-directed approach in which students initiate learning by designing creative and innovative practical solutions which fulfill academic and industry expectations. Integrating design and technology tools into science education provides students with dynamic learning opportunities to actively investigate and construct innovative design solutions. A design based learning environment helps to practice 21st Century skills needed for students such as hands-on work, problem solving, collaborative teamwork, innovative creative designs, active learning, and engagement with real-world assignments. By engaging students in learning design, DBL provides an opportunity to experience individual, inventive and creative projects that initiates the learning process in relation to their preferences, learning styles and various skills.

D. Collaborative and Inquiry-based Learning

Collaborative Project-based Learning is focused on the creation of a friendly learning environment that is less intimidating to students. The key features of CPBL include:

- 1) A series of small in-class projects that are simple enough for students with limited background knowledge but collectively serve as a ladder to build up the students' design skills progressively.
- 2) Fostered peer collaboration to help build up students' confidence to complete the projects.
- 3) Timely help and immediate feedback from the teachers.

The core of the CPBL model is a set of well-designed in-class and after-class projects. The in-class projects are directly tied to the content discussed in lectures and is used to introduce concepts. Although small in scope, each in-class project is developed to contain the complete cycle of inquiry-based learning. After-class projects are generally bigger in scope (median-scope projects) and require the collaboration of team members to achieve the project goals. After-class projects are done remotely, team collaboration can be problematic. In implementation process, we find that an effective way to foster peer collaboration is to have dedicated tasks for each team member while to obtain the solution all members need to put their individual work together and think collaboratively. The term project offers an opportunity for the students to work on a real-world design problems. It is done after-class and the strategy mentioned above is also used to ensure each team member participate in the design and obtain the expected learning outcomes. However, the term project has a larger scope and requires the students to conduct research, come up with the design plan, implement the design, evaluate the results and propose a solution. Instructor's feedback during the process is highly recommended (Audet and Linda, 2005).

Inquiry learning is a dynamic process that uses questioning to actively involve students in their own learning. Inquiry learning moves beyond teacher directed activities that stress recall and into an area of application of skills such as synthesis, interpretation and evaluation of information. In Blooms taxonomy that would mean moving to higher levels of thinking and developing habits of the mind. Questioning is at the heart of inquiry learning. It is what drives the students to dig deeper into their topics and also promotes excitement on the part of the learner. The questions come from the student with steady guidance from the teacher to develop a clear outline of what the student wants to know. Students become active partners in their learning. Solving problems is another important element of the inquiry process. Students accomplish this goal by developing their skills for information gathering through their quest to find the information needed to answer their questions. Assessment is an important element of inquiry learning involving students and teachers throughout the entire project. It takes many forms that can range from daily short discussions and questions with students to help keep them move in the proper direction to observations, journals and organizers. Assessments are done not only by the classroom teacher but also by all who may be involved in the project including the library media specialist. Students often are encouraged to offer suggestions to their peers to help them produce their product. It include the ability of teachers to choose activities and/or topics that benefit from differing viewpoints and lived-experiences of students, the need to strategically select students who will work well together and set ground rules so that all students may have the opportunity to participate and encouraging multiple strategies to encourage deeper discussion and better learning for all group/team members.

E. Multimedia based Learning

With concern to self-learning, the multimedia platform is significantly deliver immediate feedback and student control of the learning process, since they don't have to wait for others and can proceed with more self-control compared to the traditional teaching method. The multimedia based learning platform delivers diversified teaching materials through text, music, pictures, and animation, which can provide aid to student's precise development. The attractive live designs and audio and flash effects included in a multimedia platform can entice interest and boost student progress. It provides effective learning examples through hyperlinks instead of a non-linear learning method, which aides in the obtaining related information.

It allows students to learn at any time, without expressive factors disturbing the learning schedule. The multimedia resources can also be used as preparation material for study. Students can able to learn skills at their own pace, having their individual learning responsibilities satisfied.

There are many multimedia technologies that are available for developers to create these innovative and interactive multimedia applications. These technologies include Adobe Photoshop and Premier to create and edit graphics and video files respectively, Sound Forge, and 3D Studio Max to create or edit sound and animation files, respectively. Presentations developed using these multimedia applications can motivate self-learning strongly. It is the effective integration of variety of media elements like text, audio, videos. So students can understand the subject more easily and observe its relevance. The links and buttons included in presentation increase effectiveness and scope of subject comprehension. In simulate learning environments, the student can form simulated learning environment without hazard and costs. This multimedia based learning can reduce these factors by providing an isolated space, and reduced burdens from teachers and classmates. Means it provides more comfortable learning environment.

- **Hyper linked learning system**

The multimedia based leaning system provides self-motivated learning patterns through hyperlinks instead of a non-linear learning method, which aides in the acquisition of extra interrelated information.

- **Splendid teaching materials**

Due to the high cost of instructional multimedia development tools and applications, the designers apply efforts and provide exact resources for design-ing and planning the content which makes rich quality materials.

- **Effective teaching materials**

Presentations using multimedia applications can encourage student learning and effectively integrate a variety of media elements. The multimedia learning platforms simulate situational applications, allowing students to understand the subject more easily and observe its relevance. With respect to preparation of teaching resources, the high cost of production and widespread service area of a multimedia learning platform provides assurance that more time and effort will be spent on evaluating the selection and arrangement of teaching materials. The hyperlinks included in teaching material increase overall effect-tiveness and range of subject comprehension.

DIRECT BENEFITS OF SELF-LEARNING

a. Simulated learning scenarios: In technical and vocational fields, the acquisition and practice of many skills may be dangerous or risky, or the cost of training and practice may be too high. In these cases, the multimedia platform can simulate the actual scenario without the risks or damages economically.

b.Reduced psychological impediments: Some students may be afraid of asking questions in real time due to psychological factors, such as embarrassment or shyness, leading to ineffective learning. The multimedia platform can reduce these factors by providing a neutral response, private space, and reduced pressures from teachers and classmates.

c. Repetitive learning and immediate feedback: In classroom teaching, the learning effectiveness of students is based on teaching attitude and skill of individual teachers. This multimedia based learning provides opportunities to learn and practice repetitively.

d. High quality teaching and widened education for students: The multimedia platform eliminates the human factors present in traditional teaching activities, so the teaching scenario and process provides a more stable environment. Negative factors caused by a teacher's psychological status or other phases are decreased, and a certain level of instructional quality is guaranteed. In addition, a multimedia platform allows students to learn during suitable times and under most favorable conditions.

CONCLUSION

The term Self-learning requires that students take the

responsibility for their own learning process, including acquiring the material and monitoring their own progress. Assessing whether a student is ready for self-learning is important. Teachers should teach students a variety of learning strategies and ensure they can properly use them. Teachers should encourage independence and a positive attitude toward learning. Teachers should investigate learners' needs and interests and how to support them. In self-learning concept students decide what they should learn and how to learn the material. Students develop a confidence in their own abilities and become more goal-oriented while enjoying their learning. Teachers of 21st century skills will need to be experts and have expertise in teaching 21st century skills that they are encouraging their students to excel in. Teachers will have to take conscious efforts to communicate and collaborate with each other and with students; become flexible with managing new classroom dynamics; be able to support and enable self-learning, and be willing to adapt their teaching styles to accommodate new pedagogical approaches to learning. For the above to occur, teachers will need professional development opportunities and strong support systems. The professional development of our nation's workforce must be a top priority and teachers will need to become 21st century learners themselves.

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