



Sudan University of Science and Technology
College of Computer Science &
Information Technology
Post Graduate Studies
Master of Information Technology



Proposing a Framework for Applying Project Based Learning in
Sudanese Institutions

اقتراح نموذج لتطبيق التعليم المبني على المشاريع في المؤسسات السودانية

A thesis submitted for the Partial Fulfillment of the
Requirements for the Master Degree of Information Technology

Prepared by: Nazar Abdelhadi Elmona

Supervisor: Dr Nisreen Beshir Osman

August 2020

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

In the Name of Allah Most Gracious Most Merciful

الآية

(قَالَ رَبِّ اشْرَحْ لِي صَدْرِي * وَيَسِّرْ لِي أَمْرِي * وَاحْلُلْ

عُقْدَةً مِّن لِّسَانِي * يَفْقَهُوا قَوْلِي)

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صدق الله العظيم

Abstract

Project Based Learning (PBL) is about giving students a real projects and asking them to come up with solutions to it as an academic task. Studies pointed out some problems associated to PBL approach, such as social loafing, that is when some students hide themselves behind active students, doing less or no works within the team and put the effort on other team members. Another problem is unfair assessment which result in giving all the students the same marks in spite of their efforts or their contributions. These problems have been solved using peer assessment, in which students evaluate each other, but the PA still has some problems which are bias, so you can't rely on PA as a final evaluation. this study proposed a framework for applying PBL and then developed a prototype software. This software prototype shares the evaluation process between teachers and students, and hence decreasing the load on teachers and giving students more room for participation and engagement. The Framework is developed and the software solution is demonstrated through developing a prototype to show how the system will function, the software's screen and its reports showed these evaluations functions clearly. Finally, the result showed that students found the PBL approach more effective than the traditional way of teaching.

مستخلص البحث

التعليم المبني علي المشاريع, ويعني ان نمّح الطلاب مشاريع فعلية وواقعية مستنبطة من العالم الحقيقي ومحاولة ايجاد حلول لها كتعيين اكايمي ومن ثم تقييم مجهودهم واعطائهم الدرجات بناءً على هذا العمل. بعض الدراسات حددت مشكلات رئيسية بالنسبة الى آلية التعلم من خلال المشاريع, وهما التسلق الاجتماعي, ويعني بها ان بعض الناس تكون مشاركته محدودة في الفريق ويعتمد علي الغير في انجاز المهام, والمشكلة الثانية وهي التقييم غير العادل, وتعني ان يقوم المعلم بأعطاء درجات مشتركة ومتساوية لكل اعضاء الفريق بغض النظر عن انجازاتهم الفردية في المشروع. و اشارت بعض الدراسات ايضاً الى ان هذه المشكلات يمكن ان يوجد لها حل باستخدام طريقة تقييم الاقران, وهي الطريقة التي يعمل فيها الطالب علي تقييم اخيه الطالب الآخر, ولكن هذه الآلية ايضاً لا تخلُ من عيب التحيز وايضاً لا يمكن الاعتماد علي هذا الاسلوب من التقييم بشكل كامل ونهائي. وهنا في هذه الدراسة نحن بصدد اقتراح اطار نظري يتم توضيح طريقة عمله باستخدام نموذج اولي لبرنامج حاسوبي يعمل بالتشارك ما بين الاستاذ والطالب بحيث يقلل الجهد المطلوب من قبل الاستاذ لمتابعة وتقييم الطالب, ان يكون هنالك جهد لمقاة علي عاتق الطالب ليكون هو ايضاً جزء من عملية التقييم. البرنامج النهائي تم شرحه من خلال تصميم واختبار النموذج الاولي وذلك بغرض توضيح طريقة عمل البرنامج بشكل فعلي, والشاشات التوضيحية والتقارير المستخرجة من البرنامج اظهرت ذلك. أخيراً النتائج اظهرت ان الطلاب يعتقدون ان طريقة التعليم من خلال المشاريع هي الاكثر فاعليه من طريقة التعليم التقليدي المعتمدة علي ان الاستاذ له الدور المحوري في العملية التعليمية.

Acknowledgement

First of all, with my highest sense of gratitude, I wish to thank my advisor Doctor Nisreen Beshir without whom this work would not be possible to accomplish. I am deeply indebted to her for providing thoughtful guidelines for my MSC Research and detailed comments on the multiple draft versions of this thesis, during numerous discussions over past year.

Also, I would like to express my sincere gratitude to my friend, inspire, and motivator, Dr Amjad Atta

Last, but not the least, I wish to express my thanks to all of my family.

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Table of Abbreviation

Acronym	Meaning
PBL	Project Based Learning
GA	Group Awareness
PA	Peer Assessment
TTA	Traditional Teaching Approach
VB	Visual Basic
SQL	Structured Query Language

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CHAPTER ONE - INTRODUCTION

1.1 Background

Education liberates the intellect, unlocks the imagination and is fundamental for self-respect. It is the key to prosperity and opens a world of opportunities, making it possible for each of us to contribute to a progressive, healthy society. Learning benefits every human being and should be available to all (SDG 2019).

Learning is the process of acquiring new, or modifying existing, knowledge, behaviors, skills, values, or preferences Learning have different methods, styles, and approaches which it differs from context to others based on different factors, for example learning methods in behavioral science field it differs from learning method in applied science field. (Gross, 2012).

Project Based Learning is a teaching method in which students gain knowledge and skills by working for an extended period of time to investigate and respond to an authentic, engaging, and complex question, problem, or challenge

Project Based Learning (PBL) has become widely used method of teaching in technical subjects. In the last ten years our experiences with PBL reveal a very complex picture. (Blumenfeld et al., 1991).

Project-based instruction is innovative by its emphasis on cooperative learning. Additionally, students create tangible results to represent what they have learned. Students use technology and inquiry to respond to a complex issue,

problem or challenge. PBL focuses on student centered inquiry and group learning with the teacher acting as a facilitator, as opposed to the one in charge. Activities match as nearly as possible the real-world tasks of professionals in practice rather than classroom-based tasks. This encourages interdisciplinary perspectives and enable learners to play diverse roles and build expertise that is applicable beyond a single well-defined. Lastly, it allows a range and diversity of outcomes open to multiple solutions, rather than a single correct response obtained by the application of predefined rules and procedures.(Blumenfeld et al., 1991)

1.2 Problem Statement

- Giving students working in a group work project the same marks it's not always fair, because some students do extra effort than others, and these way of grading will not encourage students to do hard work because at the end will get the same marks similar to other colleagues
- Another problem is the free rider, which is about the students whom they want to make less or no effort and get the same mark as other students. Which we can refer to it as unfair mark and free rider.

So the problem here its appear clearly, how do you can assess each of the students in each group on the quality of the outcome fairly?

1.3 Research Objectives:

The objectives of these research are:

- To propose a framework to avoid the problems related to PBL (Unfair Student Grading and free riders)
- To develop a prototype to demonstrate the proposed frameworks and show how the system will work.

1.4 The Research Questions:

- 1 Does the suggested framework will increase student's participation and decrease teacher overloading?
- 2 Does the implementing of the proposed framework of project-based learning approach will increase student's satisfaction?

1.5 The Research Hypothesis

1. Compared to traditional assessment approach, the proposed framework will increase student's participation and decrease teacher overloading.

2. Compared to traditional assessment approach, the proposed framework will increase student's satisfaction.

1.6 The Research Methodology

Researcher follow 5 steps to reach to the final conclusion, so researcher start by collecting secondary data for the literature review to gain a solid knowledge about the topic of Project Based Learning and to know the stage where the science and theory are standing now, then the questionnaire is designed and distributed to the intended group. Then the second step was analyzing the collected data to see to which extended the suggested model can contribute to the solution of the problem. The third step is designing the model and developing a prototype that show practically how the system is going to function. The fourth step is the result and verification, which is done through analyzing the collected data which has been collected by the questionnaire and the analysis is done using SPSS.

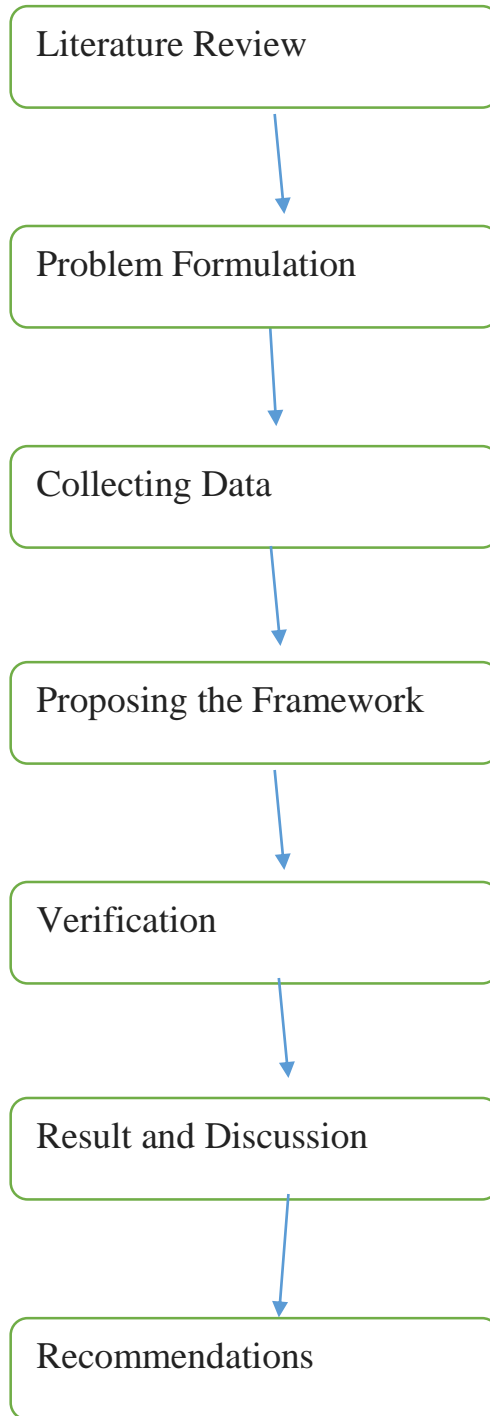


Figure 1.1 Research Methodology

1.7 Thesis Organization

The thesis is organized to five parts, chapter one, chapter two, chapter three, chapter four and chapter five. Chapter one is the introduction and containing the overall of the research like research problem, method, objectives, and hypothesis. Chapter tow is the literature review, and it gives the reader solid background and about the state of the Project Based Learning topics. Chapter three is the research methodology, and it's about the methodology and the steps followed by the researcher to conduct the thesis, questionnaire is used as a tool for data collection and SPSS is used as an analysis application. Chapter four is result and discussions and here you are going to find the results generated from collected data and how its related to the research problem, and objective through a systematic discussion. Chapter five, is conclusion and recommendation and its conclude all the work done through the research journey and its related recommendation toward a better state of the body of knowledge.

CHAPTER TWO - LITERATURE REVIEW

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2.1 Introduction

The following review of literature confirms that Project Based Learning is highly demanded and needed in education sector.

Project-based learning (PBL) is an active student-centered form of instruction which is characterized by students' autonomy, constructive investigations, goal-setting, collaboration, communication and reflection within real-world practices (Kokotsaki, Menzies, & Wiggins, 2016).

2.2 Challenges of Project-based Learning

In spite of the benefits of Project Based learning, it has some shorts which it should be addressed clearly to be solved in the future. (Pucher & Lehner, 2011) mentioned in their article that: handling of numerous projects is complex and the evaluation of the results difficult to standardize. Teaching with projects quite often turned out to be chaotic in the perception of students. Remarks, based on the results of projects turned out to be highly depended on the subjective point of view of the teacher.

(Lin, Tsai, Hsu, & Chang, 2019) mentioned that: Project Based Learning have two main flaws: social loafing and unfair assessment marks. Although some studies agree that peer assessment can correct the above flaws in project-based

learning, some concerns (e.g. unreliable and/or biased marking) have not been addressed.

In many cases projects ideas suggested by the students turn out to yield exceptional good results. This is probably due to the high level of motivation students tend to have under such circumstances. Surprisingly these types of projects do not get as good remarks as projects defined by members of the faculty. Various facts could be the cause of this phenomenon. One likely cause is the complex organization of projects in Computer Science. If students suggest the idea, they also are in charge of defining project goals. But due to the lack of experience in defining such project goals these goals do have a tendency to be unreachable. The learning outcome in such situations is high, even if the results of the project in terms of marks are poor.

2.3 Searching for solution:

Project Based Learning, is used in education in different sectors and it combined with different approaches, and techniques, for example it combined with STEM (Science, Technology, Engineering, and Mathematics) and it has a great impact on student performance as it stated by (Kuo, Tseng, & Yang, 2019) “STEM Interdisciplinary Project-based Learning (IPBL) approach was applied to teach

a total number of 45 college students registered in the departments of engineering and design.

It is found that the STEM IPBL course had a different impact on the student's originality, while the originality of engineering majored students significantly improved”.

Project Based Learning in Computer Science is of high value for the students, but requires much attention in the organization (Pucher & Lehner, 2011).

Many approaches and techniques it could be followed to come up with accurate result, but (Kokotsaki et al., 2016) used an experiment to control the uncertainty.

The majority of the reviewed studies were based on a quasi-experimental pretest–posttest design with some baseline equivalence established but no random allocation of participants to control and experimental groups, and as a result, a causal link between PBL instruction and positive student outcomes cannot be established with certainty.

The authors conclude with six key recommendations considered to be essential for the successful adoption of a PBL approach in the mainstream school setting

1. ***Time management*** - This theme relates to scheduling projects effectively by coordinating project schedules with other teachers,

2. *Getting started* by giving them a rubric that clearly explains what they are expected to search for and try to accomplish and jointly agreeing on grading criteria before the start of the project.
3. *Establishing a culture that stresses student self-management* - Here, responsibility is shifted from the teacher to students
4. Managing student groups
5. *Working with others outside the classroom*, such as other teachers, parents and people from the community,
6. Getting the most out of technological resources,

(Lin et al., 2019) come to solution and proposed a model which he can link between two assessment tool, Peer assessment (PA) and group awareness (GA) tools, and he mentioned that: Group awareness tools can inform the learning activities of group members (including the context of member interaction and knowledge degree), in a computer-supported collaborative learning (CSCL) environment by providing each group member with a visual representation of the activity of other group members. Since the GA tool provided a visualization of the number and average length of messages sent by other team members, each team member could easily compare their own participation to the participation of other members. In a CSCL environment, learners are not

explicitly instructed on how to adapt their behavior's. Group awareness tools can implicitly guide behavior and reflection by the group and its members, and it can improve participation and member communication. For students, GA tools increase class participation because students are unable to hide in the crowd and they are concerned that their peers will view them as free riders so team members can use GA technology to observe the interactions and contributions of other team members in an online collaborative learning environment. Experimental results show that the proposed PAGA can increase students' online participation. Moreover, the proposed PAGA avoids the above two flaws, unlike conventional PA.

But always shorts are there and further studies are always needed, However, this study did not show that PAGA effectively enhances the quality of interactive messages and the quality of project achievement (Lin et al., 2019)

another study found that: learning outcomes are improved by a 2-stage formative assessment and time optimization strategy that allows students to extract as much value as possible out of the limited time they have to devote to this exercise. To decrease inefficiency, the author, follow this method which it consists of three strategies:

- Early graded formative assessment to provide an incentive to begin work early and set meaningful milestones.
- Periodic scheduled feedback to ensure all students have a realistic view of their own progress throughout the term.
- Imposed individual assessment to force a “divide and conquer” approach to taking on a multi-faceted problem (Galiano & Liu, 2016).

2.4 Future of Project Based Learning

Automation and information systems are very necessary for the efficiency, Here the author noticed the importance of PMIS and he suggested it as tool for efficiency. And he come out with the result which it shows that the use of a project management information system is in fact advantageous to project managers. Improvements in effectiveness and efficiency in managerial tasks were observed here in terms of better project planning, scheduling, monitoring, and control. Improvements in productivity were also observed in terms of timelier decision-making. Advantages obtained from PMIS use are not limited to individual performance but also include project performance. These systems were found to have direct impacts on project success, as they contribute to improving budget control and meeting project deadlines as well as fulfilling technical specifications. One can therefore conclude that PMIS make a

significant contribution to project success and should continue to be the object of project management research (Ju-mari, 2011).

To go further in automation process of PMIS for a PBL assessment model, you need to investigate the issues related to design and requirement process, we can refer back to (Breiter & Drechsler, 2005) in their article which they mentioned that: : Designing information systems according to user requirements is crucial for software developers. In computer science education, acquiring necessary social skills to elicit and define those requirements is underdeveloped.

In summary, the author assumptions about learning effectiveness in respect to acquiring social and technical skills with student projects were positively supported.

More enhancement to PBL could come true if we try to make the design of the curricula electronically, so we can design Electronic Systems Curricula for making electronics more appealing to students. Since electronics is an important grounding for other

disciplines (computer science, signal processing, and communications),

this approach proposes the development of multidisciplinary projects using the project-based learning (PBL) strategy for increasing the attractiveness of the

curriculum. The proposed curriculum structure consists of eight courses: four theoretical courses and four PBL courses (including a compulsory Master's thesis). In PBL courses, the students, working together in groups, develop multidisciplinary systems, which become progressively more complex.

This curriculum has been evaluated successfully for the last four academic years: the students have increased their interest in electronics and have given the courses an average grade of more than 71% for all PBL course evaluations (Macías-guarasa, Montero, & San-segundo, 2006).

PBL can be managed automatically through designing a PBL web application, which can allow students to engage with each other to evaluate, comment, and learn in interactive way.

Kose in his article support the idea of building a web based application and mentioned that: "web based system designed and developed to support project-based learning activities in "Web Design and Programming" course given at Information Technologies program of vocational high schools. The system aims to enable students to learn web site designing and programming by creating a web site with advanced tools". (Köse, 2010)

However, further research is needed to more clearly categorize the difficulties caused by Project Based Learning in education context.

2.5 Literature Review Table

On the following section, researcher listed down all the papers, articles, and sources which he uses to conduct his research, the data is organized in table and columns and the abstract is summarized and then written in bullet point.

Top ranked journals are used as a data source like springer, IEEE and ELSEVER. Most of these journals are recent and within the past five years in maximum, but some articles are relatively old, but because they are essentials and have too many citations.

No	Title	Year	Author	Publisher	Abstract
1	Project-based learning: A review of the literature	2016	Dimitra Kokotsaki, Victoria Menzies, Andy Wiggins	SAGE	<ul style="list-style-type: none"> • This study of Project Based Learning focused more on the methodology, which is done through pre and posttest based on a quasi-experimental control and experimental groups, and the result of this study was there a causal link between PBL instruction and positive students to outcomes cannot be established with certainty. • The study also supported the role of technology, group processes of high quality teachers, ability to effectively scaffold students' learning and provide guidance and support. Also the balance between didactic instruction with in-depth inquiry methods and well-aligned assessment have been identified in the literature as facilitating factors in the implementation of PBL.
2	IMPROVING PROJECT-BASED LEARNING OUTCOMES BY FORMATIVE ASSESSMENT AND	2016	Leo Stocco, Roberto Rosales, Ignacio Galiano, Andy Liu, David Feixo	ASME International Mechanical Engineering Congress &	<ul style="list-style-type: none"> • The concept of PBL has been adopted and applied in different fields, in electric engineering also proved its efficiency, by giving a practical hands-on nature on design and simulation, and the result

	STRATEGIC TIME OPTIMIZATION			Exposition- Arizona USA	is being proved by an end-of-term student survey and a subjective evaluation of their work, in comparison to the previous year.
3	Peer assessment with group awareness tools and effects on project-based learning	2019	Jian-Wei Lin, Chia-Wen Tsai, Chu-Ching Hsu & Lung-Chun Chang	Routledge Taylor and Francis Group	<ul style="list-style-type: none"> The two major flaws in project-based learning are: social loafing and unfair assessment marks. To come over these flaws the study applied two tools, which are group awareness and peer assessment to ensure more involvement and more participation from other parties of the project. However, this study did not show that these two tools effectively enhance the quality of interactive message and the quality of the project achievement.
4	Project-Based Learning in Student Teams in Computer Science Education	2005	Andreas Breiter, G'orschwin Fey, and Rolf Drechsler	FACTA UNIVERSITATIS	<ul style="list-style-type: none"> For designing information systems, the approach of project based learning is also applied to increase the participation of stakeholders for more accuracy of requirements collection process. The benefit of this approach for the computer science

					<p>students are allowing them to explore method for project management as well as requirements analysis and participatory design with real end users.</p>
5	<p>The Functional Design of a Project Management Information System: Case Study with South African Breweries Ltd</p>	20 11	<p>Anna Ju-Marié Bester</p>	<p>STELL ENBOSCH UNIVERSITY</p>	<p>In order to succeed, companies must deliver projects on time and within budget, and meet specifications while managing project risks</p> <p>Thus, to provide a tool for the successful management of project, this final year project presents a project management information system (PMIS). The value of a PMIS and a description of a PMIS as well as the essential elements and components of a PMIS are offered.</p> <p>In order to validate and verify the information gathered from literature and experience, a research test model is presented to prove that a PMIS is the correct model to use within project management as well as to prove that the model is defined and described correctly.</p>

					<p>Recommendations are made to provide SAB Ltd with concrete solutions that will improve productivity and project success rate. This in turn will have a positive influence on SAB Ltd on their road towards meeting their company goals.</p>
6	A project-based learning approach to design electronic systems curricula	20 07	J. Macias-Guarasa ; J.M. Montero ; R. San-Segundo ; A. Araujo ; O. Nieto-Taladriz	IEEE	<p>The design of the curriculum can be done electronically which will be easier and that will lead to the increasing the level of the engagement.</p> <p>Project based learning can be one of the best strategy for the process of designing curriculum collaboratively</p> <p>Significantly the students level of satisfaction toward the subject is increased and this is appearing clearly on their marks and their grades.</p> <p>The students at the end could build an artifact which is increase their ability to think critically and to start making use of the skill of problem solving technique, and this is one of the most great advantages of approach of the project based learning specially in the area of applied science and computer field.</p>

7	Project Based Learning in Computer Science □ A Review of More than 500 Projects	20 11	Robert Puchera and Martin Lehnerb	SciVerse	<p>Grading is the most factor that can be a problem to the teacher and students, projects can enhance the ability of students to get better understanding to the problem which they are investigating, but a good mechanism of evaluation to these projects should be in place in advance.</p> <p>Teachers believe of the PBL approach in the field of the computer science, because it gives students more space for the approach of hands on, and this approach also beside the hard skills gives students soft skills too, like working in teams and problem solving techniques.</p> <p>However involving students in projects should be consider with many factors like thinking about originals and authentic problems to be solved and teachers supposed to provide strong support for the students.</p>
8	The effect of authentic project-based learning on attitudes and career aspirations in STEM	20 19	Margaret E. Beier	WIEL Y	<p>Can engaging college students in client-centered projects in science, technology, engineering, and mathematics (STEM) coursework increase interest in STEM professions? The current study explored the</p>

				<p>effectiveness of project-based learning (PjBL) courses on student attitudes, major choice, and career aspirations in STEM. Framed in expectancy value and social cognitive career choice models, we examined the effect of engaging in at least one authentic, project-based course during the first four semesters of college</p> <p>on student STEM attitudes and career aspirations in a quasi-experimental study with a sample of (N5492) natural science and engineering students. STEM self-efficacy and subjective task value variables (STEM attainment, intrinsic and utility value of STEM courses, and relative cost associated with engaging in STEM courses) were examined as mediators of the relationship between classroom project based experiences and STEM career aspirations. Gender and underrepresented minority status were also examined. We found that engaging in at least one project-based course during the first four semesters affected student perceptions of STEM skills, perceptions of the utility value of</p>
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					<p>participating in STEM courses, and STEM career aspirations. Furthermore,</p> <p>we found that the effect of project-based courses on STEM career aspirations was mediated by STEM skills and perceptions of course utility. The effect of PjBL was not moderated by race or gender. We highlight areas of future research and the promise of PjBL for engaging students in</p> <p>STEM professions.</p>
9	<p>Promoting college student's learning motivation and creativity through a STEM interdisciplinary PBL human-computer interaction system design and development course</p>	20 19	<p>Hsu-Chan Kuo^a, Yuan-Chi Tseng^b, Ya-Ting Carolyn Yang^c</p>	ELSEVIER	<p>In recent years, STEM (Science, Technology, Engineering, and Mathematics) has been extensively advocated and implemented in education, as it is suggested to be very impactful on student's interdisciplinary learning, which can be seen as a significant driving force for a country's advancement in scientific and technical knowledge, innovation, economy, and international competitiveness. Developing a human-computer interaction (HCI) system to solve real-world problems</p>

				<p>requires the inventors to have interdisciplinary STEM knowledge and skills. Thus a STEM Interdisciplinary Project-based Learning (IPBL) approach was applied to teach a total number of 45 college students registered in the departments of engineering and design. Inspired by Design Thinking, the 18-week STEM IPBL course was delivered through four phases, including discover, define, develop, and deliver. All the finished HCI projects applied the interdisciplinary knowledge and skills from the domains of STEM. Evidence drawn from the 6-point Likert ‘Motivated Strategies for Learning Questionnaire (MSLQ)’ indicated that the STEM IPBL course was very impactful on student’s learning, which improved the participants’ (a) overall learning motivation (Pre M=4.4, Post M=4.64; p=.012), (b) self-efficacy of learning (Pre M=4.03, Post M=4.43; p=.003), (c) enjoyableness of learning STEM (Pre M=4.68, Post M=4.75; p=.556), and (d) recognizing the significance of learning STEM on future career development (Pre M=4.73, Post M=4.94; p=.077). It is</p>
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				<p>also found that compared with design majored students, the course had a better effect on the engineering majored students. Evidence collected from ‘Abbreviated Torrance Test for Adults (ATTA)’ indicated that the student’s overall creativity was significantly improved (Pre M=63.36, Post M=68.44; $p=.000$). More specifically, among the four facets of creativity, the improvements were as follows: fluency (Pre M=14.89, Post M=16.2; $p=.001$), elaboration (Pre M=16.69, Post M=18.62; $p=.000$), flexibility (Pre M=14.82, Post M=16.04; $p=.009$), and originality (Pre M=16.96, Post M=17.58; $p=.136$). It is found that the STEM IPBL course had a different impact on the student's originality, while the originality of engineering majored students significantly improved ($p=.006$), the originality of design majored students did not change. Some educational implications were also provided in the article.</p>
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10	<p>HOW SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS (STEM) PROJECT-BASED LEARNING (PBL) AFFECTS HIGH, MIDDLE, AND LOW ACHIEVERS DIFFERENTLY THE IMPACT OF STUDENT FACTORS ON ACHIEVEMENT</p>	2005	<p>Nicolas Michinov a,*, Corine Primois b a</p>	ELSEVIER	<p>This article extends the findings in synchronous room-based electronic brainstorming about the impact of social comparison process on productivity and creativity in a web-based context of asynchronous electronic brainstorming. Social comparison was manipulated with a feedback informing group members of their respective contributions on the electronic brainstorming task through a shared table regularly updated by a facilitator. In another group, although participants had the possibility to identify each contribution within the newsgroup, they did not receive any feedback in a shared table. Results showed that both group productivity and group creativity are better in the social comparison feedback condition than in the other condition. It appears that social comparison process has a positive impact on productivity and creativity in a web-based context of asynchronous electronic brainstorming, but only when participants have access to a shared table facilitating the comparison among group members. This finding provides some useful recommendations for</p>
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					learning facilitators to improve productivity and creativity in the context of computer-supported collaborative learning over the Internet. It also invites to future innovative technological developments to improve participation in online groups.
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CHAPTER THREE - RESEARCH METHODOLOGY

3 Introduction:

Research methodology is the specific procedures or techniques used to identify, select, process, and analyze information about a topic. In a research paper, the methodology section allows the reader to critically evaluate a study's overall validity and reliability.

3.1 Project based learning Assessment Framework:

On this study we combined two tools to achieve the research overall objectives, which are; the Gantt-Chart.

3.2 Gantt Chart

Gantt chart used commonly in managing projects, because with this tool you can visualize the performance of your project, which will help you to finish the project on time, while you are able to see all deliverables and tasks which it should be done. Gantt chart is a simple mechanism which is work by listing all the activities and tasks in the left side and then draw a bars on the right side to indicate the progress (PMI, 2019).

We can identify Gantt chart from the literature as state it by Project Management Institute as: A graphic display of schedule-related information. In the typical bar chart, schedule activities or work breakdown structure components are listed down the left side of the chart, dates are shown across the

top, and activity durations are shown as date-placed horizontal bars. (PMI, 2019).

Gantt chart as a mechanism for administrating the projects, is going to be managed mainly by the instructors for the purpose of setting, defining, and managing the project tasks and deliverables.

3.3 Peer Assessment

Peer-Assessment as an assessment mechanism is going to be used among the students at Ahfad University for women in Sudan, its going to be used because it relies on giving students a chance to work as an assessor to assess each other, and this will give the students the sense of importance and it will let them get more engaged. On the same time, peer assessment mechanism when it's done by the students, it will decrease the load burden from teacher and put it on the students, and here we can achieve the objective of the education by getting students as partners and put them on the heart of the education process and increasing the sense of participation

3.4 Participants Background

The project and the framework applied among students from Ahfad University for Women.

3.5 Ahfad Univeristy for Women:

Ahfad University for Women is established in 1966 as a College for Women. Begun with only 23 students and a faculty of three, including Yusuf, Ahfad now has an enrollment of over 7,500 undergraduates Students and more than 300 postgraduate Students (AUW 2019).

3.6 Management Information Systems specialization:

The Management Information Systems Specialization MIS is designed to prepare graduates to work in a variety of computing technology capacities which support the tactical and strategic goals of organizations. Students learn to design information systems which support decision making, business operations and functional areas within organizations. The design process includes the specification of hardware, software and personnel requirements. Graduates are also are capable of sitting for Professional certificates such as (CISA).

3.7 Object Oriented Programming Course

This course presents a conceptual and practical introduction to imperative and object oriented programming, exemplified by Java. As well as providing a grounding in the use of developing information systems, the course will cover general principles of programming in imperative and object oriented

frameworks. The course enables you to develop programs that support and solve the business problems.

3.8 Data Collection and Validation:

To validate the assumption, researcher is going to follow up an Action Research Methodology, the overall idea will be around making a questionnaire for the students from Department of Information Systems, and asking them about their opinion, and their satisfaction level regarding the traditional teaching which is not project based approach, and then applying the approach of PBL and then making another questionnaire to check their opinion about their satisfaction level again and see the effectiveness of the new proposed model.

3.9 Participants

This research is targeting group-of eighteen students from the department of Management Information Systems at Ahfad University, third year students for the academic year of 2018-2019, who they are studying Object Oriented Programming course.

3.10 Project Based Learning Framework

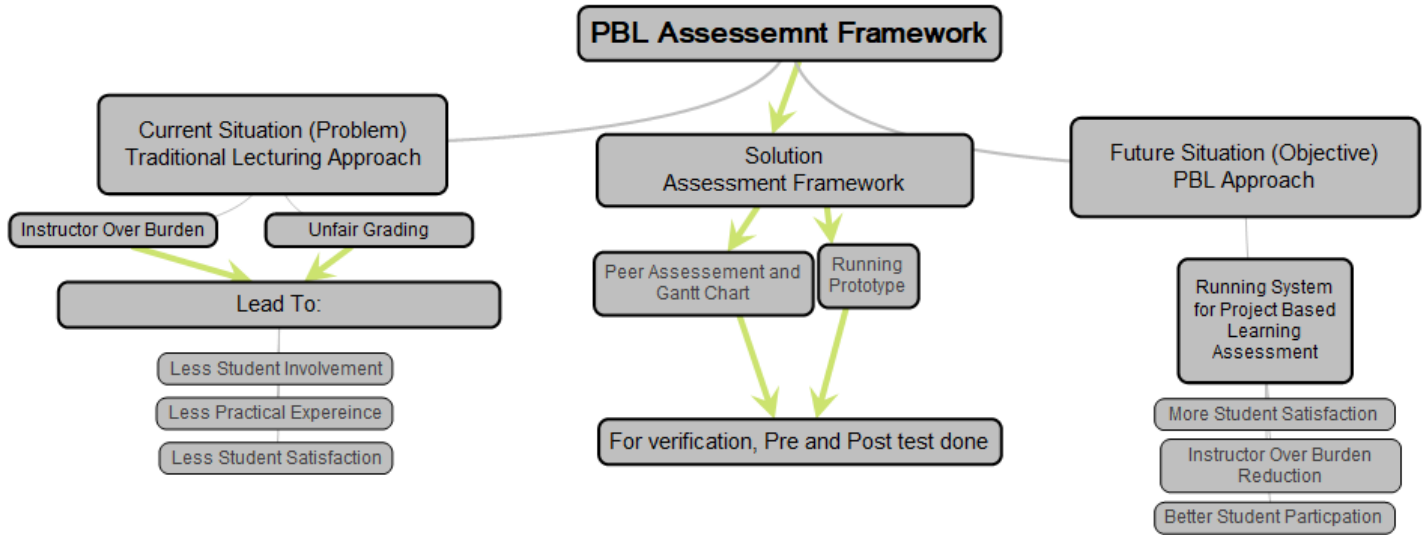


Figure 3.1 The Framework:

3.10.2 The Framework illustration:

The framework invented to solve the problem of unfair marking and social loafing, so the frame work consists of two parts, the first part is the process or the mechanism of the assessment itself, and the second part is the software or the prototype which is used to automate the process.

First part is the Peer assessment method, which is used as a method for assessment and engagement, plus the using of Gantt chart as a tool for task scheduling, visualizing and follow up.

The second part is the software to run and maintain the process with less load and higher efficiency.

Proposed framework will solve the current problems which are. 1) Unfair Grading, and this is happening due to the exes of students numbers assigned per instructors for assessment and evaluation, and this also may lead to other sub-problem; which are; 1) Student dissatisfaction. 2) Less engagement in the lecture. And 3) less practical experience.

And the second problem is social loafing, and this is about free riders, in other words, it's about students who are doing less or nothing in the group compared to their other colleagues.

For the verification and validation, an experiments test has been done, the Experimental study least for three months at Ahfad University for women involved eighteen students, the first part of the experiment is about giving the student a project and giving them clear instructions to achieve the project and tell the students also about how they are going to be marks, last but least students will be asked to deliver their projects tasks on specific dates. And then a questionnaire is being designed and distributed among all participants to assess and take their opinion about the approach and their satisfaction level.

The second part of the experiments is about using the new approach, project based approach, these time students have been told that they are going to assess their colleagues as a peer assessment mechanism, and they have been told about the rubric which is demonstrating how the assessment should be conducted, and based on what, and also the students have been free to choose the perfect time for their submission while it's within the due date range.

After explaining the project based learning approach to the students, and after the submission due date, a post questionnaire has been designed and distributed again to collect data about student's perception toward the new approach. Latter data has been analyzed and discussed in details in chapter 3 and 4 respectively.

3.10.3 Construction of the Prototype

Overview

In this section researcher is going to write about construction of the prototype, tools, and techniques which have been used. Many languages and tools are available and it can be used for the purpose of developing a prototype to test the functionality of the suggested model and to demonstrate the idea clearly to all stakeholders, to give them the ability to understand the suggested system, and to allow the teachers to set the stages of the system and its mile stone, and to allow the students to see how they can submit their progress and to give them the ability to evaluate and assess their colleagues works.

Microsoft Access has been chosen as a development tool, because it's very friendly user interface, and it's easy to be used and its comprehensive, which it combines the ability to use Microsoft Structured Query Language (SQL) as backend for designing tables and the database and in the same time also have the ability to let you modify the logic of the program by using VB as a programing language.

3.11.1 Conceptual Model Design

Researcher started the process of developing the prototype by analyzing all the available information which is collected from the participants in spite of their

status either are teachers or students, and also based on information which are collected from the literature, researcher come out by a mockup to show how the prototype of the system should be. For stage of analysis and design the researcher only used pen, pencil, and papers, no electronic tools or software are used.

3.11.2 Evolutionary prototyping

The type of prototype which have been developed by the researcher is evolutionary prototype, which it built in very strong and robust manner, but some components of the final system is still not perfectly clear, but in the same time, the components of the system which are essential and it's for sure supposed to be included in the system, are well constructed. Mainly researcher focus more on the design of the forms, because are used in the system for inserting data, and in the same time these forms supposed to explain the purpose of the system.

Reports also are well constructed, because the output data which are generated by these reports, are going to be evaluated latter to show the validity of the system.

3.11.3 Prototype's Final Product

A running prototype for PBL Evaluation Model has been developed to provide an effective education assessment mechanism, for designing this prototype, Microsoft Access and Visual Basic code are used for development. The development of the system follows the strategy of ease of use and friendly user interface.

The developed system provides two different modes, teacher module and student module.

3.12.1 Teacher Module

In the system, teacher role mainly will be around helping teacher to have a friendly environment that could help him to set the project general guidelines and its related tasks and then giving ability to the teacher to follow and monitor the student assessment process performance.

When you log to the system you will see the forms based on the role of you either you are teacher or student.

Teacher activities are mostly based on management of project, but in addition to that teacher can also perform some personal activities on the system like seeing who is evaluating whom, or making assessment to any students.

SelectProject X

Project

ProjectName: GUI with Java

StartDate: 10/23/2019

EndDate: 10/26/2019

Rating subform

TaskName	RatingValue
1 Making Text Fie	<input type="text"/>
2 Making Label	1 <input type="text"/>
3 Making Buttons	5 <input type="text"/>

Record: 1 of 3 No Filter Search

Record: 1 of 1 No Filter Search

Figure 3-1 Teacher Module for Project Selection

3.12.2 Student Module

Generally, the interface of teacher's module and student module are designed in semi similar manner to allow both of them to share the knowledge and to communicate more effectively together.

Student activity mainly will be around only assessing each other and without the ability to modify tasks evaluation which are done by other students.

Rating subform		
RatingID	<input type="text" value="1"/>	
TaskID	<input type="text" value="Making Label"/>	▼
RatingValue	<input type="text" value="4"/>	
RatingID	<input type="text" value="2"/>	
TaskID	<input type="text" value="Making Buttons"/>	▼
RatingValue	<input type="text" value="5"/>	
RatingID	<input type="text" value="3"/>	
TaskID	<input type="text" value="Making Text Field"/>	▼
RatingValue	<input type="text" value="3"/>	
RatingID	<input type="text" value="(New)"/>	
TaskID	<input type="text"/>	▼
RatingValue	<input type="text" value="0"/>	

Figure 03-2 Student Module for task rating

3.12.3 System Reports

The proposed Project Based Learning Assessment Model allow teachers to check and monitor overall performance by generating on click reports. Generated reports are dynamic to reflect the current of status of the system.

Project			
ProjectName	GUI with Java	Project.StartDate	10/23/2019
		Project.EndDate	10/26/2019
TaskName	TaskUserName	Task.EndDate	10/24/2019
Making Buttons	<input type="text" value="Omnia Ali"/>	Task.StartDate	10/24/2019
	RatingDate	RatingValue	
	10/23/2019	5	
TaskName	TaskUserName	Task.EndDate	10/24/2019
Making Label	<input type="text" value="Omnia Ali"/>	Task.StartDate	10/24/2019
	RatingDate	RatingValue	
	10/23/2019	4	
TaskName	TaskUserName	Task.EndDate	10/24/2019
Making Text Field	<input type="text" value="D Amjad"/>	Task.StartDate	10/23/2019
	RatingDate	RatingValue	
	10/26/2019	3	
ProjectName	Java Database Conectivity	Project.StartDate	1/10/2019
		Project.EndDate	12/10/2019

Figure 3-3 System Reports

CHAPTER FOUR- RESULT AND DISCUSSION

4. Introduction:

The developed framework was used in higher education institute during one term. At the end of the term, a questionnaire was developed and distributed among all fourth year's students of Management Specialization at School of Management Studies at Ahfad University for Women, with the desire of finding out to what extent students are happy and satisfied with the approach of Project Based Learning plus using the Peer Assessment Model. In the survey student were asked to express their opinions on Likert scale, checking 1) if they strongly disagree, 2) if they disagree, 3) if they have no clear opinion, 4) if they agree, and 5) if they strongly agree with the given statement.

Questionnaire are design to measure the student opinions firstly using Traditional Teaching Approach (TTA) xj, and then measuring their satisfaction latter using Project Based Learning Approach. Measured variables in TTA are over all student satisfaction with TTA, Team work ability in TTA, ability to see a tangible product, and the ability to be independent researcher. Variables are measured in Project Based Learning approach are: over all student satisfaction with BPL, Team work ability in PBL, ability to see tangible product, ability to be independent researcher, the level of student participation, and the level of teacher over burden load.

4.1. Survey results

Overview

The following tables show the data that demonstrating to which extend student are happy and satisfied with traditional teaching approach compared to Project Based Learning Approach.

4.1.1 Student Satisfaction

67% of students in total of who are agree plus the students who are strongly agree, those students are happy with traditional teaching.

When it comes to PBL approach, 94% either agree or strongly agree with the BPL approach, what is interesting is, firstly students thought the traditional teaching approach is good enough for them, but latter after being exposed to the PBL approach rather that TT approach, they realized that it's really more effective for them is to learn through PBL approach.

Table 4.1.1 Students Satisfaction with Traditional Teaching Approach

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	3	16.7	16.7	16.7
Neutral	3	16.7	16.7	33.3
Valid Agree	8	44.4	44.4	77.8
Strongly Agree	4	22.2	22.2	100.0
Total	18	100.0	100.0	

Table 4.1.2 Students Satisfaction with Project Based Learning Approach

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Strongly Disagree	1	5.6	5.6	5.6
	Agree	12	66.7	66.7	72.2
	Strongly Agree	5	27.8	27.8	100.0
	Total	18	100.0	100.0	

4.2. Team Work Ability

When it comes to team work ability, 56% of the students in total are agree plus strongly agree in traditional teaching approach, but when we look to their response in Project Based learning regard the team work ability we find 94% of the students are happy and satisfied, which is a significant difference when we look to the comparison between their response in TT approach compared to PBL approach.

Table 4.2.1 Team Building in Traditional Teaching Approach

	Frequency	Percent	Valid Percent	Cumulative Percent
Neutral	1	5.6	5.6	5.6
Agree	8	44.4	44.4	50.0
Valid Strongly Agree	9	50.0	50.0	100.0
Total	18	100.0	100.0	

Table 4.2.2 Team Building in Project Based Learning Approach

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Strongly Disagree	1	5.6	5.6	5.6

Disagree	2	11.1	11.1	16.7
Neutral	5	27.8	27.8	44.4
Agree	6	33.3	33.3	77.8
Strongly Agree	4	22.2	22.2	100.0
Total	18	100.0	100.0	

4.3. Ability for Delivering Tangible Products

Regarding the student ability to create or develop a tangible product like a real software or running small scale project application, student respond negatively regard the Traditional Teaching Approach and responded very positively toward the Project Based Learning approach. 44% of them they said yes it could be in TTA, but after being exposed to the PBL approach, 83% of them said yes to PBL approach, yes it allows us to create tangible product.

Table 4.3.1 Tangible Products in Traditional Teaching Approach

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	2	11.1	11.1	11.1
Disagree	5	27.8	27.8	38.9
Valid Neutral	3	16.7	16.7	55.6
Agree	6	33.3	33.3	88.9
Strongly Agree	2	11.1	11.1	100.0
Total	18	100.0	100.0	

Table 4.3.2 Tangible Products in Project Based Learning Approach

	Frequency	Percent	Valid Percent	Cumulative Percent
Neutral	3	16.7	16.7	16.7
Agree	7	38.9	38.9	55.6
Valid Strongly Agree	8	44.4	44.4	100.0
Total	18	100.0	100.0	

4.4. Ability to Make an Independent Researcher

When you come to think about to which extend student is going to be able to be fully responsible and able to go and search alone, and independently for information, you will find only 22% of the students agreed they are able to go alone and search, but when they got exposed to the Project Based Learning approach, 89% of them they said with this approach we can be a better researcher.

Table 4.4.1 Independent Researcher in Traditional Teaching Approach

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	1	5.6	5.6	5.6
Disagree	7	38.9	38.9	44.4
Neutral	6	33.3	33.3	77.8
Agree	2	11.1	11.1	88.9

Strongly Agree	2	11.1	11.1	100.0
Total	18	100.0	100.0	

Table 4.4.2 Independent Researcher in Project Based Learning Teaching Approach

	Frequency	Percent	Valid Percent	Cumulative Percent
Neutral	2	11.1	11.1	11.1
Valid Agree	8	44.4	44.4	55.6
Strongly Agree	8	44.4	44.4	100.0
Total	18	100.0	100.0	

4.5. Student Participation Level

Student when they asked about their level of participation due to the space and consideration which they found in the project based learning approach, when

they assess themselves alone following Peer Assessment Review, only 39% agree that is going to be more effective and that will increase their participation level, but 33% denied that and they think No, peer review assessment is not going to help, while 28% of them stay neutral.

Table 4.5.1 Students Participation Level in Project Based Learning Teaching Approach

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	1	5.6	5.6	5.6
Disagree	5	27.8	27.8	33.3
Neutral	5	27.8	27.8	61.1
Agree	7	38.9	38.9	100.0
Total	18	100.0	100.0	

4.6. Teachers Burden and Overload Reduction

Survey also is distributed among the four teachers from the department of the Management Information Systems, and when they asked, to which extend the idea of Peer Review Assessment will help to decrease the load and overburden duties on you? Only 25% of them said yes it will help, 25% of them said No it will not, and 50% of them staid neutral.

Table 4.6.1 Teacher Overburden in Project Based Learning Teaching Approach

	Frequenc y	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	1	25.0	25.0	25.0
Valid Disagree	1	25.0	25.0	50.0
Neutral	2	50.0	50.0	100.0
Total	4	100.0	100.0	

CHAPTER FIVE - CONCLUSION AND RECOMMENDATION

5.1 Overview

Due to some limitation factors likes time and scope of the study and the proposal which is been produced and agreed to from the faculty committee, so some of the works need to be handled latter,

5.2 Participants comments and observation

After implementing the proposed solution which is project based learning approach, we expect that; the potential benefits gained from the lectures will include:

- 1) Better Student Participation in the class room
- 2) More Student Satisfaction.
- 3) Instructor Over Burden Reduction.
- 4) Better understanding for the lecture.
- 5) And better teacher's students' communication.

Teachers think it's better for those students to study through projects and real cases, but students prefer what is easier for them and most of the time they focus on marks and grades which they are going to get at the end of the semester.

Researcher come out with different recommendations which are:

5.3 Rubric for the assessment:

Before the assessment, teachers supposed to be sure that the rubric has been clarified, because rubric will tell the students what and how to assess. Also this rubric supposed to be included in the system as a main approach for the assessment.

5.3.1 Teacher's to Students continuous and close support: researcher noticed that most of the students lack self-confidence and they think the handling of real problems in real context is something very advance and its above to their capabilities, so teachers or instructors need to pay close attention and gives clear instruction to the students and should let them feel safe and confident.

5.3.2 Management to Teachers Support: also the management need to provide continuous support, like 1) training for the staff to enrich their knowledge about the new method of teaching and handling a good relation with the students, 2) rewards and any kind of motivation which is very important to keep the teachers happy and appreciated, and this kind of reward it could be an appreciation letter, and also because implementing project based approach need good knowledge about the framework and the assessment, and this need time,

effort, and money, and without the support of the management this couldn't be done.

5.3.4 Selecting the team members: also teachers should be very careful when selecting the team members in terms of harmony and student's quality and commitments.

This study contributes to the field body of knowledge by emphasizing more on the importance of combining between Project Management Gantt Chart tool as a technical model to control the follow up of the task and assignments schedule, with the Peer Assessment Model as a psychological model to increase the level of ownership among the students and increasing their participation level.

Developing a prototype to demonstrate how the assessment model is going to work, is consider the technical part of the thesis, which it gives the light for the programmer to take the work furthermore and develop a complete running system to reduce the headache among teachers.

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Appendix

Source Code of the Prototype

```
Private Sub Form_Load()
```

```
Me.ProjectName = Null
```

```
' Me.[SubFormRting].Form.RecordSource = "select * from RatingQ where  
projectID=" & Me.ProjectName.Value 'rs2
```

```
Me.SubFormRting.Form.Requery
```

```
End Sub
```

```
Private Sub ProjectName_AfterUpdate()
```

```
Me.StartDate.Value = Null
```

Me.EndDate.Value = Null

Me.SubFormRting.Requery

Dim db As DAO.Database

Dim rs As DAO.Recordset

Set rs = CurrentDb.OpenRecordset("select * from project")

rs.FindFirst ("ProjectID=" & Me.ProjectName.Value)

If rs.NoMatch Then

Exit Sub

Else

rs.MoveFirst

Me.StartDate .SetFocus()

Dim ss As String

ss = rs![StartDate]

Me.StartDate.Value = rs![StartDate]

Me.EndDate.Value = rs![EndDate]

Dim rs2 As Recordset

Set rs2 = CurrentDb.OpenRecordset("select * from RatingQ where projectID=" & Me.ProjectName.Value)

rs2.FindFirst ("ProjectID=" & Me.ProjectName.Value)

If rs2.NoMatch Then

Exit Sub

Else

,

Dim mySQL As String

'mySQL = "SELECT * from tblEmpPhone where mid(txtphone,4,3)='444'"

'Me!frmEmpPhone.Form.RecordSource = mySQL

'Me.frmEmpPhone.Requer*/

'Forms !BusinessTablesearchsubform.RecordSource =

"BusinessTableQueryA"

```
Me.[SubFormRting].Form.RecordSource = "select * from RatingQ where  
projectID=" & Me.ProjectName.Value 'rs2
```

```
Me.SubFormRting.Form.Requery
```

```
End If
```

```
'SubFormRting.records
```

```
End If
```

```
End Sub
```

```
Private Sub Form_Load()
```

```
Me.Command0.Visible = Me.OpenArgs = 2
```

```
Me.Command1.Visible = Me.OpenArgs = 1 'student
```

```
Me.Command2.Visible = Me.OpenArgs = 2
```

```
If Me.OpenArgs = 1 Then
```

```
Me.Caption = "student"
```

```
Else
```

```
Me.Caption = "teatcher"
```

```
End If
```

```
Private Sub Command0_Click()
```

```
DoCmd.OpenForm "form1", acNormal, , , acDialog, 1
```

End Sub

Private Sub Command1_Click()

DoCmd.OpenForm "form1", acNormal, , , , acDialog, 2

End Sub

Private Sub Report_Load()

DoCmd.Maximize

End Sub

SQL Query Statement

```
SELECT Task.TaskID, Task.ProjectID, Task.TaskName, Rating.RatingID,  
Rating.RatingDate, Rating.UserID, Rating.RatingValue
```



```
FROM Task LEFT JOIN Rating ON Task.TaskID = Rating.TaskID;
```

RESEARCH QUESTIONNAIRE

Project Based Learning

(investigating STUDENTS perception and satisfaction)

Pretest

This analysis is meant for a research work on the level of perception and satisfaction of Project Based Learning Approach for the Third year students in the depart of Management Information Systems at Ahfad University for Women. This analysis is exclusively for research purposes. Please provide the needed information and respond to the questions by ticking your choice.

Note that this evaluation is subjective in nature and there is no “right” or “wrong” answer. Your Corporation is highly appreciated.

SECTION A: BIO-DATA

Respondent Status: Staff () Student ()

Academic Level: Undergraduate () PGD () Master () Ph.D. ()

Others.....

SECTION B: Respondents Perception and Satisfaction level of Project Based Learning Approach.

(Project Based Learning is a teaching method in which students gain knowledge and skills by working for an extended period of time to investigate and respond to an engaging and complex question, problem, or challenge.)

In this section, all items are measured on the following scale: 1=Strongly Disagree, 2=Disagree, 3= Neither agree nor disagree (Neutral), 4=Agree, 5=Strongly Agree.

S/N	Criteria	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree.
1	Overall, are you satisfied with the teaching approach(Lecture & Lap)					
2	Traditional Teaching Approach allow you to engage with					

	groups and work within teams					
3	Traditional Teaching Approach allow you to create a tangible product.					
4	Traditional Teaching Approach allow you to search independently for solutions?					

RESEARCH QUESTIONNAIRE

Project Based Learning

(investigating STUDENTS perception and satisfaction)

Posttest

This analysis is meant for a research work on the level of perception and satisfaction of Project Based Learning Approach for the Third year students in the depart of Management Information Systems at Ahfad University for Women. This analysis is exclusively for research purposes. Please provide the needed information and respond to the questions by ticking your choice.

Note that this evaluation is subjective in nature and there is no “right” or “wrong” answer. Your Corporation is highly appreciated.

SECTION A: BIO-DATA

Respondent Status: Staff () Student ()

Academic Level: Undergraduate () PGD () Master () Ph.D. ()

Others.....

SECTION B: Respondents Perception and Satisfaction level of Project Based Learning Approach.

(Project Based Learning is a teaching method in which students gain knowledge and skills by working for an extended period of time to investigate and respond to an engaging and complex question, problem, or challenge.)

In this section, all items are measured on the following scale: 1=Strongly Disagree, 2=Disagree, 3= Neither agree nor disagree (Neutral), 4=Agree, 5=Strongly Agree.

S/N	Criteria	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree.
1	Overall, are you satisfied with the teaching approach(Project Based Learning Approach)					
2	Project Based Learning Approach allow you to engage					

	with groups and work within teams					
3	Project Based Learning Approach allow you to create a tangible product.					
4	Project Based Learning Approach allow you to search independently for solutions?					
5	Compared to traditional evaluation, Techno-Psychological evaluation model will increase student's participation.					

6	<p>Compared to traditional evaluation, Techno-Psychological evaluation model will decrease teacher overloading.</p>					
7	<p>Compared to traditional evaluation model, Techno-Psychological evaluation model will increase student's satisfaction.</p>					