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Improving Computing Graduates Writing Skill using Constructivism based Blended Learning Model– An Action Research Study

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Abstract: *Recognizing that technical report writing is an important employability skill, an action research study was embarked to examine the efforts of implementing writing interventions through constructivist based blended learning model to improve computing graduates writing skills. The research was implemented in 142 term for computing graduates of Prince Sultan University, Saudi Arabia. Data was collected through students' interviews and from Moodle Turnitin, Workshop, Forum and Wiki to analyse the benefits that the students perceived from each intervention to improve their writing for computing discipline. Encouraging results from this research suggest new avenues that the computing instructors can practise in their teaching learning process to help students improve their writing skills. In addition, students' confidence level increased and the approach encouraged a positive attitude towards writing.*

Keywords: *Constructivist Theory, Blended Learning, Moodle, Writing Activities, Computer science courses, Action Research*

I. Introduction

Conventionally and even today, the success of the software project is determined by good software documentation and user's guide [1]. In accordance to this, Tom Nurkkla et al in his study has pointed out that external software documents is crucial for the program's ongoing development, support and utilization, and professional computer scientists are regularly called upon to write technical documents [2]. Therein, employers of software engineer expect the entry level computing graduates to exhibit competency not only in problem solving and critical thinking skills but also in technical report writing skills [3]. With regard to this expectation, the computing graduates are required to practice writing effectively to succeed in their professional career. Colleges and universities across the globe are increasingly aware that students at senior level face the problem of communicating their ideas effectively in writing. Furthermore, national professional accrediting bodies such as ABET have also emphasized the importance of integrating the teaching of effective written communication into computer courses [4, 5]. Yet fulfilling these standards does become very challenging for individual teachers, programs, and institutions, taking into account the technical nature of the discipline. However, it is essential that this problem be addressed to make the student more employable as well to gain professional credibility in workplace.

Research Literatures in this direction swayed me in the power of writing skills, in its potential as a valuable asset for computing graduates to quickly advance in their chosen career. Realizing my responsibility as an educator of computer science to help the computing graduates develop writing skills, I recognized that the best way to improve writing skill is through continuous practice. Also I presume with my 15+ years of teaching experience in computer science field that technology is a powerful tool for helping students to enhance their writing skills. However, I was topsy-turvy of how could I blend technology to provide extensive writing activities that will encourage and help students develop their writing skills. This moved me to execute an action research in this stance to help me align my teaching practice with my values on technology and design instructional plan that will create a learning context for my students to improve their competence in writing.

Moving towards implementing the action research led me to read the literatures critically and adopt a model well defined by Nunan to serve the purposes of the current research [6]. I carried out this research in the term 142 for an elective course, Building Ecommerce Systems. The key reason for administering this research in this course was twofold: firstly, the prime learning outcome of this course "Design and Develop eCommerce System" was in line with this research outcome and secondly the course is offered at senior level. Additionally, all students entering this course had already obtained at least 8 credits in English and had taken software engineering course as prerequisite. Relying that these students' prior knowledge will enable the students to construct the knowledge required to improve their technical writing skills, if provided with suitable learning context. The action research project was conducted for this course with time target of 6 weeks for the main intervention stage. The anticipated outcome of the research is envisaged to help computer science educators

design instructional plan integrating "write to learn" activities and facilitate their students to improve writing skills progressively through the course of study.

II. Reflection on practice

First and Foremost, I ventured in the process of identifying the key issues in my current pedagogical practice that did not provide a learning context for students to improve their writing skill. This includes the following,

a. Course assignments were created emphasizing programming applications to determine students' understanding of concepts or content being taught
b. Grade and return model of assessment activities in which the students were not given opportunities for revision with authentic feedback.
c. Assessment grading criteria with more weightage for technical correctness rather than for content consistency
d. Lack of effort in motivating students to engage in writing out-of-class work
e. Lack of effort to utilize students' prior knowledge and experience to improve their writing skills

I attempt to be mindful of these issues in my current practice and provide a learning context that will facilitate the students to enrich their writing skills. In this regard, I did extensive literature review and determined that numerous pedagogical approaches which takes the advantage of learning theory and information technology to tackle the writing problems associated with computing graduates are proposed [7-11]. However, there are very few evidence-based experiences, and the difficulties in creating meaningful-learning contexts that provide computing graduates opportunity to improve their writing skills through different types of technical writing still remain to be researched.

In this context, I endeavour to practice blended learning which is becoming more pervasive in higher education as the most prominent delivery mechanism [12]. Many researchers reinforced that blended learning has improved students' writing skill and the students have shown positive attitude towards the implementation of such blend [13-15]. Cameron, added that blended learning allows students to read their peers' writing, and learn how to use correct modes of writing. Particularly, provides comfortable environment to share their thoughts when required without any time constraints [16]. Thus I deemed that blended learning is the only solution to motivate and engage students in writing out-of class work.

Nonetheless, Nichols argues that blended learning will not provide the desired effects, if it does not rely on learning theory and pedagogical principles [17]. Oliver et al concurred that blended learning focuses on educator for creating the knowledge, rather than on the student [18]. Alex Koohang et al suggests to circumvent this problem by applying constructivism theory, which present students with opportunities to construct new knowledge based on their prior knowledge and previous authentic experience [19]. Therein I determined to adopt constructivism theory with blended learning model to help student connect their prior knowledge and improve student writing competency through interactive and collaborative environment.

Lots of studies revealed that the correct choice of information communication technology (ICT) support tools determines the successful implementation of constructivism based blended learning model. Because ICT tools play a crucial role in creating interactive and collaborative environment and in increasing student involvement for knowledge construction [20-23]. My experience with Moodle (Modular object-oriented dynamic learning environment) has been highly positive and reinforces my view that Moodle can offer set of ICT tools for creating a learning context with interesting and motivating activities that can engage students either individually or in groups to improve their writing [24,25]. John et al has examined the effectiveness of constructivism based blended learning model using Moodle and have endorsed it as a strategy to help create a more integrated approach for both instructors and learners [22]. Siirak concurs that social constructivism based blended learning when embedded in the instructional design process and integrated with Moodle provides effective teaching and efficient solution for learning in occupational health and safety discipline [26]. Based on these inferences, I came to the conclusion that designing "write to learn" activities in Moodle based on constructivist theory could help my student construct knowledge at the same time improve their writings. Furthermore, I resolved that, though, some efforts has been made in literatures to address the issues in using Moodle with constructivism based blended model, its effectiveness for improving students writing skill still remain to be investigated. Therein, I decided to make an attempt to gain practical insights in measuring its effectiveness by executing an action research with two main goals,

a. Design instructional plan to support constructivism based blended learning model and create "write to learn" activities that will facilitate students to learn new concepts linking their prior knowledge
b. Determine the best ICT support tool in Moodle to implement constructivism based blended model and measure its effectiveness in improving students writing skill

The study findings will be useful in raising the awareness among faculty members about the benefits of constructivism based blended learning model and its effectiveness in enriching students subject knowledge as well in improving their writing in discipline

III. Planning the Intervention

Consistent with my aim of improving the writing skills of computing graduates, I decided to prepare a plan of action employing constructivism based blended learning model and create "write to learn" activities that connects the new concepts with students' prior knowledge to improve their writing competency. The plan was centered to design writing component for the computer science course, "Building Ecommerce Systems" with three main objectives to achieve the research goals. The first objective is to create a learning context that can help student become comfortable to express their ideas in writing. The second objective is to integrate extensive writing assignments into instructional design. The third objective is to expose students to a variety of types of technical writing appropriate to the computer science discipline. Keeping these objectives and time constraints to complete the course content in mind, I decided to maintain the same number of assessment components but emphasize technical writing as briefed in the subsection below,

A. Programming Assignment: In this assignments, writing component was stressed with grading weightage of 50% for technical report briefing the software's purpose, design decisions made by the student, the efficiency of an algorithm being used in the software. This type of requirement can be useful because it provides practice in written communication and does so in a professional context.

B. Class Participation Assessment: This assessment component was replaced with Technical proposal assignments which describes a real world problem scenario based on the assigned reading or delivered lecture concepts and questions the students to identify an appropriate technical solution. Here writing component was stressed by requiring the students to submit an abstract with 100-150 words that proposes a technical solution with valid justification. This type of assignments are expected to stimulate independent thought about course topics and express the same in writing.

C. Peer Assessment Assignment: Since code walkthrough is commonly practiced method in Industry to evaluate the program code critically, each student was given opportunity to peer assess the programming assignment draft submitted by other students. Here, writing component was enacted by requiring the students to submit the key recommendations for revision after reviewing the programming assignment draft of another student. This type of assignment provides opportunities to develop their ability in giving constructive feedback as well receive advice feedback from broader audience to improve their programming skills as well to learn from others mistake and improve the quality of their writing.

D. Course Project Work: Here, Writing was incorporated by requiring the students to submit three report namely, Requirement Specification, and Design Specification document, and user manual as a documentation of the project. This type of report expose the students to different types of writing skills that are expected from them in workplace and helps the student to raise the bar for Industry expectations

While preparing these assignments, I was reminded of Kurt Rowley arguments that choice of right blend of technology plays a significant role in obtaining optimal results in blended learning environment [23]. Smith et al concurs that the focus of mixing instructional technologies to meet learning needs in blended environment and the key to the human uses of educational technology resides in the intelligent mix of activities and use of appropriate technologies [27]. Eventually after extensive literature study, I learnt almost no other better modules in Moodle than Forum, Turnitin, Wiki and Workshop can provide comfortable environment to promote students' participation. Nevertheless, I shared my findings with peer reviewer assigned for this course as well launched student group meeting to share their views. The peer reviewer feedback along with students' remarks helped me to validate my findings. Having high regard for my colleague and students' view, I decided to create the above mentioned assignments on Moodle Turnitin, Moodle Forum, Moodle Workshop and Moodle Wiki respectively.

The writing activities planned above for investigating the effectiveness of adopting constructivism based blended learning model are expected to improve the students' technical writing competency as well promote their social and individual performance. Also, they are presumed to make the class more attractive, and enhance the students' motivation and creativity

IV. Implementation

The action research project took place in term 142 during the academic year 2104-15 to implement the assignments designed for the course under study utilizing the features of Moodle. Moodle served as a repository for course content. All information regarding the organization and operation of the class resided in Moodle. The Moodle course site was divided into weekly sessions and the content (assignments and supplementary materials)

were organized under each sessions. Particularly, the course calendar that includes the deadlines for all assignments and project phases were made available in Moodle.

At the start of the term, a comprehensive introductory session was held, at the beginning of the semester. The session objective was twofold: first, to brief the significance of writing to succeed in professional career and explain how the course of study will help to improve their writing skills. Second, to make the transition to writing in computer science less traumatic, sample assignments, rubrics and grading criteria were demonstrated clearly.

According to devised plan, three assignments and the course project were created in Moodle and were opened for students as per course schedule. The following subsections discusses briefly the successful implementation of these assignments.

A. **Programming assignment**: It was created in Moodle Turnitin and grading criteria for internal and external documentation were emphasized. It was opened during the first week and the students were given two weeks to work on it. Most of my students requested a chance to revise their submission based on the originality report generated by Turnitin. Accordingly, the submission deadline was extended for one more week as well they were give permission to view their originality report before doing their final submission.
B. **Technical Proposal Assignments**: This was conducted using discussion forums and the students were prompted to write on three topics namely, real world applicability of a concept described in the class, relationship between different lecture topics discussed in the course content and any software technologies released in last three years to support building ecommerce system. These three forum were introduced one by one over 8 weeks to encourage the student focus on one topic at a time. Students were assigned to write a posting of a given word count (generally between 100 and 150 words) and to give a substantial response to other students' postings. Each forum was left open as another was introduced, to allow students to add more content.
C. **Code Walkthrough Assignment:** The workshop ICT tool in Moodle was utilized to create this assignment by specifying criteria for peer assessment, deadlines for submitting first draft of programming assignment, review feedback and the final draft. The scoring rubrics were prepared to urge the student reviewer point out the positive and negative aspects as well provide insightful and sophisticated comments for improvement.
D. **Course project:** Here, the students were asked to form a group of three members. The groups were given freehand to identify a real-world problem for which they can propose computerised solution in 12 weeks through course project. Bearing the project activity in mind, the Wiki space was created in Moodle with two levels: a public level to hold all common information such as detailed format for each project phase report, rubrics for project evaluation and Wiki guides; and a private level, to record their works, to develop outlines and to create the final product. After the submission deadline, editing capabilities of private level were turned off and then private level were made public so that all students can see each other's work.

V. Findings And Reflection

During this study, as per the assigned peer reviewer suggestion, the students were asked to reflect on the impact of the planned intervention in improving their writing skills. Also, the student submission papers from Moodle Forum, Moodle Wiki, Moodle Workshop and Moodle Turnitin were collected and analyzed. Based on student feedback and analysis results, I was able to make several assertions and ensure that the objectives of this study are achieved. This section summarizes the findings and associated implications for improving writing skills of computing graduates in a constructivism based blended learning environment.

A. **Programming Assignment:** The result of this activity revealed that the programming assignment was well created not only to provide an opportunity to improve the student writing skills but also to provide support to understand the role of software engineering in programming task. The students were satisfied in their efforts to acquire skills associated with analyzing the problem, designing algorithms before coding, comparing and contrasting possible solutions and reflecting on solution process. More importantly, the assignment contents indicated that the submission through Turnitin has assisted the students to self-assess their submission and improve their writing as well their referencing skills. Students also welcomed the introduction of Turnitin for assignment submission stating that it has paved way to build their confidence and competence in writing by making plagiarism harder. This finding supports the assertion of Smith et al that "Turnitin as a formative instructional tool to teach academic integrity through exercises devised for each subject and support student's progress in building confidence and competencies" [28]. This activity can be further refined to motivate the students to reduce plagiarism by offering prizes for top two original papers.
B. **Technical Proposal Assignments:** To accomplish this activity, the students were informed to use Moodle forum and discuss the various possible solutions for the given problem scenario. Looking the results from the point of view of constructivist theory, it was observed that the discussion threads have provided a

context for students to improve their ability by relating new information learned in classroom with their previous knowledge and apply it in new and concrete situations to solve a problem. The results also displayed that the students' were comfort in expressing their ideas in Forum than in the classroom. The students also concurred with the findings that this activity provided an interactive learning context to better understand the subject matter and construct knowledge along the way by reading each other's postings and revisiting each other's ideas. Also they expressed that it has laid the first stone to improve their argumentative writing skills. This is similar to the findings in previous studies [29, 30]. However, the degree of success of this activity depends on the assignment question which should promote the students to extend their discussion outside the classroom to solve problem at the same time prevent lack of interest in the discussion topic.

C. **Code Walkthrough Assignment:** The main findings of this activity indicates that it was executed with appropriate ICT tool as it supported in promoting students' cognitive skills and evaluative capacities. As a result, the finding advocated the constructivist theory by involving students to reflect on gaps in their understanding, noticing the aspects in which to improve from peers' feedback and then making them more resourceful by constructing the required knowledge. Student agreed that code walkthrough has helped to broaden their awareness by showing different ways to solve the given problem. Also they highlighted that this activity has increased their involvement not only in understanding the logic behind the code but also has provided an opportunity to add their critical review commentary on writing. The results were in line with the Ru-Chu Shih's findings that the blended learning provides effective environment for peer assessment [31]. One major difficulty faced during this activity is convincing the students for biased marking. Though the activity was initiated after discussing clearly the grading criteria and rubrics for marking, some student faced difficulty in completing this task successfully. This can be addressed by incorporating practice sessions to familiarise students with the process of assessment.

D. **Course Project**: Findings demonstrated the high level satisfaction of students with the use of wiki which act as facilitator for group member collaboration and participation, both in-class and out-of-class, and benefited to complete the project successfully. This was reflected by their interactive postings and informal social talks. It is apparent from data analysis that there was a very high level of collaborative behaviour within the group with equal contribution from all group members. Students concurred by saying that wiki provided a great way to accomplish the group project collaboratively but at their own time without having to schedule face-to-face group meetings. Few students reported that the wiki was easy to work collaboratively and were able to write freely. Few students mentioned that the use of wiki enabled them to develop critical thinking skills while expressing their ideas and sharing knowledge. The student response and finding supported Mohammed Rejual Karim notes that Wikis can be used to support collaborative and cooperative learning in agreement with the constructivist principles [32]. Regarding the quality of wiki content, it was observed that wiki environment has facilitated the students to prepare the documentation better than those in the face-to-face collaborative group. Students also accepted and expressed that wiki is a valuable tool to improve summary writing skills. This may be because students realized that their written work is reviewed and corrected by their group members.

Past studies reporting writing competency and self-efficacy outcomes in all level of student learners are extensive in literature. This pilot study, however is the first research of its kind in investigating the effectiveness of constructivist based blended learning model to improve students writing competency by integrating "write to learn" activities within course assignments. The above discussions support the objectives of this research that the students' writing competency improves if quality assignments are designed utilizing the potential of constructivism based blended learning model integrating weekly "write to learn" activities throughout the semester.

VI. Conclusion

Recognizing that writing skills is essential for success of computing graduates in their workplace, I sought to investigate through action research how effectively writing practices can be integrated into course assignments to improve student writing competency. Based on the outcome of this action research, it is argued that it is possible by applying constructivist theory in blended learning environment and creating variety of assignments in Moodle. Although many students grumbled in the beginning, later all students remarked that they feel confident of their writing skills and in turn feel they are prepared for industry expectations. Also the study has indicated that students were content with the potentialities of Moodle for the affordance provided. From my perspective, this study clearly spotlights that this approach has had lasting impact on improving student writing skills progressively through continuous practice of different types of technical writing assignments that will be expected in their workplace. The results indicate that the key success of this approach depends on how "write to learn" assignments fit the goals of the course, how rubrics make writing expectations

clear, and keep grading consistent and simple.

The conclusions I drew and key points that I learnt from this study are as follows:

- Quality of the Assignments, Rubrics and Grading Criteria plays crucial role in the success of adopting constructivism based blended learning to improve the students writing skills
- Moodle can be effectively used to implement "write-to-learn" assignments with high level of students involvement
- Motivation is key to encouraging constructivism based blended learning;
- Students enjoyed using Moodle with Constructivism based blended learning more than traditional approaches.

This study not only has provided great way to improve writing skills of computing graduates, it has showed how the power of constructivism based blended learning model can be used to improve the students' technical writing irrespective of their discipline. I hope this study will serve as a wakeup call to all computer science educator community to adopt Moodle with Constructivism based blended learning model to design course assignments with key objective to improve the students writing competency and help them succeed in their chosen career. For future research, I will attempt to investigate the effectiveness of constructivism based blended approach for improving computing graduates teamwork skills.

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