Study on Blended Instruction in Automotive Technology for Secondary Education Students

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Abstract- Blended learning is increasingly being used within K-12 environments to deliver instruction. Some research suggests digital natives are efficient multitaskers who work collaboratively. For this study, blended online learning was used within a face-to-face automotive technology course that was offered as content enhancement for high school students and it also served as a “warming up period” for students becoming familiar with online technologies.

CDX Automotive: The Leading Online Interactive Automotive Training Program was primarily used as an online interactive resource to assist students to develop technical understanding and psychomotor skills that are concrete and visual, rather than abstract and descriptive.

This blended learning approach provided students greater learning flexibility in understanding automotive technology, as well as providing the opportunity to acquire online skills. This paper will report student strengths and weaknesses in using CDX Online Automotive as an interactive resource.

Furthermore, this paper will assess personal knowledge of online learning by measuring confidence levels using pre/post student survey and instructor field observation. Preliminary analysis of data and field notes indicates student confidence has increased in understanding both automotive and eLearning technologies.

Keywords- blended learning, interactivity, psychomotor, visualization

I. INTRODUCTION

In 2020, when Baby Boomers have retired from the workplace, the United States will face an urgent need for more automotive technicians and industry related personnel. Automotive technology has vastly changed; as a result, new technicians will require a higher understanding of science and supporting technologies. With today’s focus on “green” energy and new alternate fuels, course content materials must be accessible and current to support these new technologies. Today’s automotive technician requires web research skills to obtain updated textual and visual information needed in troubleshooting and repairing automotive technical problems.

Students entering into trade or traditional colleges will be expected to have many of these basic computer and online skills to be successful, yet many are neither technologically fluent nor information literate. Digital skills that students ought to possess should be identified to prepare students for university-level work [1]. Many of these online skills have been identified and integrated into this unit of instruction.

This study began with the instructor brainstorming ways to develop a new unit of
automotive technology instruction that included strategies to help students develop eLearning skills and at the same time acquire basic knowledge of automotive technology systems and psychomotor skills. Whilst this study focuses on learning automotive technology within a blended learning environment, it may be useful in parallel content areas that mirror similar frameworks.

This curriculum-based assessment study takes place in a small rural public Hawaii high school within a geographic area that contains a widely diverse population with an overall socioeconomic status below state averages. Twenty nine percent of families with children in this school are living in poverty [2] and the majority of students in this study do not have internet access at home. This statistic begs the question whether to make a general assumption that all students are digital natives.

Student pre/post test and instructor field notes are discussed to evaluate this curriculum-based assessment study.

II. REVIEW OF RELEVANT LITERATURE

A. Blended Learning

In the report, K–12 Online Learning: A 2008 Follow-up of the Survey of the U.S. School District Administrators by Sloan-C, it concludes blended instruction is a better option for districts with concerns of quality, student readiness, and staff development related to online education; moreover, the report estimates that in the next five years multiple types of blended models will emerge which makes the case that any future research on online learning environments needs to differentiate between the diverse instructional models such as fully online and blended learning.

Furthermore, data suggests the enthusiasm for the future of online learning as expressed by Christensen, Horn, and Johnson will likely come to pass only with the proliferation of blended learning models where online instruction not only meets individual student needs, but where there is also a “flesh and bones” teacher available to assist and guide students in their studies, according to the report.

A meta-analysis of studies comparing face-to-face classrooms to distance classrooms has found student performance and quality of instruction equally well and some distance courses outperformed their classroom counterparts [3]. Surprisingly, these outcomes are found consistent over many studies across many disciplines that include nursing, engineering, technology, and virtual laboratories. Development in communication technology and innovative methods of delivery of instruction at a distance has challenged the idea that laboratory courses can only be delivered in a face-to-face laboratory setting [4].

B. Interactivity

In Rod Sims article, Interactivity: a Forgotten Art?, he argues multimedia in itself is not inherently interactive, unless the value in an instructional resource is a function of the design effort, not the technology. Interactivity of multimedia becomes important only when level of interaction is adequate or relevant to facilitate the acquisition of knowledge or the development of new skills and understanding. Thus, educational products will likely require more complex forms of Interactivity depending on strategy and application. [5]

In the paper, Online Learning: Social Interaction and the Creation of a Sense of Community [6], three protocols are suggested that can be embedded into the framework of online courses in order to create a sense of community and for a productive social interaction to occur. They are: (1) the greater use of synchronous communication facilities (in addition to, rather than instead of, asynchronous ones); (2) the deliberate design and inclusion of a “forming” stage, or
“warm-up” period, incorporated as an essential component into the course structure; and (3) a much greater emphasis on the provision of (and adherence to) guidelines for successful online communication. Bender and Vredevoogd put forth the concept that, by creating an online sense of “self” the members of an online course can alleviate feelings of isolation and create an online community that assists the learning process [7].

Despite the need for technology integration in today’s classrooms, many lack technology based teaching methods and curricula. Teachers with more traditional educational beliefs and practices must be willing to change in order to face complicated barriers for technology integration. “In order to integrate technology into the curricula as the high–tech teachers have done, the very nature of their practices would have to change” [8].

In Wendy Dow’s article, Developing Inclusive Communities of Learners in Technology Education: Practical Craft Skills – Facilitator or Hindrance, she puts forth that classroom activities and assessment methods can be structured in three basic ways: those which encourage an ethos of competitiveness, those which encourage cooperative or collaborative working, and those which encourage the pursuit of individualistic goals [9].

However, Dow argues for structure that supports collaborative environments; they have been found to result in greater gains in academic achievement [10] rather than a competitive ethos which has been found to: undermine effective learning by reducing intrinsic motivation, creativity and risk taking and to have an adverse effect on interpersonal relationships and attitudes towards school [11].

Dow concludes, “The basic foundation of instruction, the underlying context on which all instruction rests is cooperation. . . A cooperative goal structure should dominate the classroom, being used for 60–70% of the time.” [9].

The “Y Generation” or “Millennials,” i.e., the last generation of people born in the twentieth century, between 1981 and 2000, for the most part, has never experienced life without computer. Many are efficient and effective multitaskers whom have known nothing but technology. Most are eager to use technology and question the status quo routinely. Sometimes viewed as needing lots of structure, this group is built on the mentoring model. They thrive and enjoy working when they are part of a team [12]. The target audience for this curriculum-based assessment study is the Y Generation.

As these studies reveal, blending eLearning creates a new type of interactivity which supports collaborative environments and a creation of an online sense of self.

C. Psychomotor

In the 2006, ACTER Presidential Address, it concludes: “Career and Technical Education is the premier educational delivery system in the world. It addresses all learning styles by employing pedagogical strategies that embrace all of the multiple intelligence areas and incorporate the current knowledge in brain-based research.”[13].

Thus, blended instruction fits well in Career and Technical Education instructional environments even though certain content, such as psychomotor skills, may have some reasonable challenges being taught in a solely online course. However, as technology has improved, some approaches to addressing this issue have included the utilization of videotaping/streaming of skills demonstrations, partnerships between four-year teacher education institutions and technical/community colleges, where students take the technical courses locally, along with online simulations. [14]
D. Visualization

“Technological and visual literacy maintain a significant role in successful knowledge and skill development in technology-based career paths. Modeling, visualizing, and presentations reinforce the concepts of communication technology. This strengthens individual technological and scientific knowledge and ability while providing opportunities to firmly grasp the principles behind the technologies [15], as cited by Jeremy V. Ernst and Aaron C. Clark.”

It is of good practice to make use of visualization as a way to communicate scientific/technical content and research to enhance viewers’ abilities to identify and retain important information that is not as easily accessible through traditional mediums [16].

The abilities to problem-solve and think critically can be augmented in technology education curricula through the design and the creation of visualizations, the study reported.

III. STUDY OVERVIEW

This curriculum-based assessment study had two primary objectives: to blend technologies to facilitate an increase in student confidence in automotive technologies and to serve as a “warming up period” for students becoming familiar with online technologies. The instructor provided face-to-face instruction using an LCD projector to present streaming CDX Online interactive automotive training program as a resource.

The instructor paused videos at key points to elaborate further, check student understanding, and allow students to work in collaboration to answer open class discussion questions. The instructor circulated among students and provided one-on-one instruction during student centered work time when students practiced CDX online quizzes. On laboratory days, students were allowed to practice target skills that were covered prior in classroom blended instruction.

IV. METHODOLOGY

This curriculum-based assessment study began in the spring, 2009, with a pilot trial of CDX Plus Online and ended in June, 2009. The automotive technology course began with 10 students between the ages of 15 and 17; approximately 30% students of this study have special education needs.

Students completed a preliminary anonymous 29-question self-assessment pre-test designed to identify: (1) personal knowledge of online learning; (2) strengths and weaknesses in using CDX and (3) each student’s level of confidence in their ability to perform target skills on a scale of 1 to 3: 1=No Confidence, 2=Some Confidence, and 3=Total Confidence.

The primary focus of this pre/post student survey was to assess curriculum, not individual student performance; it was collected and assessed as a group to establish general assumptions as one way to evaluate the interactivity of resources.

This blended study used the workshop model where students collaborate with each other and work on projects together. The survey results were tabulated in each column scale using Microsoft Excel and the results presented in the form of graphs. Each graph (pre and post test) was compared and contrasted to provide numbers to indicate any change in confidence level in described skills.

V. RESULTS

The overall, average student confidence and comfort level increased overall approximately 24% (Figure 1) through the duration of study.

Four notable student responses within the survey questions correlate with cite studies:
I can complete a blended online/face to face course easily, jumped 46% in the confidence.

I can use CDX practice exams to help my understanding jumped 42% in confidence;

I understand CDX color legend: Know-See-Do-Prove 38%

The visuals in CDX will help me better understand automotive technology 27%

Field observations indicated students were absorbed with the streaming videos and instructor interaction with them. Instructor uses of the video player pause function at key points to check for student understanding. It seemed more effective than conventional lecturing where students are expected to be attentive for long intervals with little breaks for collaboration, assimilation, and reflection. However, this instructor lead video method was pragmatic to be effective up to twenty minutes maximum, otherwise, students began to get restless. Student preferred to log on individually to their CDX online course and repeat videos individually if needed.

It has been many years since the instructor of this study reviewed emerging automotive technologies. Yet, with CDX’s extensive industry and education experience, the instructor was able to supplement his prior years of automotive technology experience with CDX’s updates and thus offer the students, as well as himself, the benefit of CDX, a cutting edge automotive technology educational resource.

Moreover, the field observations revealed generally that the students prefer getting content through streaming videos rather than through lecturing. When lecturing, the instructor could barely hold complete class attention more than 10 minutes before a few students began to interrupt the presentations causing the instructor to go into a classroom management mode rather than continuing with the presentation of content. Alternatively, with videos, a one-way communication format, students were not able to provoke and disrupt the instructor in the video by asking off topic questions or by not paying attention. Furthermore, most of the students who participated in this study were visual learners and preferred a visual presentation over audio. As a result, students were more engaged and tend to stay more on task.

The online practice test was found novel by students as a new way to take test, as well as a way to learn. In a way, it became a game for students to see if they could pass it since they could retake the test unlimited times. As a result, the blended learning environment was a successful median for this study.

VI. CONCLUSION AND DISCUSSION

Regardless of the high learning curve that comes with introducing a new curriculum, this study found that students felt confident that they could be successful in a blended online automotive technology course. This finding suggested that a sense of an online self had occurred even though all students had never participated in an online course.

This correlates with cited research, Online Learning: Social Interaction and the Creation of a Sense of Community [6] in such “the deliberate design and inclusion of a “forming” stage, or “warm-up” period, incorporated as an essential component into the course structure.”
Moreover, both automotive technology and online skills were attained in a collaborative learning environment, supporting Murphy and Epperson’s research that students enjoy and thrive when working in a team and that the integration of digital media enhances learning by allowing students to learn at a pace that is comfortable on an individual level.

Furthermore, since many students were not the ‘typical’ digital native due to their financial circumstances, they were none the less successful, thus challenging the digital native myth. With a 46% increase of student confidence in completing “a blended online/face to face course easily,” a general assumption could be made that many students were lacking digital skills prior to the blended instructional unit and yet were successful developing them within a blended environment.

Perhaps the chief factor in student success was that students were engaged. It is not enough to provide technology by itself but to integrate it in such a way that engages students to learn, as this study has revealed.

One significant drawback of this study, like any new curriculum development, is that there are a number of small problems or irregularities to work out. Moreover, to draw broad conclusions on a limited number of students who participated is premature. Future studies may offer a variety of assessments to address possible literacy differentiations and other learning style considerations. To do a fair assessment of this blended instructional unit would require starting from the beginning of the year and fully integrating all of the CDX features and laboratory practice. [17]

If a researched based study of this instructional design were considered, a lab performance assessment could be included as an additional way to evaluate the effect of the overall instruction. Moreover, using web survey services, a revised study could offer a multitude of options to analyze the data as well as the inclusion of an area for students to add comments. Student careless markings and lack of concern on paper-based surveys could be avoided, too.

The instructor did find one big challenge where students would go off task and surf the web for fun and games. To curtail this practice, instructor allowed students to surf the web in the last ten minutes of class providing they did their assigned work.

This study concludes that integrating online educational technology within the face-to face classroom enhances the learning experience for the students.

As a result, there is an increase in student motivation and confidence when learning automotive technology skills as well as gaining other abilities, perhaps as a byproduct of the blended instructional design. The increased levels of student confidence found in this study support the research of Epperson and Murphy as well. Based on the results of this study, blended instruction is strongly recommended as a way to enhance student learning for today’s classroom.

Furthermore, by understanding the processes of blending media, teachers with minimal expertise can supplement their lesson plan content by using professionally created media related to their content area and/or creating their own instructional media.

The results of this study support further use of this new and innovative form of instruction.
REFERENCES


[16] Bomphrey, 2006; Payri, Pastor, Garcia, & Pastor, 2007)