FINAL REPORT FOR Fall 2023 ECETDHA MINI-GRANT

DEVELOPMENT OF POST-COVID MICROPROCESSOR LABS MODULES

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Abstract:

This project aims to provide an efficient way to meet the diverse needs of students with different learning styles and educational backgrounds in their hands-on practice. It also encourages student engagement. The ideal outcome is to offer virtual real-time assistance to students through the online learning platform, while also providing quick feedback to instructors. The Brightspace quiz tool is utilized in the project, and students have given more positive feedback after using it.

Project Background:

Hands-on practices are crucial for every engineering technology student as they not only aid in comprehending classroom material but also provide practical applications of theoretical concepts, thereby fostering students' interest in their college education. Interest is a key motivator for student engagement. However, there are some problems found in students' hands-on work:

1. According to student feedback, many need to frequently relearn how to use lab equipment. Sometimes, they forget how to use certain equipment. Within the same group, not every student can use the equipment independently. Some, especially those who transferred from other programs or institutions, need to relearn how to use lab equipment, even senior students.
2. Most lab manuals only cover material related to the new course and do not provide basic information about how to use lab equipment. It is also challenging to include this information in a hard copy every time.
3. Due to the length of the lab manual, some students may not like to read it. As a result, some cannot follow the manual to perform hands-on work, and others skip steps, causing trouble in completing subsequent tasks.
4. When electronic manuals or lab reports are widely used, cheating, such as copying others' work or files, happens frequently.
5. Tutorial schedules cannot meet every student's needs.

This project uses the Brightspace quiz tool to convert the lab manual into online quizzes, providing a potential solution to the above problems.

Project Implementation:
Every lab is organized as an online quiz to guide students in performing hands-on work through both reading and visual instructions. All labs are carefully designed so that each step covers only one small topic or specific hands-on task. Each step is presented as a quiz question, beginning with the process goal followed by detailed instructions, similar to the regular instructions in a hardcopy lab manual. Additional visual aids, such as pictures and hyperlinks, may also be included in the written instructions. A short demonstration video follows the detailed instructions. After students complete the hands-on work for the step by following the instructions or demo video, or both, they must answer a question related to the step before proceeding to the next one. The lab is graded according to the response to the questions. Figure 1 shows one step instruction implemented in the project where the purple text and block show every part in one step.

If some detailed instructions about how to use lab equipment are difficult to cover in the written instructions, they can be easily reviewed through demo videos. Specific information, such as details related to the response question, is more easily located in the written instructions than in the demo videos. Students can use the written instructions, the demo video, or both as a real-time tutor whenever they encounter problems with hands-on work.

Only one step is shown on the screen at a time, and the graded question encourages students to complete the related work carefully. This approach also helps prevent cheating, as instructors can observe that the lab is being completed step by step, making it difficult to copy or use other students' files.

The quiz tool helps students save their progress, allowing them to stop and resume their lab work at any time. It also enables instructors to quickly evaluate student performance, so common problems can be addressed promptly. problems can be addressed promptly.

Project Evaluation:
The proposed method was implemented in the Introduction to Microprocessor Systems lab. These labs focus on program design and using an oscilloscope to troubleshoot hardware and software errors. Many students struggled with the labs for various reasons. A survey, as shown in Figure 2, was conducted after the proposed method was used. According to student feedback, the proposed method helps students in their hands-on work.

The idea of the project was presented at 2024 ASEE annual conference.

Suggestion to the Project Implementation and Future Work:
To maintain student interest, each video was kept short (most are 1 to 2 minutes long) when the project was implemented, which required significant time to edit the demo videos. Typically, the video was recorded for the entire lab and then edited into shorter segments. It is recommended to use a faster computer with more RAM for video editing.

Due to the positive student feedback, this method will be adopted in another class involving more hands-on work with microprocessors, computers, and physical lab equipment. Future work will be supported by D2L’s the Brightspace Innovation Grant in Purdue University.

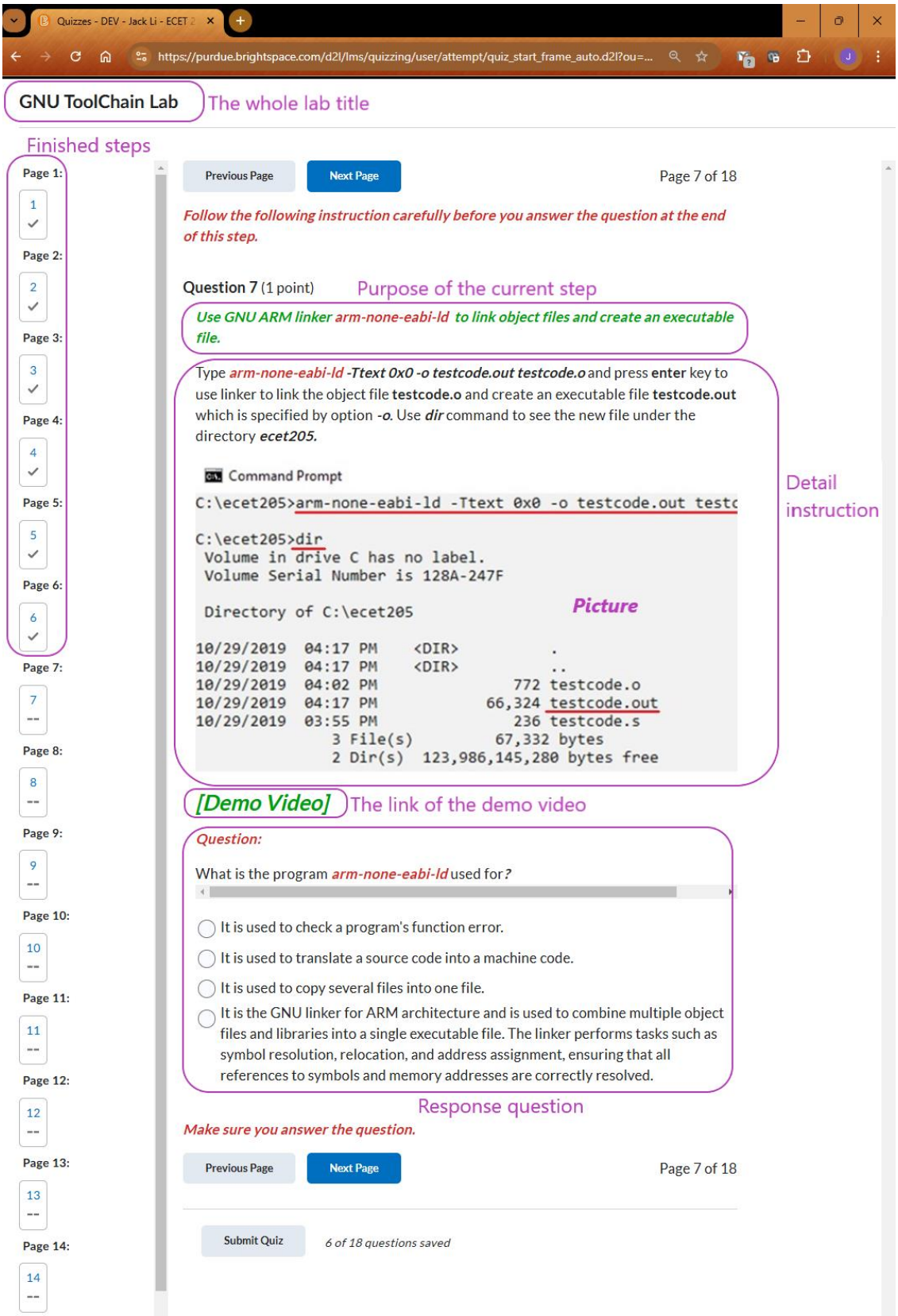

Figure 1 A sample of one step in a quiz format lab manual

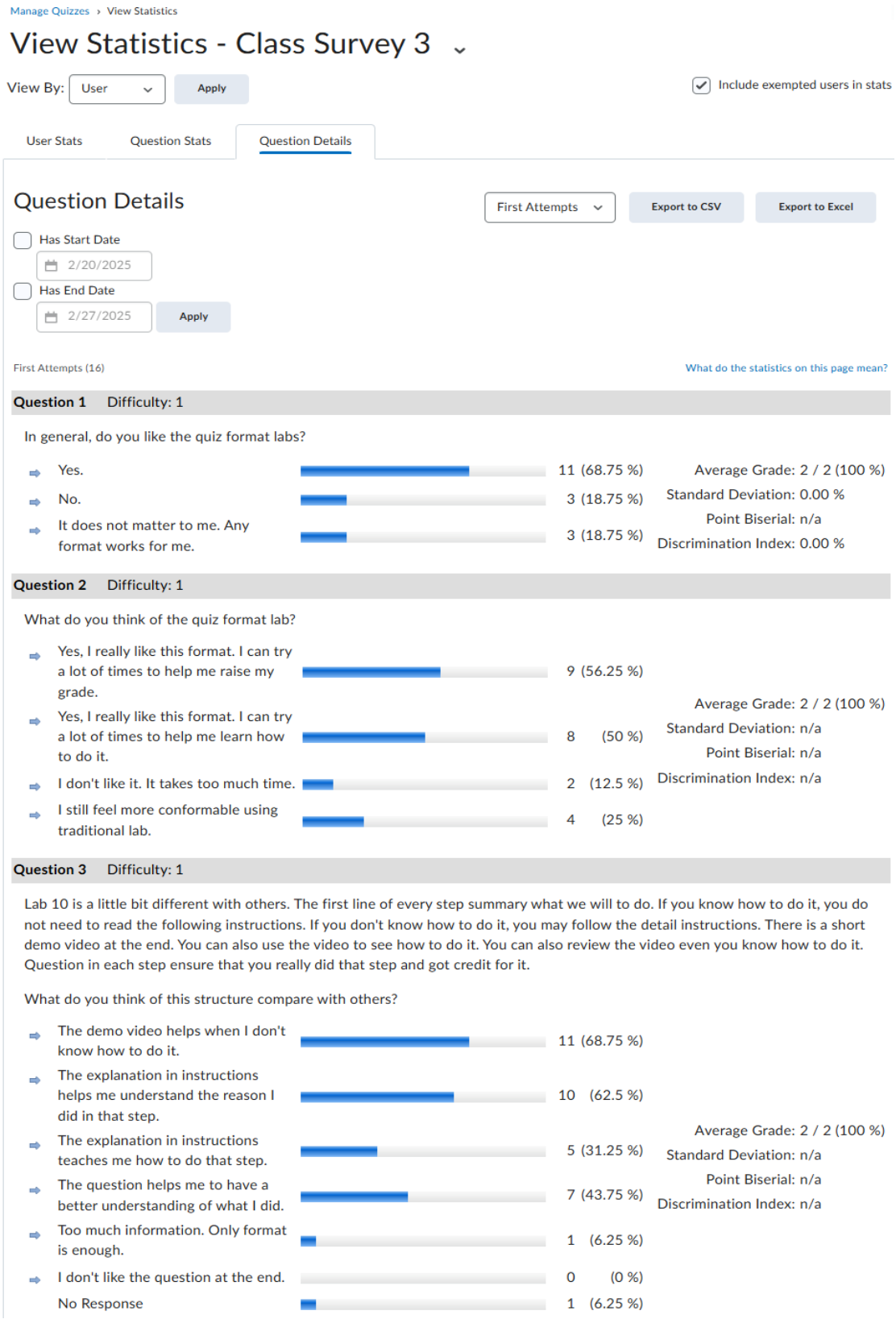

Figure 2 Student survey

Appendix A:

Sample lab packages are included in this report.

Appendix B:

Actual Budget:

Items	Cost	Fund
Pay to the written instruction reviewer and transaction fee	$466.90	ECETDHA MINIGRANT
Print material for reviewer	$250.32	ECETDHA MINIGRANT
Support hardware	$120.10	ECETDHA MINIGRANT
SK-S7G2 microcontroller board		PFW
Video edit software and computer		PFW
USB camera and lab equipment		PFW
	Total	$837.32