Assignment 3:
CS6460: Education Technology

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***Abstract*—This work covers the ongoing research around picking a project for CS6460: Education Technology. Section 1 covers current state of research, new research, as well as synthesis, reflection, and planning. Section 2 covers the practice of writing problem statements.**

1. RESEARCH LOG

1.1. Background

Current status of this work is as follows. Further thought and discussion around the Slack & Canvas integration was done. I opened a dialog with my mentor. Where I pitched the initial idea of integrating Slack & Canvas such that a teach could organize Slack around assignments in Canvas, as well as collect student engagement metrics within Slack that are then shared with Canvas such that participation points could automatically be assigned.

Feedback from my mentor raised some verify good and interesting points. These point include, is this work unique or does it extend existing work? Does this project time estimate approximately sum to 100 hours of work? Finally, what thoughts have been put toward privacy? Specifically The Family Educational Rights and Privacy Act (FERPA). FERPA is a Federal law which attempts to protect student education records. The mentors main concern is around protecting private student information.

Starting with FERPA, I began researching Slack's response to this law, and found Slack and FERPA Compliance (Slack, n.d.). I have yet to get a response from my mentor on this information. For estimate project time, I began looking into how to generate client code to interact with the Canvas code as there is no existing Swift client. To do this, I must convert Canvas's swagger definition version 1.2 to a newer version, only then can I generate the proper Canvas Swift client. This is an example of the work required to get this project done.

Given there isn't existing tooling, I must create it, which is more time. Thus I believe this project meets the project time requirement. As for novel vs extending existing work, I will use a portion of this research log to explore that question.

1.2. Papers

1.2.1 Paper

Rodriguez, J., Piccoli, G., & Bartosiak, M. (n.d.). *Nudging the Classroom: Designing a Socio-Technical Artifact to Reduce Academic Procrastination*. 10.

1.2.1 Found Via

Google Scholar search, "slack application in the classroom" filtered to since 2019

1.2.1 Summary

This work describes a study done around using a Chatbot within Slack to nudge, and encourage students to complete their work. Results are encouraging in 2 forms. One, in the use of the Chatbot by its intended audience. Two, performance improvements which can inform future work.

1.2.1 Take Aways

This is an example of what an integration between Slack & Canvas can unlock. Providing a point-and-click integration between these 2 tools can afford new tools to be build on top of it, empowering and encouraging the students to do their best work.

1.2.2 Paper

Ross, S. M. (2019). Slack It to Me: Complementing LMS With Student-Centric Communications for the Millennial/Post-Millennial Student. *Journal of Marketing Education*, *41*(2), 91–108. https://doi.org/10.1177/0273475319833113

1.2.2 Found Via

Google Scholar search, "slack application in the classroom" filtered to since 2019

1.2.2 Summary

This work begins by assess the creation of engaging student learning experiences afforded by Learning Management Systems (LMS). Then, present and assess Slack as an LMS complement. Results show that student-teacher communication present challenges within LMS's. Results also showed Slack positively enhances students' perceptions of class as well as enhancing the learning outcomes from group work.

1.2.2 Take Aways

Another positive example of how an integration between these 2 systems can lead to greater perceived outcomes for collaborative learning. Interesting this works calls out the use of these tools on Millennial and Post-Millennial students.

1.2.3 Paper

Ross, S. (n.d.). *IMPROVING THE POST-MILLENNIAL STUDENT EXPERIENCE THROUGH STUDENT-CENTERED CONTENT COMMUNICATION*. 19.

1.2.3 Found Via

Google Scholar search, "slack application in the classroom" filtered to since 2019, selecting relating articles.

1.2.3 Summary

This works studies the integration between Canvas, Blackboard, Moodle and Slack. Results showed the integration between LMS's and Slack enhances learning outcomes for group work. In line with previous work

1.2.3 Take Aways

Another publication of work suggesting positive affect of integrating these 2 tools.

1.2.4 Paper

Lamas, D., Loizides, F., Nacke, L., Petrie, H., Winckler, M., & Zaphiris, P. (Eds.). (2019). *Human-Computer Interaction – INTERACT 2019: 17th IFIP TC 13 International Conference, Paphos, Cyprus, September 2–6, 2019, Proceedings, Part II* (Vol. 11747). Springer International Publishing. https://doi.org/10.1007/978-3-030-29384-0

1.2.4 Found Via

Google Scholar search, "slack application in the classroom" filtered to since 2019

1.2.4 Summary

This is a larger piece of work around using Slack as not just a student collaboration hub, but a mechanism for integrating with Virtual Teaching Assistants. This work highlights the rich communication experience with use of multiple-choice messages, and private communication with students.

1.2.4 Take Aways

This is another example of how integrating LMS's and Slack can enhance the student experience. It goes into much detail on a full integration and what that affords. This work should be investigated further

1.2.5 Paper

Mehlhase, A., Heinrichs, R., & Gary, K. A. (n.d.). *Effective Use of Slack and Short Video to Scale Online Learning Communities*. 7.

1.2.5 Found Via

Google Scholar search, "use of Slack technology in classroom", filtered to "Since 2019".

1.2.5 Summary

This work is an experience report of the advantages and disadvantages of using Slack compared to conventional forums for student communications in an online classroom context. This work also discuses the use of weekly notifications and intro videos.

1.2.5 Take Aways

This work showed a positive affect of using Slack as a communication hub in a learning environment. It does also introduce other related changed to online learning which might have been the positive contribution.

1.2.6 Paper

Vrba, T., & Mitchell, K. (2019). Contemporary Classroom Innovation: Exploration. *Journal of Instructional Pedagogies*, *22*. https://eric.ed.gov/?id=EJ1216818

1.2.6 Found Via

Google Scholar search, "use of Slack technology in classroom", filtered to "Since 2019".

1.2.6 Summary

This work highlights the modern students need to use the classroom as a leader to the office. It also discusses the use of innovative technology being iteratively researched and implemented in the classroom.

1.2.6 Take Aways

Highlights the growing research around how technology in the classroom can prepare students for "the real world" in an innovative company.

1.2.7 Paper

Schrameyer, A. R., Graves, T. M., Hua, D. M., & Brandt, N. C. (2016). Online Student Collaboration and FERPA Considerations. *TechTrends*, *60*(6), 540–548. https://doi.org/10.1007/s11528-016-0117-5

1.2.7 Found Via

Google Scholar search, "The Family Educational Rights and Privacy Act & slack". Filtered by "Since 2016"

1.2.7 Summary

This work highlights the change taking place in the classroom in terms of the use of technology, with an attempt to consider the The Family Educational Rights and Privacy Act (FERPA). This work also describes strategies for staying compliant.

1.2.7 Take Aways

After feedback from my mentor, this was needed research. It's a great example of the laws and regulations needed to keep student & teachers data safe. This work will be used in the future of this project.

1.2.8 Paper

Haston, A. (2019). Keeping It off the Record: Student Social Media Monitoring and the Need for Updated Student Records Laws Notes. *Vanderbilt Journal of Entertainment & Technology Law*, *22*(1), 155–180.

1.2.8 Found Via

Google Scholar search for, " FERPA U.S.C. § 1232g; 34 CFR Part 99"

1.2.8 Summary

This work highlights the purpose of FERPA, as well as other State laws put in place to protect 3rd parties from accessing information that in accurately depicts students current emotional state.

1.2.8 Take Aways

This work describe how important it is to keep student data safe and secure. However they use the term "public social media", which I am not sure what they mean, could that be Twitter/Facebook?

1.2.9 Paper

Slack. (n.d.). *Slack for Education*. Slack Help Center. Retrieved May 30, 2020,

from https://slack.com/intl/en-ca/help/articles/206646877-Slack-for-Education

1.2.9 Found Via

Google search for, "is slack FERPA compliant"

1.2.9 Summary

This is an article published by Slack themselves describing discounts, and process for using Slack as an educational tool. It describes a process for which institutions can apply to get discounts

1.2.9 Take Aways

This article highlight the versatility of Slack as a communication tool. With the specific focus on the education industry. Showing that my work is not novel.

1.2.10 Paper

Four reasons Slack will change how you teach (opinion) | Inside Higher Ed.

(n.d.). Retrieved May 30, 2020, from https://www.insidehighered.com/digital-learning/views/2018/09/19/four-reasons-slack-will-change-how-you-teach-opinion

1.2.10 Found Via

Google search for, "is slack FERPA compliant"

1.2.10 Summary

This is an option article highlighting the use of digital tools in the classroom. Specifically using slack in a learning environment. It describes, Slack Is the New Email, Slack Allows Students to Contribute in Diverse Ways to the Learn-

ing Community, Slack Is Great for Teaching Online, Communication With Colleagues

1.2.10 Take Aways

Because I am not a teacher. I need to gather information from the perspective of the people that might be using this tool. This information can help define the need of this tool, and inform possible features.

1.2.11 Paper

Tindall-Ford, S., Agostinho, S., & Sweller, J. (2019). *Advances in Cognitive Load Theory: Rethinking Teaching*. Routledge.

1.2.11 Found Via

Google Scholar search, "collaborative learning"

1.2.11 Summary

This work discusses the Cognitive Load Theory. Which involves knowledge of how we think and solve problems.

1.2.11 Take Aways

It is important to understand how we think such that we can make tools to enhance that process. Any tool developer as part of my work should take this theory into consideration and attempt to lower cognitive load in a learning environment.

1.2.12 Paper

Jeong, H., & Hmelo-Silver, C. E. (2016). Seven Affordances of Computer-Supported Collaborative Learning: How to Support Collaborative Learning? How Can Technologies Help? *Educational Psychologist*, *51*(2), 247–265. https://doi.org/10.1080/00461520.2016.1158654

1.2.12 Found Via

Google Scholar search, "collaborative learning"

1.2.12 Summary

This work proposes 7 core affordances of technology for collaborative learning based on theories of collaborative learning. 1) engage in a joint task, (2) communicate, (3) share resources, (4) engage in productive collaborative learning processes, (5) engage in co-construction, (6) monitor and regulate collaborative learning, and (7) find and build groups and communities.

1.2.12 Take Aways

These are 7 guiding principles for an integration between Slack and Canvas. This work can help describe the need for such looks, and round out my research.

1.2.13 Paper

Retnowati, E., Ayres, P., & Sweller, J. (2017). Can collaborative learning improve the effectiveness of worked examples in learning mathematics? *Journal of Educational Psychology*, *109*(5), 666–679. https://doi.org/10.1037/edu0000167

1.2.13 Found Via

Google Scholar search, "collaborative learning"

1.2.13 Summary

This work describes previous work where examples and collaborative learning have both been shown to facilitate learning. This work also describes 2 experiments where 7th graders were taught math. Results from 1 experiment showed individuals to learn better when using examples. The work concluded, that while collaboration could be beneficial when learning under problem solving conditions, it may be counterproductive when studying worked examples

1.2.13 Take Aways

This is good counter-balance research for understanding the strengths and weaknesses of collaborative learning. It helps me understand when collabraotve learning is effective and where it is not.

1.2.14 Paper

Martin, F., & Betrus, A. K. (2019). Online Learning. In F. Martin & A. K. Betrus (Eds.), *Digital Media for Learning: Theories, Processes, and Solutions* (pp. 111–127). Springer International Publishing. https://doi.org/10.1007/978-3-030-33120-7_6

1.2.14 Found Via

Google Scholar search, "slack lms mooc"

1.2.14 Summary

This work describes delivery methods for online learning to frame the context in which the materials will be used. It also discuss the use of Synchronous Online Tools.

1.2.14 Take Aways

This work highlights the use of tools to make teachers more efficient. Which can help the learning environment.

1.2.15 Paper

Kalas, P. (2019). What motivates students to work their hearts out? Insights and reflections from an upper-level biology lab. *The Western Conference on Science Education*. https://ir.lib.uwo.ca/wcse/WCSENineteen/Wednesday/24

1.2.15 Found Via

Google Scholar search, "motivates students to learn"

1.2.15 Summary

This work introduces a definition of motivation as, someone's impetus to do something. This work uses a study of randomly collected data and established 5 themes that emerged from that data

1.2.15 Take Aways

That motivates students is something I haven't researched much. As an integration between Slack & Canvas will attempt to make the students and teachers lives easier, in order for it to be affect the student must be engaged & motivated.

1.3. Synthesis

1.3.1 Domain Identification & Domain Summary

Through the process of compiling research a domain has been identified. I am keeping it high-level on purpose at this point. That said, the domain will be tool/tools for enabling student engagement in a collaborative environment such teachers and administers can track, assess, and action on student progress. The current specific application in this domain is an integration between Canvas and Slack. More information to follow.

1.3.2 High Level Trends

This domain is not a novel one. While completing the research log over the past 2 weeks some high level trends have emerged. These trends include, tools for augmenting the learning process. A specific example of this is PARQR, a tool developed to reduce the number of duplicate posts on the online forum Piazza (Bilgrien et al., 2019). The use of this tool saw a 40% reduction in the number of duplicate posts. This work is an example of a tool *augmenting* the existing systems such that learning can be done in a more efficient manor. Other examples that show this work is not novel include teachers writing articles explaining how the use of Slack changed they way they tech (Four Reasons Slack Will Change How You Teach (Opinion) | Inside Higher Ed, n.d.). Finally existing work shows how Slack can complement LMS's in a learning environment (Ross, 2019).

Another trend was student motivation both in an individual sense, and collaborative sense (Kalas, 2019). What drives students? With the goal of this work being to provide students, teachers, administrators tools to do their job more efficiently I should take some time to understand students and their motivations. As a tool or systems should enhance a students motivations not hinder it.

Finally, the last trend is around collaborative learning and cognitive load. Learning is an inherit friction-based experience. Trying to learn is hard, whether that be individually or learning collectively. Thus the tools created which facilitate learning should not add to the friction of learning. Exiting work attempts to establish concepts technology affords in a collaborative learning environment (Jeong & Hmelo-Silver, 2016). These concepts should be adopted for the Slack & Canvas integration I aim to build.

1.3.3 Interests Moving Forward

Further explore the ways Slack & Canvas could be integrated such to enabled collaboration. This could include creating workspaces for courses, channels for assignments, advanced data collection techniques such that engagement can be objectively measured. Lastly I will be examining the affect of laws like FERPA, and its impact on this work (Haston, 2019).

1.4. Reflection

Initially the synthesizing of the research, and the research itself was difficult. Due to not having a clearly defined idea. Initially, I had thoughts around Intelligent Tutoring Systems, thus research was driven in that direction. However, now the idea is around enabling student engagement in a collaborative learning environment. Which concretely is an integration between Canvas & Slack. With this idea clarified, research became more focused. With this new focus, existing research was found around this specific idea of leveraging Slack as collaborative learning tool. Once this research was found, drove the selection of this idea to be what will be used in the Final Project.

I will also begin looking into more domain specific considerations. A concrete example of that is the affect of Federal law on protecting student data & privacy. With I hope this work can actually turn into product Schools and teachers use to make the learning process a more efficient one, in the scope of this course and due to Federal laws in the United States, I might have to limit it to a proof of concept.

1.5. Planning

The current preliminary plan is to integrate Slack & Canvas. Base features should include creating a workspace in Slack for a Canvas course. For each as-

signment in canvas, a channel in Slack must be created. In addition, this systems should track a Slack users usage statistics. Which should include, but is not limited to, the number of posts accords all channels, number of private messages, The number of posts per assignment (or channel) . A stretch goal will be to gather the sentiment analysis around assignment such that the teacher or administer can have a sense of how the student are reacting to the assignment. Additional though should be put around more statistics around usage as to assist the teacher and administer to monitor student progression.

To accomplish these goals in the short term. Research will be done around what is required to extract this data from Slack, as well as how to programmatically create a workspace via the Slack API. As well as the information that can be extracted from Canvas in terms of courses, assignments, and modification of the grade-book. As well as exploring ways to generate Swift clients for communicating with Canvas via the API. Because the source code for Canvas is open-source I was able to find the Swagger files which can bemused to generate Swift client code. However, it appear that Canvas is using an older version of the Swagger spec, which could make this code generation process more difficult.

2. ACTIVITY

2.1. Background Information

Canvas is a Learning Management System (LMS) used by Georgia Teach, and others to help manage all the goes into having an online distribution of a course. While Georgia Teach is a Higher Education Institution, the application of Canvas can be used in other industries. For example, a Corporation could use Canvas as a way of management the content required for its employees to learn and grow within their business. Canvas has entities such as courses, assignments, quizzes, grade books, and others. Which are all basic entities needed to administer an online distribution of a course.

Slack is a communication tool used by different industries. Personally I use Slack at my work as a Software Developer. We use it for general company wide announcements, team specific communication, external application notification like our ticket tracking system Jira, private messaging and more. Slack has a rich set of existing integration what augment the experience of collaborating

and sharing information. Which make the communication process light, fun, and interactive.

2.2. General Problem Statement

An objective way to measure collaboration & engagement.

2.3. Scholarly Support

Existing research has been done in this area. Specifically around finding learning analytics from the perspective of engagement in collaborative learning (Zhang et al., 2019). Where 181 people were used to analyze the problems around learning in a collaborative environment. Issues around effort assignment in a collaborative environment are discussed. Put a another way, trying to measure the feeling that 1 or more of the people in the group don't actually contribute to a project or discussion. Anyone who has done a group assignment in school has felt some part of this.

Other research has shown a need to develop tools that measure some model of student engagement in a Learning Management System (LMS) (Nizam Ismail et al., 2019). Here, a University attempted to model student engagement using trace data in an effort to objectively measure student engagement.

The use of modern software to enhance the learning environment is not novel. Existing work show use of Chatbots to nudge students, which aims to reduce procrastination (Rodriguez et al., n.d.). Examples like this show the type of enhancements possible when systems do 2 main things, one integrate with each other and two, meet the user where they are.

2.4 Specific Problem Statement

Objectively measure collaboration & engagement via an integration between a Learning Management System & a social interaction platform.

2.5 Closing Commentary

Society could be affected in a positive way by enabling the learning from others. The concept of Collaborative Learning has been proven in previous work, and is not the goal of this work. The goal of this work is to attempt to objectively measure engagement via integrating Canvas & Slack in a structured fashion. If this integration can be done effectively, having the ability to report metrics around engagement should be a side-affect. The question of actionable insight is one that maybe explored in this work, but is not a prominent goal as I am not an expert in how to assess what is actionable and what is not. This will be left as future work or domain experts such as teachers or school administers.

2.6 Research Questions

Can student engagement be objectively measured in a collaborative learning environment?

2.6.1 Decomposed Research Question 1

Can Slack be used as a "public square" where students & teachers work together to facilitate a collaborative learning environment?

2.6.2 Decomposed Research Question 2

Is there meaningful & actionable insights that can be gathered from an organized Slack workspace such that student engagement can objectively be measured?

2.6.3 Decomposed Research Question 3

Is the students overall experience positively affected in a structure/organized Slack workspace?

2.7 Justification

Complexity of these question meet the criteria in that they are not yes/no questions. They require multiple levels of sub-problems to be solved, and the impact of these problems would then need to measured. For example, integrating Canvas and Slack needs to be solved. Once that is solved, the collection of the interactions needs to be solved. Once that is done, analysis will need to be completed such that the integration of these 2 systems has a positive impact on the student learning, the teacher teaching, and the administer monitoring student progression.

The attempting to model student engagement is not novel work (Zhang et al., 2019). Part of the complexity of this problem comes from structuring the environment in such a way as to enable proper data collection such engagement metrics can be gathered. Thus a dependency is formed between the environment (Slack), and the model of student engagement.

Layer onto that the concept of actionable insight. Assuming the environment is structured in a way to enable proper data collection. As well as a model for defining student engagement is define. There is still the concept of making that

actionable. We may see a student is engaged or not, but what does this system do to empower the teacher to act? Currently, my best though it to attempt to provide the teacher with the insights, aka the data, and allow them to action on it. Possible actions might be, sending private messages, creating automatic reminders for students that are less engaged, etc. Much of this will most likely be pushed off to future work, and require further in investigation via teacher survey's and interviews.

Finally, the complexity of measuring the impact of such a product in a student's learning experience is subjective. Qualitative method would most likely be deployed in the form if user surveys as done in previous work (Muhisn et al., 2019). This will require a built product, with core features implemented. Thus will most likely be pushed to future work once the system has sustained adoption. Steps can be taken in the design of these user surveys as to ensure less subjectivity in the measurement of the impact on to the student as part of the learning process. A concern here is the variance in the way students learn, it may become challenging to develop a tool to meet the needs of all the different students. The best attempt at solving this problem will be user surveys as part of future work.

It is important to also acknowledge that these research questions must be answered via facts not opinions. Two different methods could be deployed in an attempt to answer these questions with facts. One, qualitative research in the form of teacher, admin, and student surveys. Two, quantitative research in the form of usage static's gathered by the system itself. To do this, basic statistical analysis should be deployed around measuring engagement and impact. Some examples of this could be, average number of messages sent, number of channels where at least 1 message was sent, etc. These metrics could be used in isolation, or could be normalized to the class as to objectively measure one students engagement over another within the same class. Additional statistics should be developed as the project progresses.

In conclusion, attempting to answer these research question is complex in that they can not be answer with a simple yes or no. They have interdependencies on each other. As well as require software to be developed for use and tracking. Even then, assuming everything is in place, the subjectively of gaging user im-

pact is additional complexity. A best attempt of designing a user survey should be deployed.

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