Project Proposal
CS6240: Education Technology

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***Abstract*—**Welcome in this document you will find a project proposal for an integration between Canvas, a Learning Management System (LMS) & Canvas, a business communication platform. This work describes the process of integrating these 2 systems for use in a learning environment.

1. HEADER

1.1. **Title**: Canvas & Slack

1.2. **Members**: Steven Prichard

2. INTRODUCTION

Communicating & Engaging as students in a learning environment has long been a challenge for teachers & administrators. Contributing to group projects, classroom discussion and the like while getting properly credited for that effort is also a challenge. In my personal experience the classroom has seen more and more technology introduced to it. From smart boards in Elementary schools, to personal polls in College lectures, to a fully online Masters program. With this introduction of more technology, teachers & administrators are have a hard time keeping up. In my personal discussion with teachers in my area, they voice concern about student maturity, how to use the technology in a constructive way, and ease of use.

With tool like Canvas, a Learning Management system for managing all aspects of a digital classroom, from assignments to quizzes and tests. Even when Canvas doesn't support something a teacher or student might need they have an extendable design that allows a 3rd party's to plugin that missing functionality.

In the business community you have tools like Slack. Which lower the barrier of entry to fully contested, rich discussion that add value to all participants. Where discussion can be organized into "channels" where members could be

added to discussion topics pertaining to a main idea. Slack too has an extendable design which allows for 3rd party's to integrate where functionality is lacking.

Existing tools like Piazza, a forum based discussion board that aims to encourage & track classroom discussion in an online setting, miss the mark. Specially not all discussion is forum based. You run into issues where student create duplicate posts around the same topic. Which require teachers or teaching assistant to duplicate answers. Piazza is also singular in its focus, in that it just tries to be a messaging board. By having this narrow focus, it misses the opportunity to augment the student in the learning environment. For example, I would have to resort to keyword search if I wanted to find out when assignment 3 is due. When a more natural way to interact would be to ask the system "When is assignment 3 due?", and the system has the ability to answer that question. Enhancing & augmenting the learning process for students and easily organizing workspaces for teachers is the opportunity to contribute something meaningful.

2.1. Background: What is Canvas?

Canvas is an open-sourced Learning Management System (LMS) which combines teachers & students in a digital classroom (Canvas the Learning Management Platform | Instructure, n.d.). Canvas states that over 30% of Higher Education Institutions use Canvas. Canvas isn't a single tool, but is a composition of multiple tools together. Canvas was selected for this project because its something I have direct experience with. A majority of courses in the OMSCS program provided by Georgia Tech use Canvas for managing assignments, grade books, tests, quizzes, etc.

2.2. Background: What is Slack?

Slack is a business communication tool used to replace email. It tries to replicate the collaboration people have when working face to face (Slack, n.d.). Slack attempts to be a collaboration hub where conversations can happen, applications can integration with, and work can get done. Conversation is focused around channels, and threads allowing for focused and open communication. Slack was selected for this project because if my previous experience using it at

my job. It is a powerful tool for allowing structured conversation to happen, and extendable by other applications that make its Users more efficient.

3. RELATED WORK

3.1. PARQR - Augmenting Learning Management Tools

As mentioned in the previous section, one issue with existing discussion tools like Piazza is the issue of duplicate posts. PARQR, is a tool which aims to solve this problem. The tool augments the discussion within Piazza, such that it can try cases where students are posting similar topics and reduce the number of posts. When used, PARQR saw a 40% reduction in the number of duplicates posts (Bilgrien et al., 2019). This is a great example of existing work which attempts to augment the learning process, and narrow discussion in a constructive way.

3.2. Supporting Collaborative Work

Existing work has describe 7 ways technology can help collaborative learning. Those include, 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 & regulate collaborative learning 7) Find and build groups & communities. This work discusses how technology can help in all these ways and should be used in conjunction with pedagogical strategies (Jeong & Hmelo-Silver, 2016).

3.3 Slack Already in the Classroom?

Ongoing future work in the use of Slack in the classroom exists. This work focuses on using Slack in a 2nd year Marketing course where data will be collected from 6 four groups consisting go 8-10 students & 2 semi-structured individual interviews. With member of the teaching team in order to evaluate the use of Slack in supporting & engaging student in group assignments (Cook et al., 2019). This work mentions that 2 areas consistency mentions as areas of improvement in higher education are assessment & feedback, and they hope to use Slack as a solution to these issues (Cook et al., 2019).

3.4 The Role of Analytics

Existing work has described a difficulty with collaborative learning groups is measuring & assessing each student's engagement in said groups. As well as *promoting* students' engagement in said groups. This work examined the role of Slack in students' engagement in collaborative learning, specially whether the openness & visibility of each group member's contribution on Slack can promote students' engagement. Results showed that mutual trust, social influence & reward valence amount student can promote their teamwork engagement. As well as teamwork engagement can prompt students' learning & work satisfaction (Zhang et al., 2019). This work treats Slack as one collaboration environment, and didn't analyze the data from Slack. The contribution of this work to this project is that it identifies some key concepts that positively contribute to student engagement (Zhang et al., 2019). The Slack & Canvas project has the opportunity to gather this data from Slack. At a minimum we have the ability to create a dataset based on data collected within Slack such that future research could leverage this dataset for further study around student engagement on Slack in a collaborative learning environment.

4. PROPOSED WORK

4.1. Admin User Interface - Required

The Admin UI, will be a stand-alone webpage, which could be loaded in an iFrame within Canvas similar to how Piazza behalves. As a part of this Application, it is required to have an interface for teachers to do 2 primary things.

1) Configure the Slack workspace

2) View student engagement metrics

When configuring the workspace, the teacher will be prompted for which Applications or Bots they would like added to that workspace. An example of this is the Intelligent Teacher Assistant, or the Assignment Reminder (descriptions below). The items "live" in Slack, but the teacher configures them in the Admin UI.

The seconds required feature of the Admin UI, is to view the different analytics around student engagement. At this time, the minimum metrics the Applica-

tion should capture are, number of messages sent per channel per student. This feature will allow the teacher to assign credit for participation back in Canvas. Optionally, this feature, if configured, will automatically assign participation credit to the students on the teachers behalf.

4.2. Workspace Configuration - Required

The problem this application aims to solve is to focus discussion. To do this, the environment must be structured a certain way as to afford the Users this narrowed focus. To do this, all students must be created as Slack Users in the same workspace. As well as having Slack channels created for each assignment in Canvas.

4.3. Student Engagement Analytics - Required

Another core piece of functionality this application must deliver is student engagement metrics. At a basic level, this will be the number of messages a student has sent both within different channels, and privately. In its advanced forms, it could be sentiment analysts around assignment channels as to inform the teacher of engagement of the entire class, as well as how the student is feeling about a specific assignment. Time permitting, sentiment analysis will be added in this way. These metrics will populate dashboards within the Admin UI.

4.4. Assignment Reminder SlackBot - Required

Once the core integration between Slack & Canvas is complete, Bots within Slack could be created to help the students stay engaged. An example Bot that will be created is the Assignment Reminder Bot (ARB). ARB will know of all assignments & the due dates and will do 2 things initially.

1) Send messages to assignment channels reminding all members of that channel that an assignment is becoming due

2) Send private messages to students that have not completed an assignments that are coming due.

4.5. Jarvita: Just Another Rather Very Intelligent Teaching Assistant - Time permitting

Existing work has been done around trying to automate some aspects of the classroom. Some of which have been covered in previous research logs, however this feature is different. Once the core pieces of this application are build, something that will be afforded to this system is knowledge of all the different assignment, quizzes, etc. Why can't this system leverage that knowledge to save the student time. That is exactly what Irving tries to do. Irving is a chatbot created for Strayer University which tries to assist the student in answering questions such that a human does not need to be asked or involved. Students can ask, Where can I find a tutor? How do I register for winter quarter? When will I graduate based on my current pace? Irving has the answer to all these questions (Meet Irving, the Strayer Chatbot That Saves Students Time, 2019).

Another example of an intelligent assistant is Spartan Answer. Student can ask questions like, how can I schedule a Safe Ride? What is happening on campus this weekend? Spartan Answer knows the answer to all of these questions (CWRU Digital Assistant, 2019).

The commonality within these systems is that they leverage a tool called Google DialogFlow. This is an API prodded by Google, and abstracts away the smarts of the system, and provided a way for system to integrate with it and build intelligent systems.

The goal of Jarvita is to build off the integration between Slack & Canvas in a way that will allow a student to ask a question within Slack, and the system can answer it based on the data in Canvas. An example of this would be, When is Assignment 3 due? A student types that question into the Slack interface, and the system uses Google DialogFlow to parse, understand and answer this question. The system does this by creating what are called entities in DialogFlow. With entities created for every assignment, the system can now answer questions about that assignment such as the due date.

This is a labeled a time permitting feature, as it builds off the of the core functionality of the integration. So, if there is enough time towards the end of the project, this work will get done. Also, initial implementation will be focused around assignments only. Another interesting note, is that this is a paid API

from Google, so testing & interacting with the Google API might be difficult and more details need to be researched.

4.6. Languages, Tools & Libraries Used (Intro)

Where possible all aspects of this Application will be written in Swift. A open-source programing language initially created by Apple in 2014 (Swift - Apple Developer, n.d.). Because Swift is a young language, there may not be the same robust set of tools for server development like languages such as Go. In cases where it is just not feasible to write the Application in Swift, Go will be used. The Application will be "dockerized" such that it can be deployed and answer by a container management system. Optionally, and time-permitting the Application will have Kuberentes manifest files created for it such that it can be run on Kubernetes. Having the Application running on Kubernetes is not a requirements as much as it is a nice to have.

4.6.1. CanvasKit (Build from scratch)

In order to get the data needed to power this Application on the Canvas side, a Swift package will beed to be written from scratch as there doesn't exist one already. This package will be called CanvasKit, and will be a library or framework that the Application will use to communicate with Canvas.

4.6.2. SlackKit & SKWebAPI (existing package)

For communicating with Slack, there exists a Swift package called SlackKit (https://github.com/pvzig/SlackKit). This package will be used for working with or communicating with the Slack API. SKWebAPI could be used as a fallback if the required functionality is not in SlackKit itself. SKWebAPI is another Swift package which allows more direct access to the Slack API.

5. DELIVERABLES

In conjunction with the 5 status updates, there will be 2 intermediate milestones. Please consult the "Task List" section for more details.

5.1. Milestone 1 - 6/28/2020

Plan is to have the pieces in place that cover the base or core features of this application builds & working. These core pieces include, programmatically cre-

ating Slack workspace with all students in course added as Slack Users, and channels created for every assignment. As well as an Admin UI, teachers will use to interact/configure with the app. Goal is to have a video demonstrating this core flow working.

5.2. Milestone 2 - 7/12/2020

By the second intermediate milestone, the goal will be to build off the core pieces. Once the core integration between Canvas & Slack is complete, focus will shift to student engagement metrics. This consists of identifying the data that should be captured from Slack & reporting it in the Admin UI. The second important feature what aims to be complete by this milestone is the Assignment Reminders Slackbot. Which will send a message to a student days before an assignment is due to remind them that they need to complete that assignment if they haven't already. The goal would be to have a video demonstrating these features.

6. TASK LIST

Week #	Task #	Task Description	Estimated Time (Hours)	Member Responsible
5	1	Prepare & Submit Project Proposal	5	Steven
5	2	Create Swift package - CanvasKit - with function to get assignments for a course	4	Steven
5	3	Create Trello board to track work	1	Steven
Week 5 Totals	**3**		**10**	
6	4	**Feature**: Programmatic creation of Slack workspace	5	Steven
6	5	Develop End-to-End testing for programatic workspace creation feature	5	Steven
6	6	**Feature**: Create Slack Users for every student in course	3	Steven
	7	Develop End-to-End testing for every student in Slack feature	2	Steven
6	8	Complete weekly status check	1	Steven
Week 6 Totals	**5**		**16**	

Week #	Task #	Task Description	Estimated Time (Hours)	Member Responsible
7	9	Prepare Milestone 1 Deliverables (Video)	2	Steven
7	10	**Feature**: Create Admin UI	5	
7	11	Create Automated testing for Admin UI & Creating Slack workspace with channels for each assignment, and all student having Slack users created	5	Steven
7	12	Complete weekly status check	1	Steven
Week 7 Totals	**4**		**12**	
INTERMEDIATE MILESTONE 1 DUE				
8	13	Complete weekly status check	1	Steven
8	14	Process feedback from Mentor, modify plan if needed	1	Steven
8	15	**Feature**: Create/Ingest student engagement metrics	10	Steven
8	16	Create automated testing for student engagement metrics	3	Steven
Week 8 Totals	**4**		**15**	
9	17	Prepare Milestone 2 Deliverables (Video)	2	Steven
9	18	Complete weekly status check	1	Steven
9	19	**Feature**: Create Assignment Reminders Slack App	8	Steven
9	20	Create automated testing for Assignment Reminder feature	4	Steven
9	21	**Feature**: Allow Assignment Reminder mini-app to be an option in the “install” process in Admin UI	8	Steven
Week 9 Totals	**5**		**23**	

Week #	Task #	Task Description	Estimated Time (Hours)	Member Responsible
INTERMEDIATE MILESTONE 2 DUE				
10	22	Complete weekly status check	1	Steven
10	23	**Feature**: Create Intelligent Tutoring System (ITS) powered by Google DialogFlow	15	Steven
10	24	Create automated testing for ITS	3	Steven
Week 10 Totals	**3**		**19**	
11	25	Prepare Final Paper	5	Steven
11	26	Prepare Final Presentation	5	Steven
11	27	Placeholder Task - Used for un-planned work	10	Steven
Week 11 Totals	**3**		**20**	
FINAL PROJECT DUE				
12	28	Misc end of semester items	~	Steven
Week 12 Totals	**1**		**0**	
Project Totals	**28**		**115**	Steven

REFERENCES

1. *Canvas the Learning Management Platform | Instructure*. (n.d.). Retrieved June 4, 2020, from https://www.instructure.com/canvas/
2. Slack. (n.d.). *What is Slack?* Slack Help Center. Retrieved June 4, 2020, from https://slack.com/intl/en-ca/help/articles/115004071768-What-is-Slack-
3. Bilgrien, N., Finkelberg, R., Tailor, C., Irish, I., Murali, G., Mangal, A., Gustafsson, N., Raman, S., Starner, T., & Arriaga, R. (2019). PARQR: Augmenting the Piazza Online Forum to Better Support Degree Seeking Online Masters Students. *ArXiv:1909.02043 [Cs]*. http://arxiv.org/abs/1909.02043
4. 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
5. Cook, J., Mabe, R., & Harman, B. (2019). *An exploration into the use of the digital platform Slack to support group assessments and feedback and the impact on engagement—Working Paper* [Working Paper]. https://dora.dmu.ac.uk/handle/2086/18073
6. Zhang, X., Meng, Y., Ordóñez de Pablos, P., & Sun, Y. (2019). Learning analytics in collaborative learning supported by Slack: From the perspective of engagement. *Computers in Human Behavior*, *92*, 625–633. https://doi.org/10.1016/j.chb.2017.08.012
7. *CWRU Digital Assistant*. (2019, February 13). University Technology, [U]Tech | Case Western Reserve University. https://case.edu/utech/resources/cwru-digital-assistant

8. *Meet Irving, the Strayer Chatbot That Saves Students Time*. (2019, October 31). Strayer University. http://www.strayer.edu/buzz/irving-strayer-chatbot-saves-students-time
9. *Swift—Apple Developer*. (n.d.). Retrieved June 14, 2020, from https://developer.apple.com/swift/