Word Count: 2477

ECE1778 - *Baton* Final Report

Apper:
Zack Teitel - 992259541

Programmers:
Victor Li Chen - 1000352361
Fiona Yi Zhao - 1000983000

University of Toronto

1. What, Why, and Scope:

Research into hand-raising as a classroom communication tool has found the traditional classroom action to be lacking. Chiefly, hand-raising is problematic as it takes students out of their "work-flow", and additionally leads to teacher error in determining how long a student has been waiting for help and/or to participate. We have solved this problem by creating a mobile application called Baton,that offers teachers an objective visualization of how long students have been waiting.

Arguably more pivotal in terms of creating an a rich learning environment for teaching and learning, is the observation (made by our Apper, Zack Teitel) that student hand-raising is also problematic in creating strategic lesson flow, i.e. a lesson that flows from one learning piece to the next in an intelligent way. Our Apper's desire to solve this problem served as our chief inspiration for Baton's core functionality: empowering students to reveal previously hidden information about "participate-intent" (i.e. *why* they want to participate).

The Baton team has solved the issues initially identified by our Apper, and outlined above, by providing the following functionalities:

1. Allowing teachers to create and students to join a shared virtual classroom space.

2. Allowing up to 70 student mobile devices to communicate with a teacher device, within a virtual classroom space, through cloud server and Wi-Fi technologies.

3. Allowing students to select from a menu of four participatory descriptors - "Build, Challenge, New Idea, Question" - letting teachers see (on their end) a list of student icons displaying who wants to participate and why.

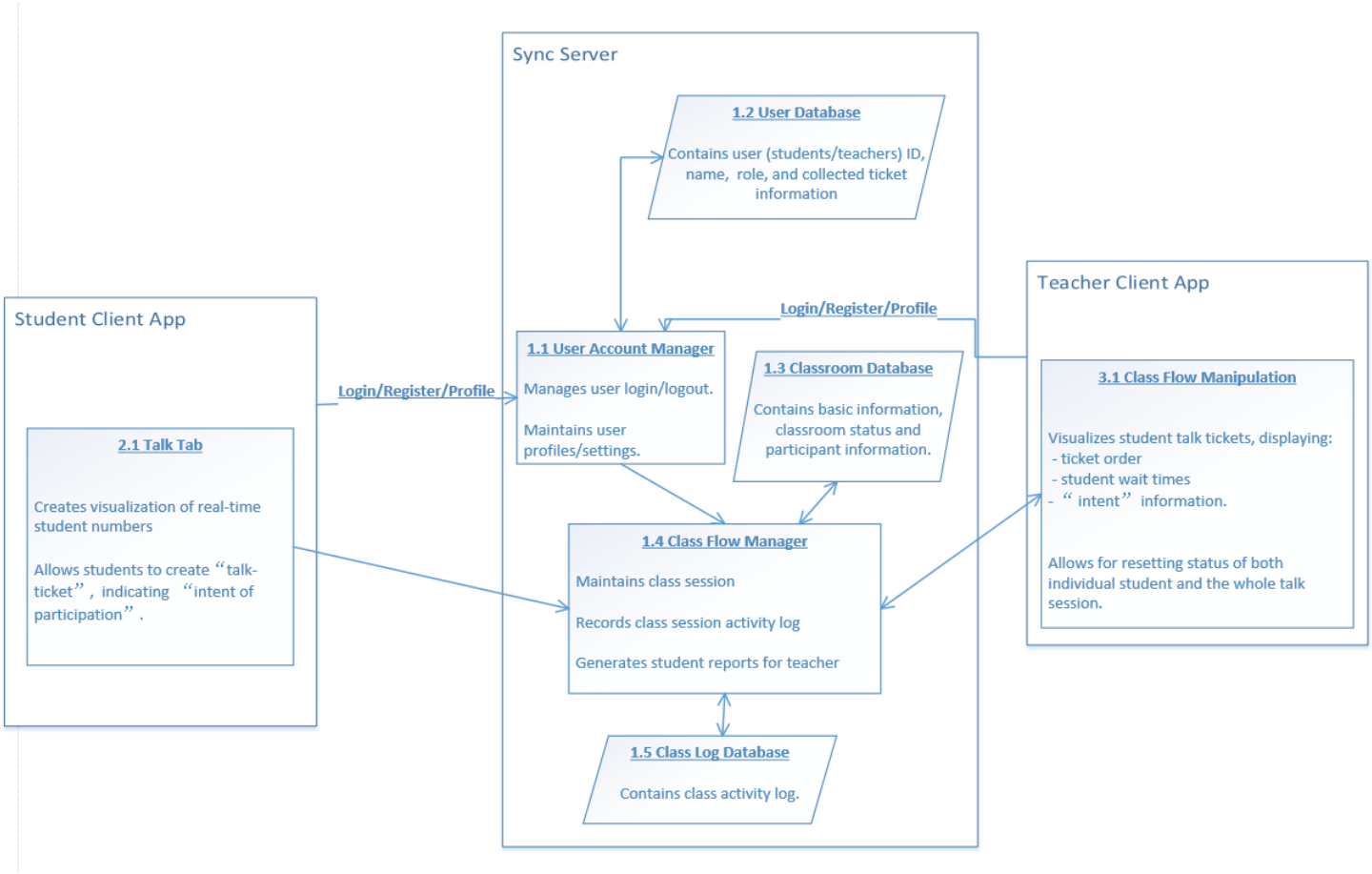
4. Displaying student wait-time visually through coloured interpretation, i.e. green avatar = under 1 minute of wait time, red avatar = over 1 minute, allowing teachers to access valuable classroom information at a glance.

5. Displaying a sequential representation of participation, i.e. the order in which students have digitally participated, giving teachers another layer of information for strategic lesson flow design.

6. Displaying the number of times that a student has participated, again offering teachers useful data that typically goes untracked and unrecorded.

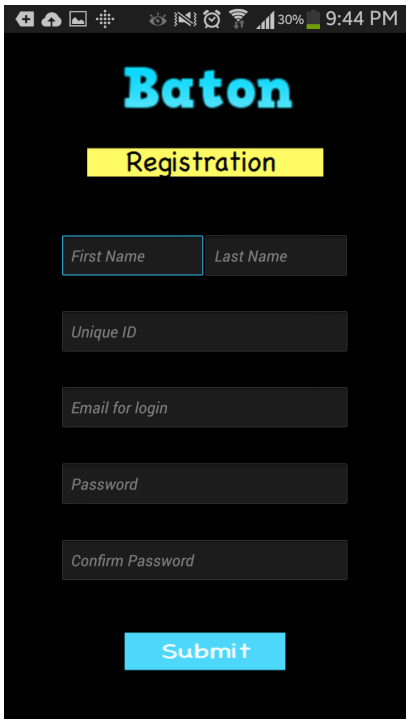
****

2. Overall Design/Block Diagram:

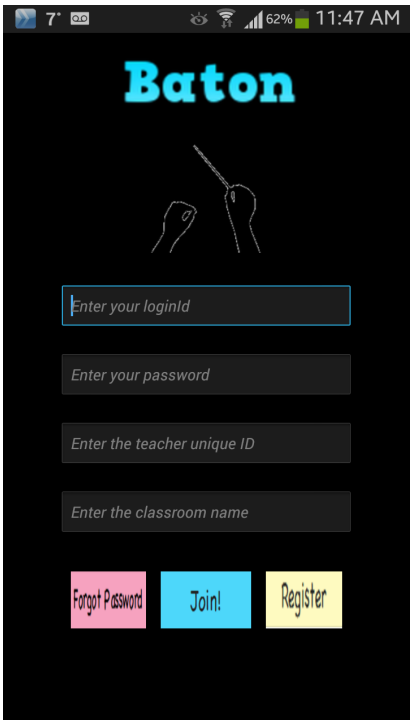


****

3. Statement of Functionality: (NB: ALL functions are working, as described)



1.1 Registration Screen



1.2 Login Screen

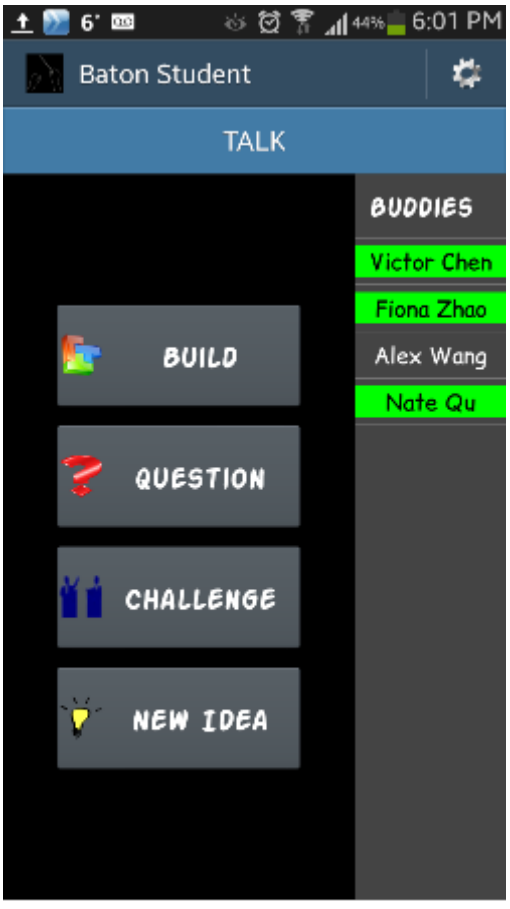
i. Registration/Login

Baton uses identical registration/login processes and screen navigation for both students and teachers (Registration illustrated in 1.1, Login illustrated in 1.2). Containing standard registration/login prompts, there isn't anything particularly thrilling about Baton's registration/login process.

There are two points worth mentioning, however:

- Baton uses a global Unique ID registration system, meaning that once a teacher or student selects a Unique ID, no one else worldwide can select said ID. This system was selected intentionally to avoid students entering the wrong virtual classrooms - for example, if two teachers in one school used the Unique ID of "Mr. S", this would create confusion on the backend and lead to errors on the frontend for users.

- In future versions of Baton, we will allow teachers the option of substituting any text they want, in place of "Join!" (image 2.0). Great teachers use humour as part of their class-community building toolkit, and the ability to incorporate a simple textual inside-joke from a particular class community is a "cheap" way to create student engagement.

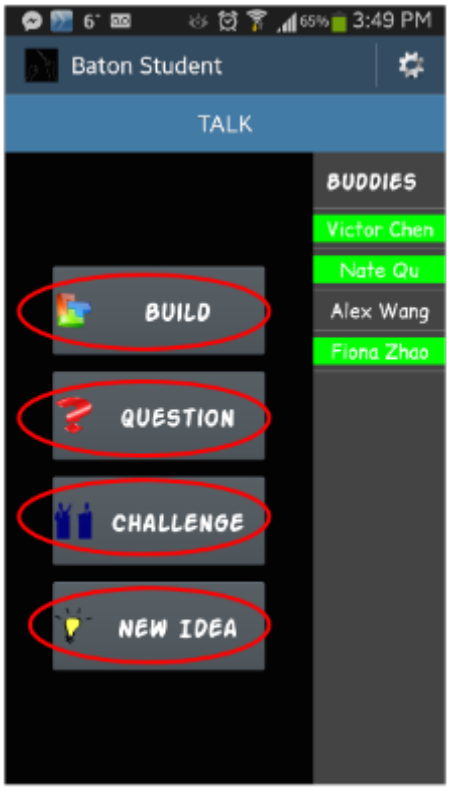


2.0 Student Talk Function

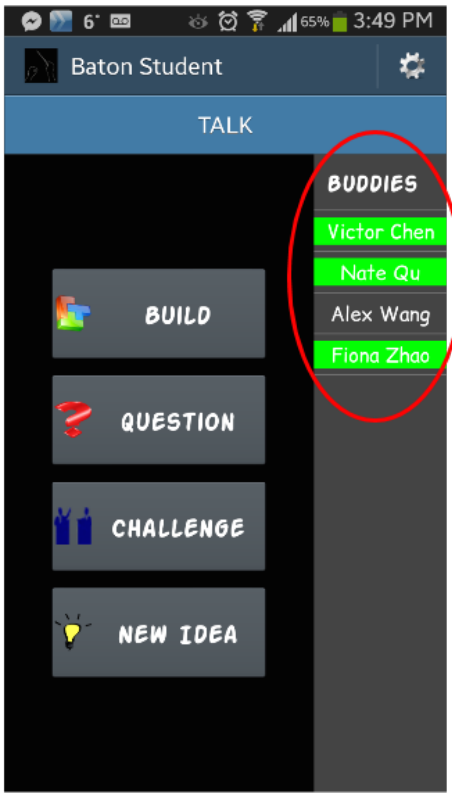
ii. Student Talk Function (STF)

The Student Talk function, (image 2.0), is Baton's core function, as it offers up the hidden participation information that Baton was created to reveal.

The STF allows students to signal "participation intent", which can be described as "*why* a student wants to participate". On communicating with potential teacher-users, we determined that almost all student participation falls into one of the following four categories: *building*, *questioning*, *challenging*, and *new ideas*.



2.1 Talk Buttons



2.2 Buddies List

These categories are reflected in the STF participation buttons that students can use, as seen in image 2.1. To participate, a student simply taps the button that matches their intent and a "talk-ticket" is created and sent to the teacher app, which displays said ticket in the easy-to-read form of a student icon (image 3.0 - pg 6)

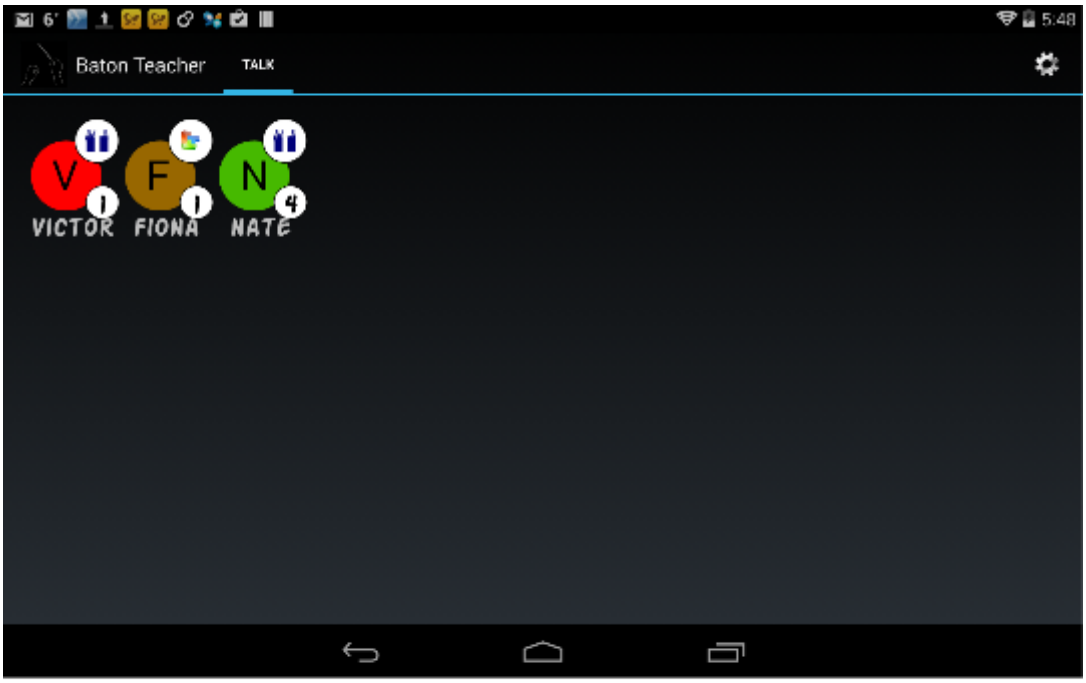
iii. Buddies List

Experience indicates that students are far more likely to participate when they know others are participating as well. To that end, we created the "Buddies" list, seen on the student talk screen (image 2.2.), that displays who is waiting to participate, just like traditional hand-raising would do.

iv. Teacher Talk Function (TTF)

The Teacher Talk function is "married" to the Student Talk function; in a sense, it is the "Rosetta Stone" of Baton - allowing teachers to easily decode the talk-tickets sent by students. The TTF screen (image 3.0 - next page) offers teachers a visualization of student participation in their classroom. The TTF converts talk-tickets into student icons, and pushes them in real-time to the teacher screen, in the order that they were sent. This already offers improvement over hand-raising, as teachers can now see at a glance the order in which students participated, instead of having to catch it all with their eyes, and then having to retain the order in their working memory. Beyond this, the student icons offer teachers three key pieces of information

towards a more strategic class-flow; please see image 3.1 (bottom right) for a breakdown of this information and the student-icon:

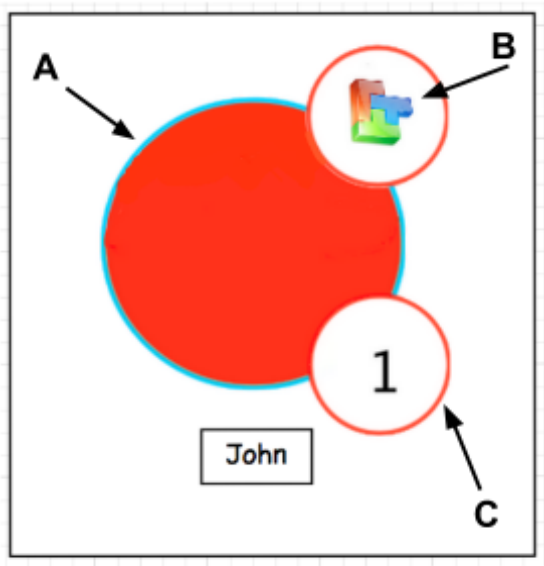


3.0 Teacher Talk Function

A. Main bubble offers a visualization of student wait-time. Student icons start green and the longer a student waits to participate, the redder their icon gets. You can see in image 3.1 that John has been waiting for quite some time. In user consultations, teachers indicated they wanted ambient awareness of wait-time via colour as giving them exact time measurements via a clock or stopwatch would have been “too much” to handle.

B. The upper bubble offers a visualization of “participation intent”.

C. The lower bubble lets teachers know how many times a particular student has participated in class.



3.1 Student Icon Breakdown

By offering teachers the above information for every student in their class, the TTF allows for class-flow decisions to come from a more informed and strategic standpoint. For example, using the TTF (and inherent information) could lead a teacher to ignore “order of participation” (i.e. calling on the student who raised their hand first, and so-on...), in favor of “continuity of thought” (i.e. calling on the student who wants to continue building or challenging ideas that

already are on the floor). This is just one example amongst many where teachers can use Baton and the TTF in order to make their teaching smarter[1].

****

4. Lessons Learned:

Zack (Apper):

My primary "lesson learned" was that it is very challenging to serve as Project Manager on the development of a mobile application, without possession of programming ability. While I was able to use my general critical thinking and leadership abilities to serve our efforts well, there were moments where my lack of technical knowledge hindered efforts to lead. As a result of this, I've begun learning how to code so that my ability to discuss issues, problem solve, and lead by example can be capitalized on more fully in an app development context.

The other major takeaway for me was that we live in a design oriented world and users expect you to recognize that. Yes, if it's beautiful but doesn't work, you haven't got anything of value. But the user feedback that I collected was often weighted heavily towards issues of style and design (likely in no small part due to the "App Revolution" of recent years, as spearheaded by Apple and their iOS design principles). Most specifically, this "attention to design" was reflected in user feedback about likelihood of use; most teachers said they would be far more likely to consistently use our app when it looks like our mockups.

Fiona (Programmer):

The lessons I learned while working on Baton were multifaceted. To start, I learned quite a bit about Android development, going from lacking any Android development knowledge, to building several core Android mobile app functions on both server and client ends.

I also learned that while Spiral Design (more on that a bit later) there *were* moments where more planning was required; before embarking on major development pieces, you want the design infrastructure to be carefully thought out.

Last, I definitely learned a lot about English language communication skills. Not solely from a "hard-language" standpoint (i.e. pronunciation, grammar) but from the arguably more important "soft-language" standpoint of English (i.e. slang, jargon, conversational linguistic convention, culture norms).

Victor (Programmer):

The major lesson I learned from working on Baton was the importance of the *minimum viable product (MVP)*. When we first started working, our list of "app wants" took up two full white-boards. As we began to work, however, we realized that doing everything listed would leave us with not enough time to finish. As well, it would likely leave us with an application that was bloated and unfocused. By using the spiral design model, we quickly learned how to efficiently

[1] For another example, please see our demo video found at (insert link when available)

scope down and prioritize functions (something I think we all learned, as seen below) and found ourselves creating a top-notch minimum viable product, instead of a weaker "*maximum* viable product".

Team Reflection:

The biggest shared takeaway for our team came in realizing that honesty truly was the best policy in terms of creating our app. We realized that Hawthorne was onto something when he said, "Accuracy is the brother of honesty…". If we wanted the app to *accurately* reflect our shared vision, then we'd need to be honest with each other. By ensuring that we were honest and that we listened attentively when others were expressing their opinion, we were able to make better decisions and work more efficiently.

****

5. Contribution By Group Member (as broken down in list format):

Zack (Apper):

- Brought the idea for the app to the team
- Led team as project manager
- Oversaw constant revision of spiral goals reflecting team progress
- Final arbiter on top level design goals and decisions
- Communicated with developers frequently, ensuring on-going crosstalk, and all were on track.
- Worked as team researcher, tapping collegial and student network for key user evaluation and feedback
- Primary designer of Spiral slides and presentation frameworks
- Conceptual design of application U/I and functions

Fiona (Programmer)

- Built the framework for the two client apps (student and teacher)
- Built the major views of the two client apps
- Built the register, login and ticket sending functionalities for the student version
- Built the "Buddies List" for the student app
- Designed the Block Diagram
- Learned and applied Google Cloud Messaging services
- Conceptual design of application U/I and functions

Victor (Programmer):

- Built the framework and most of the functions for the sync server
- Built the API to enable server service to apps
- Built the database and web server on Amazon Web Cloud Services
- Learned and applied Google Cloud Messaging services
- Conceptual design of application U/I and functions

****

6. Field/Research Implications for Apper:

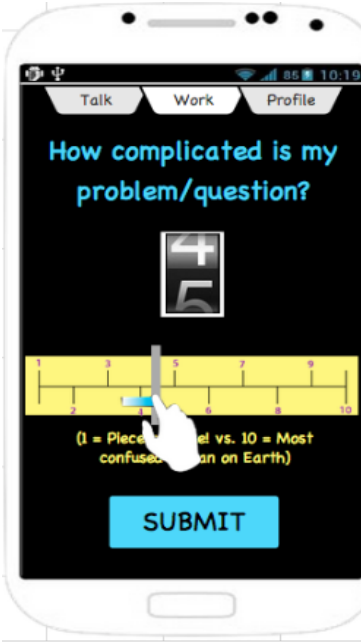
Academic Implications: A cursory investigation reveals that hand-raising in classrooms was studied as early as the 1970's.[2] Educational researchers have identified hand-raising as worthy of research given its significant role and use within classrooms as both a communication tool and a means of creating order. More recently, Pierre Dillenbourg - a prominent learning scientist with a PhD in Computer Science - researched how to leverage technology for increased efficiency of classroom orchestration.[3] With this research in mind, Baton could serve as a next step for educational technology classroom research. To this end, our Apper is in discussion with Professor James Slotta at OISE, about potentially conducting a Master's research project focused on Baton.

In a professional sense, our Apper's work as a high-school teacher leads him to believe that Baton could greatly improve teaching by creating richer and more personalized learning opportunities for students. It has been his experience (and research suggest as well[4]) that bringing technology into the classroom greatly increases student engagement, and we are convinced Baton will do the same.

7. ***Future Work***:

i. The Work Tab

The first piece of future work will be the creation of the "Work" tab (image 4.0). Included in our initial design plan, the Work tab allows students to self-assess problems they run into while working, so that teachers can make strategic decisions about the order in which they help students. Here students use the slide rule to assign a value to a problem they've encountered while working, e.g. 1 for a really simple problem, or 10 for an incredibly difficult one.



4.0 The Work Tab

This function was equally valued by teachers when early mockups of the app were brought to users in the field. Teacher specifically valued the Work tab's instigation of metacognitive practice, i.e. practice in "thinking about your thinking".

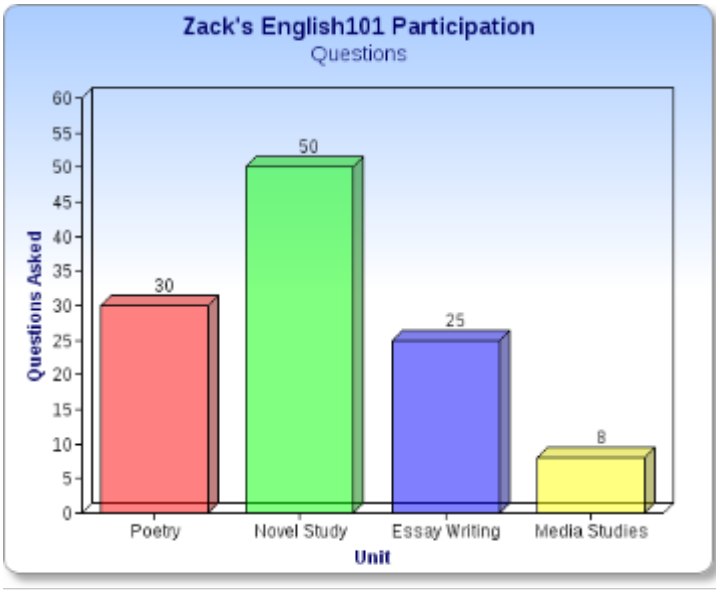
We believe that the same core problem we are solving with the "Talk" function, i.e. how to get at hidden information in the classroom, is addressed by the "Work" function, thus maintaining a continuity of app concept.

---

[2] McHoul, A. (1978) The organization of turns at formal talk in the classroom. *Language in society, 7*(02), 183-213.
[3] Alavi, H.S., Dillenbourg, P., & Kaplan, F. (2009). Distributed awareness for class orchestration. In *Learning in the Synergy of Multiple Disciplines* (pp. 211-225). Springer Berlin Heidelberg
[4] Beeland, W.D. (2002, July). Student engagement, visual learning and technology: Can interactive whiteboards help. In *Annual Conference of the Association of Information Technology for Teaching Education*.

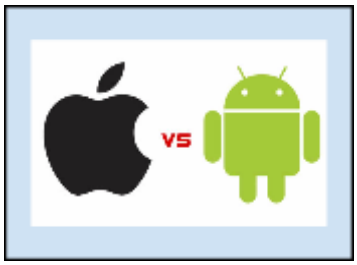
ii. Data Aggregation/Reporting/Visualization - 219

The field of learning analytics (educations biggest foray into big data) could be described as burgeoning[5], but often the field offers products that focus on end-results, what educators call a *summative learning focus* (i.e. assessment ***of*** learning). With Baton, we have the opportunity to provide analytics that have a *formative learning focus* (i.e. assessment ***as*** learning) (see image 4.0 for Baton BDA mockup).



4.0 Baton BDA Mockup

Again, thinking about metacognitive learning opportunities, we'd like to build a robust BDA platform into Baton, not just for teachers but equally for students. Imagine the simple but powerful impact that a student could glean from reviewing exactly how many questions they asked during their one unit of study vs. the next, or what teachers would get out of being offered the average value of student identified problems with a particular lesson, (e.g. "Michael ran into four sticking points while working on BEDMAS, and averaged them at a problem level of 8"). Yes, similar insight is can be arrived at by teachers currently, using the traditional tools at hand: namely, their personal level of insight into and recall for class events. But Baton could free up that working memory and brain power to focus on considering the data and deciding what to do with it, as opposed to collecting and organizing it.



iii. iOS Development - 69

While Android now holds more of the smartphone market share than Apple[6], we are well aware that a large amount of teenagers today are iOS/iPhone users. To ignore this would mean the end of our app, as it is only useful in a classroom where everyone can participate in using it. To that end, we will begin designing an iOS version of the application, as soon as possible.

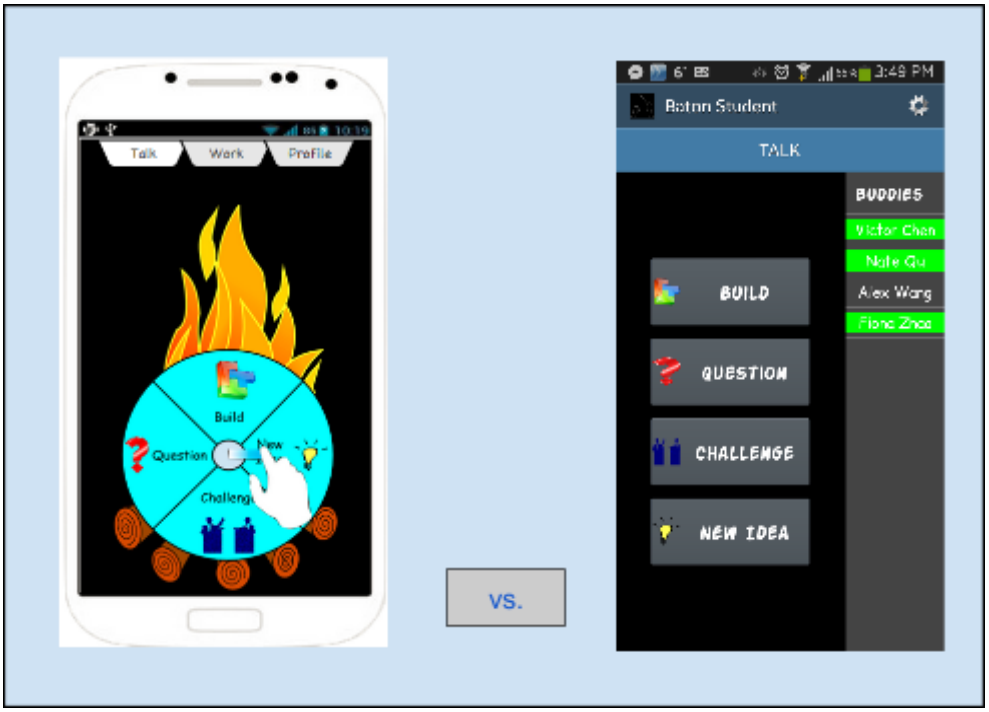
[5] For more on the concept, see this thorough 2012 brief from Malcom Brown, Director of the EDUCAUSE Learning Initiative.

[6] Fekete, Istvan. "Smartphone Adoption Hits 55% in Canada, IOIS At 34% Marketshare."*Smartphone Adoption Hits 55% in Canada, IOS At 34% Marketshare.* iPhone In Canada, 18 Mar. 2014. Web. 5 Apr. 2014.

iv. Graphic Design-122

People like pretty. And they especially like pretty in their mobile applications. We had an idea of this going into building Baton, but opted to focus on functionality over design at the start. Now we are far enough in with the function that we need to start revamping how the app looks. The look of the app doesn't solely need to be rethought for aesthetic purposes (which would be reason enough) but more importantly, the *look* contributes to the *feel*...and the *feel* contributes to the *use*. UI (User Interface) and UX (User Experience) are intrinsically tied to one another, and if we want a top-notch experience for our users, then we have to offer them a top-notch interface to work with.

(Mockup "Talk" screen vs. Current "Talk" screen)



****