

# **Towards Context-independent Gamification: An Evaluation of Intrinsic Motivation in Gamified Contexts**

by

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# Abstract

Gamification is becoming widely adopted as a way of making applications fun and engaging, in order to motivate adoption and use. Despite its popularity, the question of whether gamification actually has any effect on user motivation remains open [15].

For many years, video game designers have leveraged Self Determination Theory (especially the concept of *intrinsic motivation*) to create games that are immersive and interesting. Many gamification frameworks are also based on Self Determination Theory [25], although more evidence is required to establish a link between intrinsic motivation and gamification.

Gamification can be implemented in a variety of contexts, such as adopting sustainable habits, quitting smoking, drinking more water, or learning a new skill. Some researchers believe that the activity which is being gamified has a profound influence on how effective a gamified application is [8].

This thesis explores the questions of whether gamification works, whether gamified applications have an effect on intrinsic motivation as proposed by Self Determination Theory, and whether or not certain game mechanics are effective cross-contextually.

We have developed a general gamification layer, as a framework implementing the following game mechanisms: teams, leaderboards, predefined team-

mate messages, and email notifications. We have evaluated this framework with two case studies. The first, SU Perks, is a reward-based application which encourages students to attend campus events and learn about University of Alberta campus resources. The second, FrancoPass, is an application which encourages students to attend events in the French community with the goal of increasing their motivation to learn a second language. Both studies rely on our gamification ‘layer’, the motivational effectiveness of which is analyzed through these studies.

Both the SU Perks and FrancoPass study demonstrated that users who joined teams tended to participate more in the gamified activity. Different responses to the same game mechanics were found between the two applications: for example, FrancoPass users may have been more intrinsically motivated, which is expected because second language acquisition requires more intrinsic motivation.

The results reinforce the theory that the principles of Self Determination Theory [33] can be used to create applications which are motivating and engaging across differing contexts.

# Preface

This thesis is an original work by Ashley Herman. Both of the case studies described in this thesis received ethics approval from the University of Alberta Research Ethics Board. Details are as follows:

- SU Perks. “SU Perks: Investigating the usefulness of a gamified platform to boost awareness of campus resources” No. Pro00093367, Approved on August 27, 2019.
- FrancoPass. “The Franco App: Turning the Francophone Community into a Sustainable Educational Resource for Second-Language Learners” No. Pro00091361, Approved on July 4, 2019.

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# Chapter 1

## Introduction

*Gamification* is defined as “the use of game design elements in non-gaming contexts” [5]. Game elements such as points and leaderboards have long been used to create video games. Over the past decade, they have increasingly been used to create games designed to motivate people towards reaching a variety of personal goals, such as exercising more [1], bettering their mental health [32], learning a language, or getting involved in their community.

Despite becoming a highly adopted practice in both education and application design, the question of whether gamification actually works remains open [15]. If it does work, there is then the question of *how* to design gamified applications so that they are effective. Various design frameworks have been proposed, many rooted in research on human motivation [25][11]. Can the same design practices used to create fun and engaging video games be used to create fun and engaging motivational tools, which *feel* like games? How should the activity being gamified influence the design? Does gamification work better in some contexts than in others?

**Self Determination Theory** is a macro-theory of human motivation pioneered by Richard Ryan and Edward Deci [34]. It attempts to explain the motivational factors that make a given activity enjoyable and personally fulfilling. For many years, video game designers have leveraged the basics of Self Determination Theory (especially the concept of *intrinsic motivation*) to create games that are immersive and engaging. Many gamification frameworks

are also based on Self Determination Theory [15], although more evidence is required to establish a link between intrinsic motivation and gamification.

‘Does Gamification Work?’, a literature review by Hamari et al [15], suggested that future studies on gamification could implement specific game mechanics and hold them constant while varying the underlying gamified activity. This suggestion garnered criticism: “It is not the single elements that make a difference on whether or not gamification will be successful, but rather how they support one another and contribute to the overall experience of the gamified service” [8]. In the experiments described in this thesis, a general gamification ‘layer’ is used in tandem with a base application. The base application is designed for a specific activity, and the gamification layer adds game elements which are thought to be motivating across a variety of contexts.

We conducted two case studies to evaluate our gamification ‘layer’. SU Perks, is a reward-based application which encourages students to attend campus events and learn about University of Alberta campus resources. The second, FrancoPass, is an application which encourages students to attend events in the French community with the goal of increasing their motivation to learn a second language. Both applications make use of the same general gamification layer, the motivational effectiveness of which is compared in the two cases.

This thesis explores the questions of whether gamification works, whether gamified applications have an effect on intrinsic motivation as proposed by Self Determination Theory, and whether or not certain game mechanics are effective cross-contextually. The contributions include the general gamification layer itself and the two case studies.

The rest of this thesis is organized as follows. Chapter 2 describes the background and theories of motivation and gamification which inform the layer and experimental design. Chapter 3 provides an outline of the gamification layer, Chapter 4 describes and evaluates the SU Perks case study. Chapter 5 is

an explanation and evaluation of the FrancoPass case study. Finally, Chapter 6 presents the overall conclusions.

# Chapter 2

## Background and Related Research

Despite their enormous potential as motivational tools, many gamified applications fail due to a poor understanding of gameful design [26]. Game design elements cannot be added blindly to an application and expected to motivate users towards any given task. A variety of gamification design frameworks have been introduced to help designers thoughtfully create motivating, immersive, and task-specific games [25]. The general gamification layer evaluated in this thesis follows the MDA (mechanics, aesthetics, and dynamics) design framework and aims to examine the link between gamification and a theory of motivation called *Self Determination Theory* (SDT) [34].

### 2.1 Self Determination Theory

**Self Determination Theory** (SDT) is a theoretical framework for understanding human motivation. It attempts to define and explain the many complex factors that determine *intrinsic* and *extrinsic* motivation towards a given task or behaviour [33].

#### 2.1.1 Intrinsic Motivation

**Intrinsic Motivation** refers to “doing something because it is inherently interesting or enjoyable” [33]. When someone is intrinsically motivated towards a task, it means that they enjoy that task, they find it easy to focus, and

they are relatively unlikely to give up when things get difficult. Cross-cultural studies have concluded that intrinsic motivation is linked to psychological and physical well-being [31]. Behaviours that are both challenging and intrinsically satisfying often become a part of an individual's identity. For an activity to be intrinsically satisfying, it must meet three psychological needs: the need for *competence*, *autonomy*, and *relatedness*. Games designed with these needs in mind are fun and engaging.

**Competence** is the feeling that the task is achievable with an appropriate and predictable measure of effort. To promote feelings of competence, challenges within a game should require effort, but ultimately they must be within reach. Additionally, the game should not be frustrating to play; a simple task should require very little effort, while more complicated goals should have well-defined criteria that can be met with the right amount of effort.

**Autonomy** is a feeling of control over one's own behaviour; the ability to engage with a task by one's own volition and to express one's individuality by doing so. Players of a game should have the freedom to explore, play, fail, and make choices within the game context.

**Relatedness** is a feeling of connectedness to others. Games can cultivate a sense of community by including a team component and by allowing players and teammates to send each other messages.

Game elements such as points and badges by themselves are often not enough to persuade someone into doing something they may not feel like doing. A well-designed game gives users a sense of autonomy, competence, and relatedness, which make target behaviours (such as completing lessons or attending community events) more appealing.

Ultimately, we would like to see the gamification layer increase intrinsic motivation towards a given task. The game layer is designed to evoke a sense of relatedness by including teams and team messages. Additionally, certain



game mechanics aim to build users' feelings of competence. These include 'Thumbs Up' messages and system notifications which outline well-defined, reasonable challenges.

The hypotheses which will be assessed through the case studies focus on how the gamified applications affect user motivation, analyzing the relationship between the game mechanics used in the layer (cooperative and competitive messages, system notifications, leaderboards, and teams) and motivation as proposed by Self Determination Theory.

### 2.1.2 Extrinsic Motivation

**Extrinsic motivation** refers to “doing something because it leads to a separable outcome” [34]. Some examples of extrinsic rewards include money, prizes, or social recognition. An extrinsic ‘reward’ can also be the avoidance of a punishment or a threat, such as losing a perceived competition or avoiding getting in trouble.

According to motivational researchers Richard Ryan & Edward Deci, “extrinsic motivation has typically been characterized as a pale and impoverished (even if powerful) form of motivation that contrasts with intrinsic motivation” [33]. However, *Organismic Integration Theory*, a subtheory of SDT, describes different categories of extrinsic motivation. Some types are “impoverished” forms of motivation, but others represent “active, agentic states” [33]. It may not be a sustained or enriching type of motivation, extrinsic motivation is as important as any other factor in determining whether a person engages in a given behaviour.

There are certain tasks which no one would consider engaging in without an external reward. For example, one would not engage in the task of standing in a line for fifteen minutes without the reward of getting a coffee. Sometimes, however, extrinsic rewards may align with someone's intrinsic values to a some degree. For example, someone may apply for a job they are passionate about.

The behaviour leads to a separable outcome: a job. However, this particular job may align with an individual's identity since they may sincerely enjoy their work. Organismic Integration Theory defines four types of extrinsic motivation:

**External regulation** is motivation stemming from external rewards or avoiding threats. It is the least 'intrinsic' form of motivation. For example, a child may do the dishes to avoid parental confrontation.

**Introjected regulation** involves externally composed rules that an individual accepts as norms that they must follow in order not to feel guilty. For example, a person may hold the door for the person walking behind them.

**Identified regulation** means engaging in a behaviour because it is highly valued and useful. The task may not be enjoyable per se, but doing it is considered personally important.

**Integrated regulation** is choiceful behaviour which is coherent with an individual's needs, values, and identity. While there is still a reward or extrinsic factor involved, there is also some degree of underlying intrinsic motivation.

Understanding extrinsic motivation in a gamification context is useful for deciding when a reward is required and what type of reward it should be. If a gamified application involves filling out a potentially boring survey in order to gather data, there *must* be some kind of reward involved, and the reward should have an unambiguous and clear value. Alternatively, if the target behaviour has the potential to be intrinsically motivating, perhaps a very small 'reward' will give users a push towards the target behaviour, and even towards finding their own intrinsic reasons for engaging with it. In situations where the target behaviour requires intrinsic motivation, such as second language acquisition, users may see the reward as a progress indicator and a reflection of their effort [17].

While extrinsic rewards are not explicitly a part of the game layer, rewards were offered to teams who finished at the top of the leaderboard in both case studies. The base applications in both studies also included redeemable rewards. The impact of these rewards was evaluated.

## 2.2 Cooperative and Competitive messages

Researchers Chen and Pu explored the effects of social incentives in a mobile application for video games. Their application, HealthyTogether, tracked health-related activities such as physical activity and eating nutritious food. Users played the game in teams of two. The researchers divided the teams into three groups. In the Cooperative group, a user and their partner earn badges together. In the Competitive group, partners compete to earn badges. And in the Hybrid group, user scores were weighted so that earning badges was slightly determined by one's partner. Users could send two types of messages to their teammates: cheering (cooperative) and taunting (competitive) [1].

Overall, gamification was found to be an effective method of motivating people to stay healthy. Those who used HealthyTogether were 15% more active than those who did not. Interestingly, users in the both the Cooperative category and the Hybrid category far outperformed those in the Competitive category. It was also found that user motivation towards physical activities was linked to receiving more messages, and users were more likely to send each other cooperative messages.

The gamification layer includes two types of messages: cooperative ('Thumbs-Up') and competitive ('Challenge'). The idea is to see if the findings of Chen and Pu's study (which took place in the context of exercising and promoting healthy behaviours) hold true in the case studies, where users are not explicitly divided into cooperative and competitive groups. In a future version of the layer, the types of messages could be changed or adapted to fit a new context or accommodate a new experiment.

## 2.3 Goal Setting Theory

Locke and Latham's *goal setting theory* posits that for any action to take place, a goal must be set and pursued [22]. Goals may differ on two axes: in terms of specificity and in terms of difficulty.

When a goal is vague and onerous, such as 'I would like to learn a language', motivation may be easily undermined. For one thing, it is impossible to regulate effort and persistence if the criteria for achieving the goal is not clear. Additionally, people are not likely to judge themselves as competent towards goals that take many years to achieve, such as language acquisition.

Through mechanisms such as quests and challenges, gamified applications help to create *proximal subgoals* which serve as a powerful motivating function towards indefinite, demanding goals. Completing an activity in a gamified language-learning application meanings reaching a clear subgoal towards learning a language.

In the general gamification layer, leaderboards and system notifications are intended to help users set proximal subgoals. By seeing exactly how many points their team needs to move ahead, users can set achievable goals for themselves and their team. Users who are subscribed to system notifications receive emails that indicate how many points their team needs to move up in the leaderboard.

## 2.4 Rewards and the Overjustification Effect

The *Overjustification Effect* occurs when the expectation of an external reward undermines intrinsic motivation. Typically, introducing an incentive to a previously unrewarded activity causes motivation to become more extrinsic. When the reward is no longer offered, the initial degree of intrinsic motivation does not return [3].

The Overjustification Effect should give gamification designers pause. The aim of many gamified applications is towards long term behaviour change, and research on reward-based motivation posits that rewards are only useful in short-term behavioural change. The moment the reward disappears, so does the intrinsic motivation.

However, when rewards reflect effort and ability (as opposed to being fixed), intrinsic motivation stays intact and may even increase. This is because the reward may reinforce an individual's perception of their competence. Houldfort et al. performed two studies to examine the impact of performance-based rewards on perceived intrinsic motivation. In the studies, students were asked to perform problem-solving tasks. Some were given rewards regardless of their effort, and others only if they did well. In the first study, a correlation was found between performance-based rewards and an increase in self-perceived competence in undergraduate students. The second study drew the same conclusion among school age children [17]. The research would suggest that, for tasks which require intrinsic motivation, rewards should either accurately reflect competence or be avoided altogether in the design of the game.

Of course, not all target behaviours are intrinsically motivating to begin with. Tasks which are unpleasant or dull must be rewarded, otherwise people will not engage with them. For example, some applications gamify the experience of filling out surveys to gather data. Rewards are a necessary part of such applications.

Rewards are defined outside of the gamification layer, however, they are still an important part of the game. In both case studies, surveys included questions to assess the impact of rewards on user motivation. The intention is that future studies and implementations of the layer can take this feedback into account in order to avoid the overjustification effect.

## 2.5 Gamification in Education

Gamification has tremendous potential in the context of education. Game mechanics are thought to inspire students to learn by creating a sense of enjoyment around a subject or a skill.

Dicheva et al. surveyed 34 studies on gamification in education [6]. The majority of the reviewed studies concluded that gamification “has the potential to improve learning if it is well designed and used correctly”. The authors call for an investigation into the effectiveness of different game elements in the context of education. They found that leaderboards, points, and badges are the most commonly used elements. Additionally, they identified a few design principles which are often woven in to educational games: visual status (such as leaderboards), social engagement (such as teams), freedom of choice, freedom to fail, and rapid feedback.

Nah et al. conducted a similar survey and identified a set of particular game mechanics prevalent in educational games: points, levels, badges, leaderboards, prizes, progress bars, storylines, and feedback [28].

1. **Points** Points are a measure of progress and achievement for students.
2. **Levels** Levels are another way to give students a sense of progression in the game. Initial levels can be achieved with minimal effort, whereas advanced levels should require more time and skill.
3. **Badges** Badges are helpful for engaging the learners in setting specific learning goals.
4. **Leaderboards** Leaderboards are a motivational tool which may motivate students to advance their achievements.
5. **Rewards** Some argue that prizes, depending on the timing of rewards and the scale of rewards, are effective in motivating students.

6. **Progress bars** While badges demonstrate advancement towards a specific goal, progress bars are used to indicate to a student their overall progression in the game.
7. **Storyline** Narratives can be used to maintain student's interest, provide context for solving a problem, or illustrate how concepts being taught in the game apply to real-life situations.
8. **Feedback** Frequent feedback is critical for educational games as it helps students evaluate their decisions in real-time and become immersed in the game.

The general gamification layer described in the next chapter includes points and leaderboards as game mechanics for users to measure their progress. Both of the base applications used to evaluate the layer are already gamified; they include levels, rewards, feedback, and one (FrancoPass) includes badges. While the layer itself is intended to be context-independent, ideally it should be easy to implement in a learning environment, which is important because education is a very popular context for gamification.

## 2.6 Gamification Design Frameworks

Many frameworks for designing gamified applications have been proposed, often with a set of target activities in mind. Mora et al. reviewed and classified a variety of frameworks, both generic and context-specific, included those that pertain to business, learning, and health. In her analysis of the impact of context on gamified design, Finckenhagen considered five common environments for gamification: education, business, health, online communities, and sustainability.

Learning is one of the most popular contexts for gamification, with learning a second language being of particular interest. Methods of second language instruction have evolved throughout the years, from techniques that focused on long and elaborate explanations of grammar, to repetitive drills, and finally

to more modern approaches such as Communicative Language Teaching (CLT) [10]. CLT emphasizes five principles:

1. An emphasis on learning to communicate through interaction in the target language.
2. The introduction of authentic texts into the learning situation.
3. An enhancement of the learner's own personal experiences as important contributing elements to classroom learning.
4. An attempt to link classroom language learning with language activities outside the classroom.

CLT places an emphasis on real-world, hands-on learning when acquiring a second language. The FrancoPass application, one of the case studies used to test the gamification layer proposed in this thesis, gamifies authentic communication in a second language community.

Huang and Soman [18] proposed a framework for gamification design in education. This framework was referenced by Flores in a review of the role of gamification in second language instruction [10]. The framework consists of five steps.

1. **Understanding the Target Audience and the Context** is the first step in the design process. The game designer should know their students and consider factors such as group size, skill level, student motivation, and pain points.
2. **Defining the Learning Objectives** means setting general and specific goals for learners, including behavioural goals.
3. **Structuring the Experience** means preparing a sequence of steps for the student, based on the learning objectives, which they will complete in the game.



4. **Identifying Resources** is step four. When the learning sequence has been defined, it should be clear which steps can and cannot be gamified. Game concepts can be defined here, such as levels, rules, game mechanics, and feedback.

Few frameworks have been designed for the specific context of community engagement or event attendance, some of the main activities being gamified in the case studies described in Chapters 4 and 5. Hassan created a framework for civic engagement platforms, which may be considered relevant to community engagement [16]. The framework adopts “self-determination theory, organismic integration theory and other motivational research in order to develop a theoretical framework that explores how gamified services could be designed to extrinsically and intrinsically motivate individuals”. The researchers are interested in persuading users to engage in civic deliberation, which they argue is a core component of civic engagement.

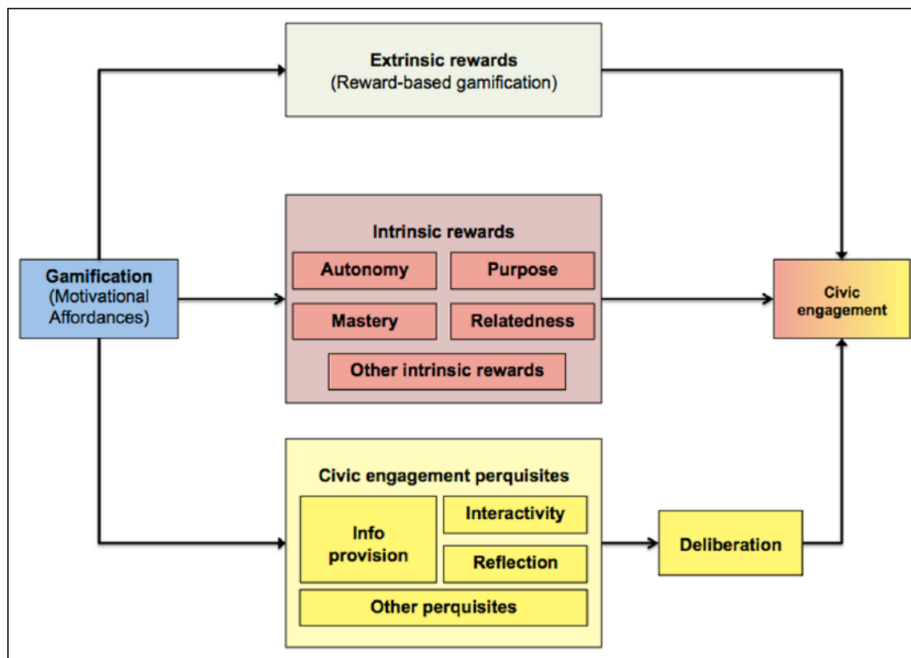


Figure 2.1: Few frameworks have been designed for the specific context of community engagement or event attendance. The civic engagement framework outlined in the above image (from [16]) may be considered relevant.

Fitzwalter et al. created a framework which was used in a case study on gamifying the campus orientation experience [9]. Their framework consisted of three interconnected principles: goals, sensing, and game. The goals of the application were to encourage campus exploration and participation in campus events. In order to sense or track these activities, the application includes a calendar showing students current and future events on campus, a contacts page where students can add each other, and a location-aware map that shows campus buildings. Finally, game elements were added to the application, namely ‘Challenges’. Students were encouraged towards specific sets of tasks, such as exploring the campus and important buildings, collecting items such as a semester planner and student card, and learning about campus services.

The gamification layer is intended to be context-independent, and cannot rely on a framework designed for the specific contexts of education or civic engagement. For this reason, a more general framework was chosen in designing the layer.

### 2.6.1 The MDA Framework

Originally used for traditional video game development, the MDA model attempts to bridge the gap between game design, game development, game criticism, and technical game research. The framework is meant to guide the game designer into creating an immersive player experience. MDA stands for Mechanics, Dynamics, and Aesthetics [19], which are defined as follows.

**Aesthetics** Games should be designed with specific aesthetic intentions. Game designers should resist the temptation to describe their games simply as ‘fun’ and instead aim for concepts that are more specific, including ideas such as *Narrative*, *Challenge*, *Fellowship* or *Discovery*.

**Dynamics** Dynamics are the means of creating aesthetic experiences. For example, *Challenge* might be created by time and pressure. *Fellowship* may be

achieved by encouraging interaction between teams and by including winning conditions that are impossible to achieve alone.

**Mechanics** Game Mechanics are the actions, behaviours, and control mechanisms allotted to the player. These are the elements which determine how the game is actually played.

Game designers decide on game mechanics, which determine game dynamics, which generate game aesthetics perceived by the player. Mechanics such as teams, time constraints, and leaderboards can combine dynamically to create the aesthetic experience of *Challenge* and *Fellowship*.

The game layer described in the next chapter is meant to embody the aesthetics of **Challenge** and **Fellowship**, in the hopes that these concepts will appeal to a variety of users across both of the proposed contexts. It is referred to as the Challenge and Fellowship (CF) layer.

**Challenge** mechanics include the leaderboard, competitive (“Challenge”) messages, and system messages which encourage the user to get more points in the upcoming week. Users may feel social pressure from their teams, especially if they receive “Challenge” messages. In both implementations, the teams competition had a time constraint. These are dynamics which relate to the aesthetic experience of Challenge.

Teams and co-operative “Thumbs-up” messages embody a **Fellowship** aesthetic: for both implementations of the game, it was impossible to win prizes without a team. Being recognized by peers for achieving a higher score (such as by receiving a ‘Thumbs-up’ message) and being able to invite peers to the application is also intended to create a sense of fellowship within the game.

# Chapter 3

## The CF Layer

The technical contribution of this work is a *gamification layer*, called the CF (Challenge and Fellowship) layer, which adds the game mechanisms of teams, leaderboards, teammate messages, and email notifications to gamify an existing application. The hypothesis is that these mechanisms are helpful in motivating individuals in a variety of differing contexts, and that adding this layer to an application can motivate users towards a given target behaviour. The layer relies on a base application, which must expose two at least two API endpoints.

### 3.1 Integrating the CF layer with a base application

So far, the gamification layer has been integrated into two contexts: campus engagement and engagement with a minority language community. Both of the base applications it has been integrated with were already gamified, but this does not necessarily need to be the case for future implementations. The hypothesis is that the CF layer will prove to be motivating in a variety of contexts. Before integrating the layer into a given context, the following must be decided on:

#### A Scoring System

The layer needs to pull scores from the base application. Any number of different scores can be adapted to the system- for example, an application

may track points and badges, or volunteer hours, or number of days without smoking. The way that team scores are computed can also be determined by context.

### **Team Types**

Teams may compete in different pre-defined categories. The intention is not to categorize teams in a strict sense, but rather to disperse the competition and give teams a better chance of appearing on the leaderboard. Anyone is allowed to create a team and give it a name of their choice. Different contexts will require the specification of different team types. Both of the implementations use three team types, however, the number of team types is not strictly limited.

### **Message Types**

A number of preset message types may be specified. Users can send messages to those who are on the same team as them. In both of the presented integrations, there are two types of messages: cooperative (“Thumbs-Up”) and competitive “Challenge”). Part of the experiment is to ascertain which type of message is more likely to encourage a user towards the target behaviour. Messages types can be customized according to a given context.

### **Leaderboards**

A basic version of the layer would contain one leaderboard for each team, an overall leaderboard for all teams, and a leaderboard featuring individual players. Leaderboards pertaining to specific quests or campaigns could be included and displayed to users who are part of the quest. This would require that campaign data be passed to the layer via the API.

### **User Types**

Certain contexts might require ‘admin’ users, whose scores do not count towards a team score. These may be course instructors, community leaders, or others in a supervisory or administrative role, who wish to take part in a team (perhaps be the team captain) but should not affect the team score.

## **Team Constraints**

The number of teams a user may join can also be decided on in terms of the application. The maximum number of members for a team must also be specified.

## **Custom Notifications(optional)**

The criteria for sending system-generated emails as well as the message content can be customized.

In both the SU Perks and FrancoPass applications, some students received system notifications while some did not. This was decided randomly (via a coin flip). In the future, other criteria could be used; for example, users may wish to subscribe to system notifications themselves.

## **Rewards(optional)**

The CF layer ranks users and teams based on the given scoring system. It does not define when and how, if at all, the teams receive a reward based on their rank. For both studies, rewards (gift cards) for winning teams were decided on by the research team and announced to players via email. Depending on the context, rewards may not be necessary for motivation. However, if an extrinsic reward system is required, it needs to be defined and communicated to users independent of the gamification layer.

Some technical work and testing is required in order to customize the CF layer according to the above design decisions. (For future versions of the layer, this may not be the case. An interface could be designed to allow an administrative user to enter team and message types, for example.)

Another step to fully integrating the layer may involve the integration of reusable components from the base application. For example, we may wish to integrate the layer with an application that has a navigation menu. This

menu can be added as static HTML in the CF layer to create consistency for the user.

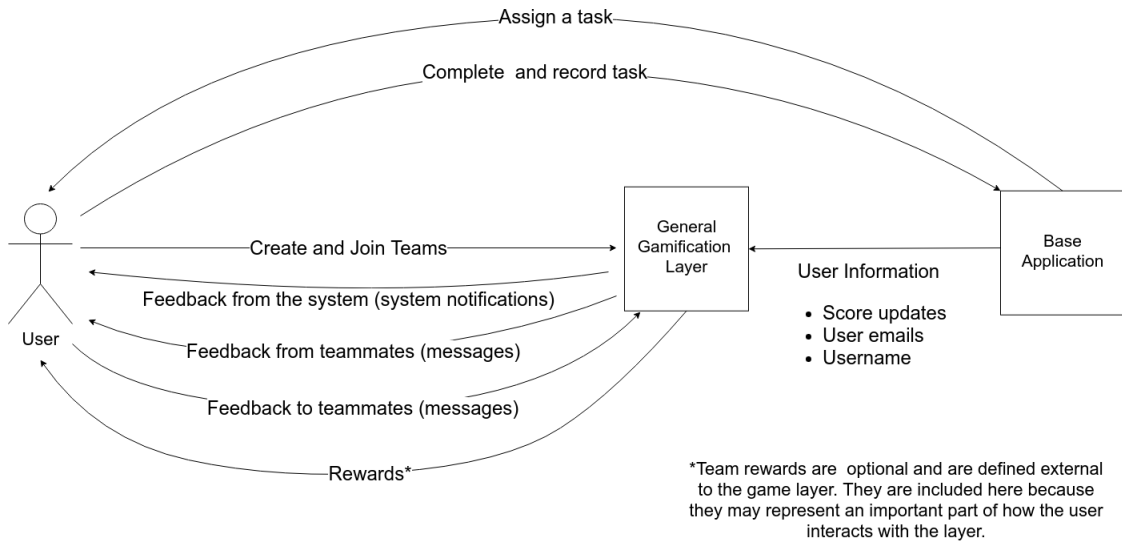


Figure 3.1: An overview of interactions between the gamification layer, the base application, and the user. A necessary factor is that the base application is able to track an activity. The activity is then gamified by the CF layer.

**Base Application Requirements** To integrate the layer, the following requirements must be met by the base application:

- **Activity Tracking** The base application must track some sort of activity which is being gamified. For example, the base application may track volunteer hours or minutes spent exercising. The CF layer uses the data gathered by the base application to assign each user a score.
- **API Requirements** Two API endpoints must be present in the base application: one to update user scores and relevant data, and another to start a session for the logged in user. These are described in detail in Appendix D.
- **Navigation to game layer** Users should be able to navigate from the base application to the game layer, via links to both the Leaderboards page and the My Teams page.

## 3.2 Functionality

Figure 3.2 outlines the navigational flow of the layer. Two links are present in the base application: one to the leaderboards and another to the ‘My Teams’ landing page.

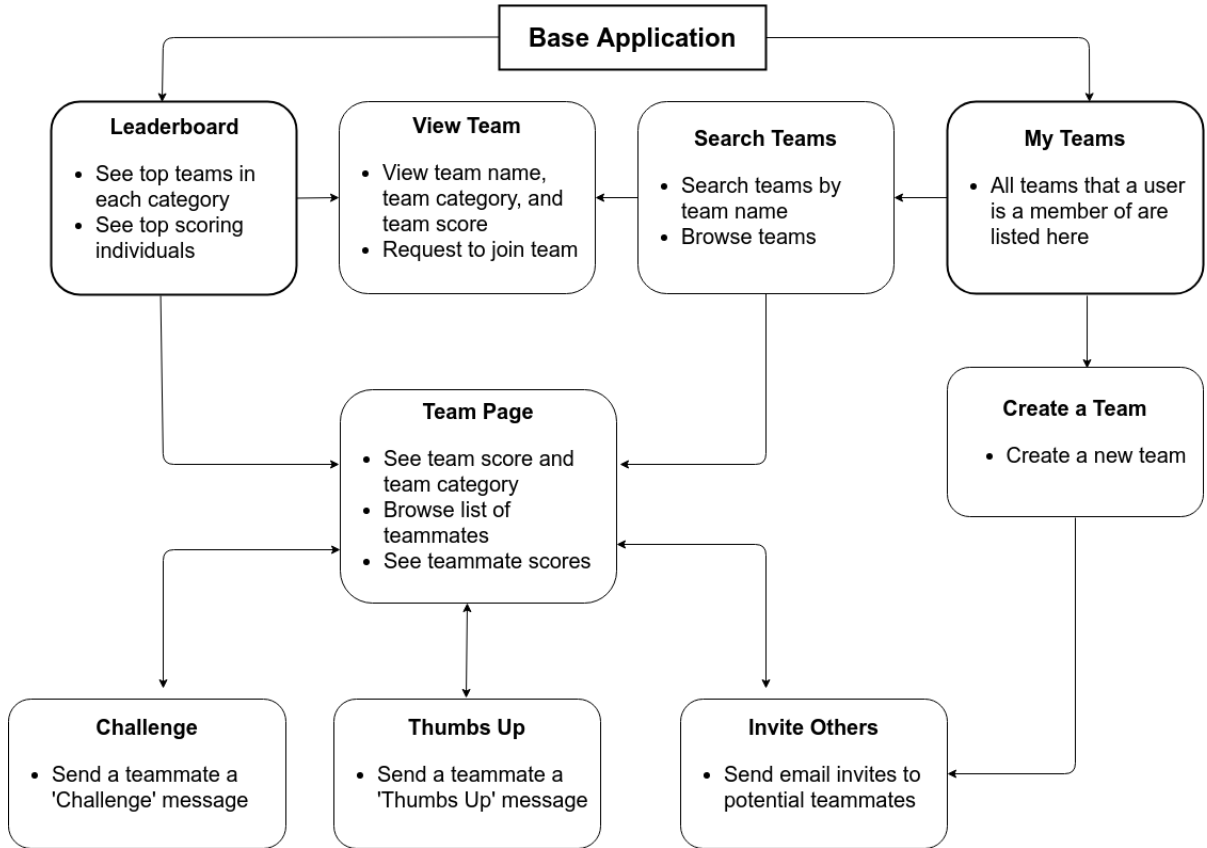


Figure 3.2: An overview of the CF layer.

### 3.2.1 Teams

Teams are intended to foster a sense of *fellowship* and *relatedness* among users, thereby increasing intrinsic motivation [33]. When creating a team, there are no restrictions on team names and users may be creative— they have some degree of *autonomy*. (Team names which are offensive or inappropriate may be reported to administrators and removed.) Users may join multiple teams and invite their peers to teams via email.



Users may request to join an existing team by going to the team page and clicking ‘Request to Join’. The team captain (who, by default, is the user who created the team) will see a message prompting them to log in to the application and approve the request. If they have already joined the maximum number of teams, they will see a statement on the team page saying they cannot join any more teams.

Team captains may remove members from their team and team members can choose to leave a team at any time.

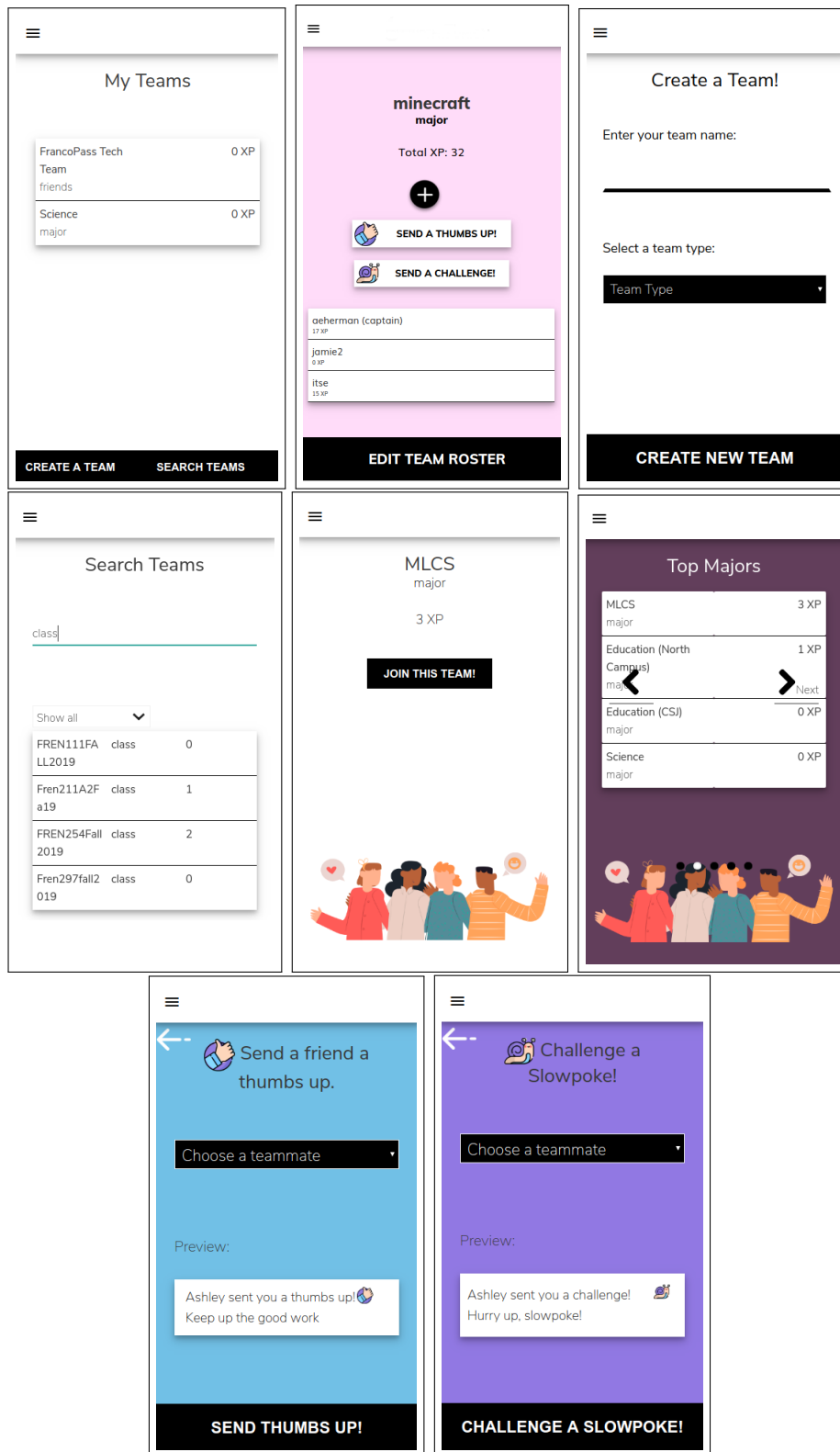


Figure 3.3: Screenshots of each page of the gamified layer.

### 3.2.2 Poke Teammates

Sending competitive and cooperative messages is another way for teammates to connect with each other and build a sense of relatedness. Users can send cooperative or competitive messages to their teammates. Chen and Pu’s ‘HealthyTogether’ study suggests that cooperative messages are more effective than competitive messages in motivating players [1]. The reason for this may be that positive messages play into users’ psychological need for *competence*, one of key factors in intrinsic motivation proposed by Self Determination Theory. We would like to compare the behaviour of users who received and sent different kinds of messages to see if co-operative messaging is a stronger motivator across different game contexts.

The cooperative message is a “Thumbs-up” telling users to “Keep up the good work”, and the competitive message is a “Challenge”, telling users to “hurry up”. Users are not able to send messages to each other unless they belong to the same team. This is intended to encourage fellowship and team cohesion.

### 3.2.3 Leaderboards

Users may scroll through a set of leaderboards to see leading players and their respective score. For team leaderboards, team names are displayed, and for individual leaderboards, the player’s username is displayed. Each team type has a corresponding leaderboard. For example, in an application used on a university campus, there may be five leaderboards in total: top teams (all teams category), top departments/majors, top student groups, top friend groups, and top members (individual users). Leaderboards help users see what they need to accomplish to move ahead in the overall rankings, helping them set challenges for themselves and their teams. They may set a clearly defined and attainable proximal subgoal [22] towards the target behaviour, which help users toward a feeling of competence [33] when using the application.

Using multiple team categories gives teams a higher chance of appearing on one of the leaderboards, also serving the motivational need for competence proposed by Self Determination Theory.

### **3.2.4 Email Notifications**

If a user is subscribed to notifications, they are sent a weekly email from the application notifying them how many points they need to catch up to the team ahead of them, and they are challenged to go for those points in the upcoming week. The email serves the same function as the leaderboard, that is, setting a clearly defined and attainable proximal subgoal [22] towards the target behaviour and thereby reinforcing a feeling of competence [33].

In both studies, participants are subscribed to email notifications via a coin flip when they agree to participate in the study. This is in part to address a concern over lack of control groups raised by Hamari [15]. Those who received email notifications were expected to be more engaged and score higher than those who are not.

## **3.3 Evaluation and Experimental Design**

Base applications used to test the CF layer include FrancoPass and SU Perks. In both contexts, the base application is already gamified, but this is not required in order to integrate the layer.

### **3.3.1 SU Perks**

The purpose of the SU Perks project was to develop a mobile application designed to encourage new and existing students at the University of Alberta to attend campus events, test their knowledge of campus resources, and provide feedback on said resources. The app uses gamification principles to trigger students' motivation to stay or become engaged on the University of Alberta campus.

The main hypothesis is that gamification can have a positive impact on students' integration into the University of Alberta community. Our expectation was that the game mechanics of the application, such as teams, would increase students' motivation to participate in campus events, especially Week of Welcome (a week-long series of orientation events which takes place at the beginning of the Fall semester). As they attend events, meet people, and are encouraged to learn about the University of Alberta campus as well as provide feedback through the app, we expected that they would experience an increased feeling of belonging on campus and would be more likely to continue studying at the university.

The base application and study methodology is described in detail in Chapter 4.

Students using the app were able to earn XP points when attending events through the base application, SU Perks. These points were redeemable for rewards such as free coffee. This implementation of the CF layer was dubbed 'SU Perks Teams'. The application first launched on August 29 to students involved in organising Week of Welcome, it launched again on September 2, at the start of the 2019 Week of Welcome, and it remained live until the end of September.

SU Perks team categories included friend group teams, student group teams, and department/major teams. The team score was the sum of the scores of all team members. Teams were limited to 15 members. The teams competition ended on September 16. Winning team members were rewarded with gift cards to either Tim Hortons or Starbucks (their choice) at a value of \$15. Winning teams were those that were at the top of their respective leaderboard at the end of the competition. The top overall team received an additional \$15 on their gift card.

Data was collected to help evaluate the impact of the SU app on the students' attitude towards the University of Alberta campus. A survey was sent out to participants which assessed student's attitudes towards the application. The base application also contains a 'surveys' feature which allows students to give feedback on specific campus resources and the application itself. They received points in the application for completing these surveys. The analysis consisted of interpreting students' answers to the surveys included in Appendix A as well as analyzing data generated from using the teams component of the application.

### **3.3.2 FrancoPass**

The purpose of the FrancoPass study was to develop a mobile application that would encourage students to participate in activities in the local francophone community and ultimately increase their motivation to learn more about French language and culture. FrancoPass users receive XP points primarily by attending events in Edmonton's Francophone community, they also receive points for taking quizzes and responding to surveys through the base application. These points can be redeemed for rewards using the base application. The rewards offered by the application were relevant to the Francophone community and included chances to win tickets to Francophone movies and concerts- these types of rewards were chosen so that intrinsic motivation would not be undermined [3]. FrancoPass launched as a Beta test during the Fall 2019 semester and was promoted to students taking French courses.

The hypothesis underlying this project is that attending events in the Francophone community can have a positive impact on students' linguistic competence and perception of the Francophone community. Positive perception of the local minority language community is thought to increase motivation to learn a minority language [12][13]. A subsequent hypothesis is that gamification can motivate students to attend events in the minority language community. This assumption is also based on empirical evidence collected by Dr. Sathya Rao over the past 7 years with the implementation of the "passport

social”, essentially a paper ‘passport’ game in which users receive ‘stamps’ for attending local Francophone events.

Three team types included in FrancoPass were: Friend teams, Classroom teams, and department/major teams. Team scores were the average score of all student members. The maximum number of individuals on any team was limited to 30. The Teams competition closed on December 6, 2019 at midnight. FrancoPass teams include ‘admin’ users, whose scores do not count as part of the team score. Gift cards to Cafe Bicyclette, a popular Francophone cafe, were offered as team prizes. Winning teams were those that were on the top of their respective leaderboard at the end of the competition, a bonus \$5 was awarded to the top overall team.

Two surveys, one for students and one for instructors, were used to collect data. The student survey includes both a Before and After section to assess whether student perceptions of the Francophone community have changed after using FrancoPass over the course of the semester. Surveys are included in Appendix B.

The FrancoPass case study is described in detail in Chapter 5.

# Chapter 4

## SU Perks: Gamification and Campus Engagement

### 4.1 Background: Motivation and Campus Engagement

During their first year of university, students take on a unique variety of challenges and opportunities. “First Year” might mean living away from home for the first time, agonizing over the decision of what to major in, or even questioning one’s motivation in going to university. Many are scrambling to find new friends and new support systems to help them navigate their next four to six years.

Multiple studies have found that providing students with information about campus services predicts student retention and even their grades. The most common way for new students to start learning about the campus is through orientation events. Murtaugh et al. analyzed 8867 first-year students and found that those who participated in orientation were statistically more likely to complete their degree [27]. Glass et al. found that completing an orientation course was statistically correlated with better grades (N=128) [20].

Motivating students to attend campus events and encouraging interaction between students could increase students’ chance of successfully completing their degree. Additionally, designing an application that gives feedback to the University of Alberta Student Union will help to assess the needs of new and



continuing students. A gamified application can act as a motivational tool to encourage students to attend events, provide feedback, and get the most out of what the University of Alberta has to offer.

#### **4.1.1 Gamification on Campus: Related studies**

There have been a few different research projects which attempted to gamify student involvement on campus, but the results are largely inconclusive. Understanding the challenges faced by the following studies is still useful in informing our effort to design a gamified application to promote campus involvement at the University of Alberta.

Miyuki et al. created WhatsINFO, a gamified app which was designed to accompany and encourage participation of first year students at the Universidad Nacional de La Plata in Argentina [24].

Over 150 students downloaded the application and gave it a positive rating; it averaged 4.93 / 5 stars. However, only half of the students who downloaded the app reported using it, likely due to technical issues.

Fitz-Walter et al. used a gamified smartphone application which was built to introduce new students to the campus services and people within their university during their first few weeks as part of orientation [9]. The researchers found that, generally speaking, the gamified app complemented the orientation that students participated in. While students reported that the application motivated them to learn more about the university and explore the campus, participation in the app itself appears to have been somewhat limited. The authors note that further research is required.

Users reported a number of problems when running the application. One issue stems from the “dynamic nature of events”, which it seems may have been cancelled or rescheduled to different times and locations. The app used

QR code scanning as a way to prove that students had attended an event, and some students had trouble finding the QR codes they were intended to scan.

Decker and Lawley created ‘Just Press Play’, a game-based achievement system designed to help first-year computer science students at the University of Rochester traverse their undergraduate experience [4]. The app connected students through both social and creative activities. Generally, the researchers claim that the app meant that students had a better experience in their first year at university. Participation in the app was non-curricular and voluntary. The game was quest-based and rewarded activities such as attending campus social events, going to an instructor’s office hours, meeting with an academic advisor, or community involvement such as creating a flash mob. The researchers noted that a number of technical problems meant that the app was not as widely adopted as it could have been, and began working on releasing a new version of the app.

‘Just Press Play’ was mostly promoted to one particular computer science class, but it was not geared explicitly towards learning the course material. Instead, the app included many ways for users to ‘level up’, including extracurricular involvement and using campus resources like academic advising. Again, the researchers noted that bugs in the app kept them from getting the data and the results that they wanted.

## **4.2 The SU Perks Application**

SU Perks is a mobile-first web application designed to encourage students at the University of Alberta to attend campus orientation events, test their knowledge of campus resources, and provide the Student Union with feedback. The app uses a system of points, levels, and rewards to educate students about campus resources and guide them towards behaviours that will help them stay engaged on campus.

The application was originally developed by Computing science students Chase Buhler, Marissa Snihur, Andy Li, Ivan Tse, James Jewitt, and Kean Wang Yap. The look and feel of the site was designed by Anna Chakravorty. It was then refined by Chase Buhler and Jay Ward of the University of Alberta Student Union (UASU) for use in a beta trial and research experiment.

Points act as a currency in the application. They can be used to redeem rewards from the shop. Points can be obtained by attending events, completing surveys, and answering quizzes correctly.

Experience points (XP) are used to track and reward user engagement. The more students engage with the application, the more XP they earn. The CF layer described in Chapter 3 uses XP for team and individual scoring. The app also contains levels, which are determined by XP. Level one users have 10 XP. Leveling up is based on an exponential curve. Users gain XP by attending events, completing surveys, attempting quizzes, and logging in to the app daily.

**Attending events** Events may include: dramatic performances and socials organized by University student clubs, events put on by the student union (such as a hypnotist show), and informative events (such as the University President’s Address). Geo-location through the google maps API is used to verify whether a user attended an event.

**Completing Surveys** Surveys can be created and added to the application to get feedback from students on a variety of topics, including the UASU website design, how they feel about job prospects after graduation, and whether they are aware of the various features included in SU Perks.

**Quizzes** Points are awarded when a student gets all the questions correct on a quiz. Quizzes are designed to test students’ knowledge about campus services, events, and resources.

### 4.2.1 Integrating the CF layer: SU Perks Teams

“SU Perks Teams” refers to the Challenge and Fellowship layer which was added to the SU Perks base application. Only XP scores were used by the layer. There were three team categories: departments/majors, student clubs, and friend teams. Approximately half of beta trial users were automatically subscribed to weekly emails which encouraged them to get ahead in the leaderboard. Team scores simply consisted of the sum of all team member scores. Teams were limited to 15 members. Winning team members were rewarded with \$15 gift cards to either Tim Hortons or Starbucks. Winning teams were those that were at the top of their respective leaderboard at the end of the competition. The top overall team received an additional \$15 on their gift card.

The API (specified in Appendix D) exposes the following information to the gamification layer: username, email, first name, last name, points to redeem, XP points, and level. This endpoint is called every hour to add new users to the system and to update existing user scores. Some of the information which was originally added to the endpoint was not used by the gamification layer in the end (first and last names, redeemable points, and levels). This information would potentially be useful for introducing more complex scoring systems or personalized emails. It is also useful for analyzing the data generated by the layer. The login endpoint exposes the users’ email (which is considered a unique identifier on the platform), as well as their user score and username, which are used only if the user is logging in for the first time and has not been added to the layer’s database yet.

## 4.3 The SU Perks Beta Trial

The SU Perks beta trial ran for approximately one month. The application launched on August 29, 2019 to students involved in organising Week of Welcome, and was introduced to the rest of the student population on September 2, at the start of the 2019 Week of Welcome (a week-long University of Alberta

orientation event). SU Perks Teams remained live until September 16, and SU Perks was live until the end of September, giving students time to redeem rewards.

The SU Perks Application is owned by the University of Alberta Student Union, who gathered their own data to assess the beta trial. SU Perks Teams was developed as an add-on by the research team. The data discussed in this thesis is from students who agreed to participate in the teams component of the application. It should be noted that many of the students who agreed to participate in the Teams portion of the study did not, in fact, join any teams.

The beta release was designed to coincide with orientation week because it was believed that new students had the most to gain from using the application. Team prizes were first announced to students on September 5 2019. A survey was sent out after September 16 which assessed student's attitudes towards the application. Winning teams were announced September 17 2019.

### **4.3.1 Data Collection**

Data generated by users was collected by SU Perks Teams during the beta trial. Specifically, the data set includes individual and team scores, team enrollment data, messages sent and received, and data on event attendance (which user attended which event). Identifying information, such as email addresses and team names, were obscured for the purposes of analyzing the data.

In the after survey, students were asked to rate how strongly they agreed with each statement (1= Disagree, 5= Agree). It should be noted that students who perceived the application positively may have been more likely to answer the survey, which introduces a potential bias in the results. Out of 134 participants, 26 responded. The survey was anonymous and can be found in Appendix A.

Because the app was presented to students through volunteers at the Week of Welcome (an orientation event at the University of Alberta), we expected that many participants would be in their first year of study. Many attendees are first-years students who are getting acquainted with the campus. However, this was not the case at all: in fact, none of the survey participants were in their first year of study, and the majority were in their fourth or fifth year. Perhaps they were able to attain a higher score due to already being familiar with the campus, and this made the application more interesting to them. In the future, more could be done to make the app useful for incoming students. For example, an information section could be added that would help them score higher on quizzes.

Table 4.1: None of the survey respondents were in their first year.

<b>Year of Study</b>	<b>Number of Students</b>
1	0
2	3
3	5
4	7
5	8
6	1
Past 6th year	2

Students from different backgrounds may perceive their degree of belonging on the University of Alberta campus differently. The survey responses of different demographics were compared (gender, year of study) when analyzing the responses. It would have been valuable to note the differences in responses between international and domestic students, but the survey responses indicate that very few international students used the application. The reasons for this are not clear. It is possible that domestic students, who may have some degree of familiarity with campus resources, were able to attain a higher score on the application, experienced greater feelings of competence [34] and thus adopted SU Perks application. Future iterations of the application could do more to target international students.

Table 4.2: Only one international student responded to the survey.

International Status	Number of Students
International	1
Domestic	25

### 4.3.2 Hypotheses and Findings

#### A note on the statistics

To evaluate responses to individual statements in the survey, a one sample t-test was performed. An unpaired 2 sample t-test was used to compare difference demographics (male/female, high scoring/low scoring). Only t-statistics with corresponding  $\rho$  values less than 0.05 are considered to be statistically significant. For all cases, two-tailed tests were considered. The statistical tests used make a few underlying assumptions.

The statistical tests used make a few underlying assumptions. In the case of the survey data, students were expected to select ‘neutral’ if they had no opinion on a statement, however, we cannot be sure that this is what they did. T-tests also assume that the data comes from a representative and randomly selected subset of the total population, which is not necessarily true of the data set: It is quite possible that students who liked the application were more likely to answer the after-survey. Finally, we cannot show that the survey data or app-generated data are normally distributed, and the number of survey data points is on the smaller side (n=26).

#### **Hypothesis: Teams increased user engagement.**

Of the students who joined teams, most knew their teammates in person(see Table 4.3). This is true in spite of the fact that they could request to join as many teams as possible to increase their chances of winning. Students generally did not seem to request to join teams which were high on the leaderboard, instead remaining on teams of people that they knew. According to Self Determination Theory [34], relatedness is a key to motivation. Users are more

motivated when they feel connected to their teammates. Pre-existing feelings of fellowship could have determined whether students would join a team in the first place.

Table 4.3: Students reported on who the students in their teams were.

<b>Response</b>	<b>Number of Responses</b>
Students whom I did not know.	3
Students I met at orientation or Week of Welcome	1
Students who share similar interests as me.	2
Friends of mine.	7
I did not join any teams.	15
No one accepted me into their team.	1

Both students who joined teams and those who didn't were equally likely to say that the application was informative or helpful (see Table 4.5 and Table 4.4). However, students who joined teams outperformed those who did not. Tables 4.7 and 4.6 indicate that students who joined teams tended to score higher. The result is statistically significant in terms of levels ( $\rho = 0.000403$ ) and individual XP ( $\rho = 0.001296$ ). It would appear that being on a team increases user motivation; which supports the hypothesis that some intrinsic motivators (specifically *relatedness*) can be utilized in the design of gamified applications.

Table 4.4: Responses to "Using this application was helpful for me".

<b>Response</b>	<b>Number of Responses (joined teams)</b>	<b>Number of responses (did not join teams)</b>
Disagree	0	0
Slightly disagree	0	1
Neutral	3	5
Slightly Agree	4	4
Agree	4	5

Close, friendly teams are expected to outperform other teams, as team members are assumed to have a greater degree of *relatedness* [35]. Teams that



Table 4.5: Responses to “The application helped me learn about campus resources”.

<b>Responses</b>	<b>Number of Responses (joined teams)</b>	<b>Number of responses (did not join teams)</b>
Disagree	0	0
Slightly disagree	1	1
Neutral	1	7
Slightly Agree	5	5
Agree	4	3

Table 4.6: Level achieved by students on teams and not on teams.

<b>Level attained</b>	<b>Students who joined teams</b>	<b>Students who did not join teams</b>
1	12	47
2	16	11
3	11	13
4	14	6
5	2	5
6	4	2
7	1	0

Table 4.7: XP achieved by students on teams and not on teams.

<b>XP attained</b>	<b>Students who joined teams</b>	<b>Students who did not join teams.</b>
0-10	16	48
11-20	12	10
21-30	11	12
31-40	12	5
41-50	3	5
51-60	1	3
61-70	4	1
71-80	0	0
81-90	1	0

attend events together were expected to score higher, since the individuals on those teams are expected to experience more motivation. Team data was divided into four quartiles based on team performance. Teams which scored

in the lowest quartile all consisted of only 1 member, so the second quartile has also been tested for statistical significance. Top-scoring teams tended to be those with a higher percentage of the team attending events together, compared to teams in the first and second quartile ( $\rho = 0.00230$  and  $\rho = 0.009401$ , respectively). This suggests that teammates who attended events together were, in fact, more motivated.

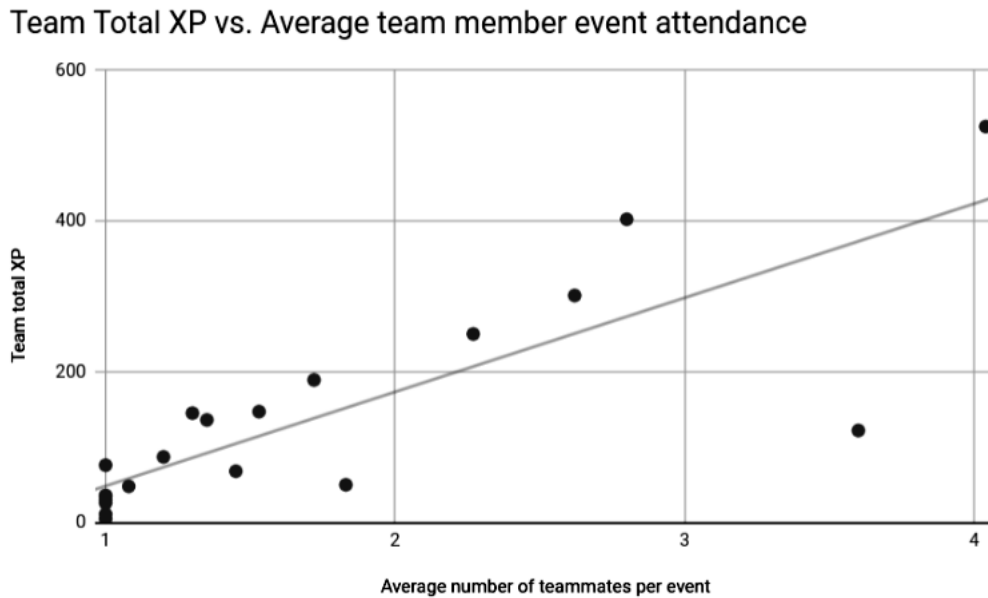


Figure 4.1: Teams who attended events together had a tendency to score higher.

**Hypothesis: Messages act as motivational tools.**

Positive feedback reinforces a psychological need for competence [35]. This may correlate to preference for receiving ‘Thumbs-up’ messages as well as for sending them. No definitive claims can be made from the survey indicating that encouraging messages were preferred over competitive ones. Out of the 26 survey responses, only 10 reported that they had joined teams. Perhaps a future trial and survey will show that students prefer co-operative messages. Data from SU Perks Teams shows that co-operative messages were more popular than competitive ‘Challenge’ messages (see Table 4.10).

Table 4.8: Responses to “I liked sending Thumbs-up messages more than sending Challenge messages”.

<b>Response</b>	<b>Number of Students</b>
Disagree	1
Slightly disagree	0
Neutral	4
Slightly agree	2
Agree	3

Table 4.9: Responses to “Receiving a Thumbs-up message from someone on my team motivated me to get more points”.

<b>Response</b>	<b>Number of Students</b>
Disagree	1
Slightly disagree	1
Neutral	2
Slightly agree	4
Agree	2

Table 4.10: Co-operative ‘Thumbs-up’ messages were more popular than competitive ‘Challenge’ messages.

<b>Type of Message</b>	<b>Number of Messages</b>
Thumbs Up	158
Challenge	101

Receiving messages from teammates is intended to increase feelings of relatedness and team cohesion, which may act as a motivator for users to engage with the application. The hypothesis that receiving messages motivated users to attend events was evaluated (Tables 4.11 and 4.12). The average time intervals between event attendance for students who did not receive messages versus those who did was compared, however the results were not statistically significant.

If messages act as motivational tools, and competence is reinforced by co-operative ‘Thumbs-up’ messages, then it is reasonable to expect that users in

Table 4.11: Number of students who attended vs. did not attend an event within 24 hours of receiving a message from a teammate.

<b>Attended an event</b>	<b>Number of Students</b>
Yes	52
No	30

Table 4.12: Number of students who attended vs. did not attend an event within 48 hours of receiving a message from a teammate.

<b>Attended an event</b>	<b>Number of Students</b>
Yes	58
No	24

the top quartile of performance received more ‘Thumbs-up’ messages. From the HealthyTogether study [1], we might also expect to see users who received more cooperative messages perform better. However, no statistical difference could be found between high scoring and low scoring users received in terms of how many ‘Thumbs-Up’ messages they received. Sending ‘Thumbs-up’ messages to low scoring teammates may represent an attempt by users to engage each other on the platform in order to boost their team score.

Table 4.13: Number of messages received by users in the top quartile of performance versus the lowest quartile of performance.

<b>Number of ‘Thumbs-Up’ messages received</b>	<b>High Scoring</b>	<b>Low Scoring</b>
0-5	16	7
6-10	0	1
11-15	1	0
16-20	0	2
21-25	0	1

**Hypothesis: System notifications act as motivational tools.**

By communicating to users how many XP points their team needs to move up one spot in the leaderboard, system-generated emails provide a clear subgoal [22] to the user which is attainable and at an appropriate level. By achieving a clearly defined subgoal, they should experience a feeling of *competence*, one of the motivational keys proposed by Self Determination Theory.

Contrary to expectations, users who did **not** receive system notifications significantly outperformed those who did. Users appear to have found system notifications demotivating somehow. They may see the messages as controllers on their behaviour [34], because the notifications are telling them what to do. This can have a detrimental affect on motivation [34] because it reduces feelings of *autonomy*.

Table 4.14: Users who received system notifications were statistically likely ( $\rho = 0.028246$ ) to achieve a lower overall XP score.

XP attained	Received system notifications	Did not receive system notifications
0-10	27	37
11-20	9	7
21-30	7	16
31-40	5	12
41-50	2	6
51-60	1	4
61-70	0	4
71-80	0	1

**Hypothesis: Students were motivated by external rewards offered by SU Perks.**

The above hypothesis is expected to be true largely due to the nature of the activities in the application. Attending a campus event, depending on the event and the person attending, may be an intrinsically rewarding activity. However, answering quizzes and surveys are typically not intrinsically satisfying, and a reward is necessary to make it worth the effort. Students were

Table 4.15: Comparison of level attained by those who did and did not receive system notifications. Users who received system notifications had a tendency to achieve a lower level by the end of the beta trial.

<b>Level attained</b>	<b>Received system notifications</b>	<b>Did not receive system notifications</b>
1	26	33
2	10	17
3	8	16
4	4	16
5	2	5
6	1	5
7	0	1

expected to fill out quizzes and surveys in order to boost their XP score. This hypothesis is supported by the survey data and the results are statistically significant ( $\rho = 0.00001$ , see Table 4.16). There are no significant differences between the responses of different demographics such as number of years on campus or gender. This suggests that students experienced a relatively high degree of extrinsic motivation when using SU Perks.

Table 4.16: Responses to “The rewards in the application helped motivate me to get more points”.

<b>Response</b>	<b>Number of Students</b>
Disagree	0
Slightly disagree	0
Neutral	3
Slightly agree	6
Agree	17

### **Evaluating how and if SU Perks provides value to users.**

Raising awareness of campus resources is the primary goal of the SU Perks application. Overall, students reported that the application helped them learn about resources available to them on campus ( $\rho = 0.000021$ ). There were no statistical differences found between different user demographics.

Table 4.17: Responses to “The application helped me learn about campus resources”.

<b>Responses</b>	<b>Number of Students</b>
Disagree	0
Slightly disagree	1
Neutral	8
Slightly agree	10
Agree	7

Students also reported that the application was helpful to them ( $\rho = .000015$ ). No significant differences between different demographics were found. However, the statement itself (‘Using this application was helpful for me’) is quite broad. SU Perks may have helped some students in the long term. For example, they may have learned where to go if they forget their campus network password or how to connect with an academic advisor. Others may have derived more short-term rewards, such as a free coffee.

Table 4.18: Responses to “Using this application was helpful for me”.

<b>Response</b>	<b>Number of Students</b>
Disagree	0
Slightly disagree	1
Neutral	8
Slightly agree	8
Agree	9

## 4.4 Conclusions

Teams are a game mechanic intended to introduce an element of relatedness and fellowship to SU Perks and to make the application more engaging for users. In the beta trial, students tended to report that the application was helpful to them and that they learned about campus resources regardless of

whether they joined teams. However, students who joined teams significantly outperformed those who did not. It should be noted that the data set for students who joined teams **and** responded to the survey was very small (n=10). It would be reasonable to expect that a larger sample of respondents would draw similar conclusions, but further experiments would be needed to verify this.

The results gathered from the CF layer used in the SU Perks study underscore the importance of **relatedness** in the gamified experience, since teams are the major game mechanic added by the layer. Students who joined teams had a tendency to score higher on the application, and more coherent teams (those who attended events together) also tended to receive a higher score.

The influence of game mechanics which were intended to add to feelings of competence are much less clear. The data set used to compare feedback on ‘Challenge’ versus ‘Thumbs-up’ messages was too small to draw conclusions, receiving more cooperative messages did not correlate to a higher score, and system notifications (which were intended to help users set clear, attainable goals) actually had a detrimental effect on motivation - which may mean that users perceived them as annoying controllers on their behaviour instead of potentially useful feedback.

While students did not report feeling different about sending and receiving Challenge versus Thumbs-up messages, Thumbs-up messages were more frequently sent than Challenges. This replicates the findings of Chen and Pu’s study on co-operative and competitive messages in exergames [1]. Future versions of the application may do away with the Challenge messages and-or introduce new message types.

Much could be done to tweak the SU Perks application to better fit its intended goal. Ideally, the application could give students who may be more likely to experience difficulty integrating to campus life an extra motivational



‘push’. As it stands, it may be more motivating for students who are already familiar with the campus; they may have an easier time getting all the questions right on a quiz, and they may enjoy the rewards more (for example, a free cookie from a place they go to almost every day anyways). An ‘information’ section would be straightforward to add to the application and could give students something to refer to before taking a quiz on an unfamiliar topic.

In the future, the application design should be refined with input from international students and students in their first year of university. Also, a future study might include different timelines for the application (students who used it for one month versus those who used it for longer) to investigate how user engagement changes over time. Survey responses could be tied to individual users instead of making the survey anonymous (this was done in the FrancoPass study, but not in SU Perks). This would give the researchers the ability to determine discrepancies between user reporting and their behaviour when using the app.

It would be interesting to investigate a possible correlation between team type and team performance. ‘Friend teams’ would likely be the highest scoring due to a sense of closeness between friends. This would require a change in the scoring system, as department-based teams may simply have a higher number of members on average. Additionally, teammates who attended events together outperformed those who did not. Future SU Perks designs could encourage teammates to attend events together (e.g. ‘Invite a friend to this event!’).

SU Perks was received positively by students, who found that it was a helpful tool for staying engaged on campus. The Beta trial investigates the effectiveness of gamification for the context campus engagement. SU Perks and SU Perks Teams can be used inform future research into the effectiveness of gamification for campus engagement.

# Chapter 5

## FrancoPass: Gamification of Minority Language Community Engagement

### 5.1 Background: Motivation and Second Language Acquisition

Language is deeply embedded in our sense of relatedness to others: it reflects culture, customs, and social belonging [7]. Because adopting a new language requires, to some extent, the adoption of a new identity, successful second language acquisition requires a great deal of intrinsic motivation [37].

*Linguistic self confidence theory* states that the quantity and quality of contact between members of different language groups strongly influences the desire to learn another language [2]. Positive interactions with individuals who belong to another language community may create a desire to learn that language.

Minority language communities exemplify the complex relationship between language, motivation, and identity. In an English-speaking community, maintaining an Anglophone identity is easy, but a Francophone identity requires upkeep. Researchers have identified that individuals who identify as Fransaskois sustain an effort to participate in French activities (whether or not French is their mother tongue), and that they maintain an identity that is complex, iden-

tifying as both Francophone and Anglophone [14]. Alberta’s francophone community represents a minority linguistic community similar to Saskatchewan’s Fransaskois community. Many individuals in Western Canada maintain a Francophone identity by taking on an active role in their local French-speaking community; attending events and volunteering with community organizations.

### 5.1.1 Gamification of L2 Acquisition: Related Studies

Slavkov et al. define *linguistic risks* as “authentic communicative acts in a learners’ second official language...which may be ‘risky’ due to discomfort about making mistakes, being misunderstood, misunderstanding others, being judged, taking on a different identity, and changing previously established second language choice patterns” [36]. Language anxiety is a widespread, well-studied phenomenon and is generally considered as a serious obstacle when learning a new language.

Slavkov’s research group distributed a Passport booklet full of proposed linguistic risks for language learners at the University of Ottawa. Learners were able to choose different risks in order to personalize the experience. At the end of the semester, if a student had 20 or more risks in their passport, they were able to enter their passport into a draw to win a prize. In the passport system, learners are rewarded for their *bravery*, rather than for their language skills. Using the passport, the researchers created a tool to re-frame the fear and anxiety associated with linguistic risk-taking into achievement. While much research has gone into linguistic risk-taking in the classroom, one of the key differences with Slavkov’s work is that it focuses on risk taking in the ‘real-world’ language community, since the University of Ottawa is a bilingual institution. The results of this research have yet to be published.

MacFarlane and Wesche [23] studied the experiences of 21 language learners who were formerly in Canadian immersion programmes. Anglophone students in their study who had extracurricular contact with Francophones were found to be significantly more proficient in French. Their study highlights the im-

portance of connecting with the language community as a means of motivating language students.

Another project similar to FrancoPass is the Explorez application [30]. Explorez was created for French students at the University of British Columbia and uses “quest-based learning and augmented reality” , transforming the campus into “a virtual francophone world, where students interact with characters, items, and media”[30]. Students asked to provide feedback on the project described it as fun, useful, motivating, and relevant.

The FrancoPass application was inspired by a paper passport initiative from Edmonton’s francophone community: the 2018 Passeport Francophile, offered by Edmonton’s ACFA (Association canadienne-française de l’Alberta). Participants were able to get their passports stamped at various community events, and were eligible for a variety of prizes throughout the year [21]. FrancoPass might be considered an online version of the Passeport Francophile.

## 5.2 The FrancoPass Application

Both FrancoPass and SU Perks involve a similar base application. The application was originally developed by undergraduate students Chase Buhler, Marissa Snihur, Andy Li, Ivan Tse, James Jewitt, and Kean Wang Yap to be used by the University of Alberta Student’s Union. It was later expanded and revised by Marissa Snihur to create the FrancoPass application, with the look and feel designed by Anna Chakravorty.

Redeemable points and XP points can be earned by engaging in a variety of activities. Redeemable points act as a currency in the application, and they can be used to obtain rewards from the shop.

XP points are used to track and reward user engagement with the application. The more students use the application, the more XP they earn. The app also contains levels based on XP. Level one users have 10 XP. Leveling up is

based on an exponential curve. In addition to the activities recommended by FrancoPass, users also gain XP by logging in to the app daily.

**Attending events** Events are an opportunity for French students using the FrancoPass app to begin to integrate into the local Francophone community. Sample events might include a show at a local Francophone movie theatre or a local concert. QR codes are scanned at the event location to confirm that students attended the event.

**Completing Surveys** Surveys can be created and added to the application to get feedback and input from students.

**Completing Campaigns** Challenges or quests, called Campaigns, can be created by system administrators (or instructors in the case of FrancoPass). Campaigns may include attending a set of events or completing a set number of surveys. Campaigns can be used to motivate students towards specific sets of behaviours. Students can be invited to campaigns via an invite code.

**Quizzes** Redeemable points are awarded when a student gets all the questions correct on a quiz. Students will receive a set number of XP points for attempting a quiz. Quizzes may test students knowledge about campus services, french vocabulary, or their retention of information after attending a certain event.

**Badges** In addition to earning points, FrancoPass users can also earn badges. To appeal to the varied interests and goals of different students, a number of badges were created which could be earned based on different behaviours and user tendencies.

- The **Courage** badge is awarded to students who attend at least three events of different difficulty levels (easy, intermediate, difficult).
- The **Fidélité** badge is awarded to students who attend three events of the same type (for example, three movie screenings at the same Francophone

cinema).

- Students who attend three events from three different cultures (e.g., French Canadian, French European and French African) receive the **Diversité** badge.
- The **Variété** badge is earned by students who attend three different types of events.
- Students with at least four different badges are awarded the **Franco-trophée** badge.

### 5.3 The FrancoPass Beta Trial

The FrancoPass project was developed with the cooperation of the Department of Modern Languages and Cultural Studies (MLCS) (specifically Dr. Sathya Rao), Campus Saint-Jean (the University of Alberta Francophone Campus), the Association Canadienne-Française de l'Alberta (ACFA), and Canadian Parents for French Alberta (CPF). FrancoPass is primarily designed to motivate students to attend events in the local Francophone community. The FrancoPass project was inspired by the 2012 “passeport social” initiative, a paper passport booklet designed to encourage French learners to connect with the Edmonton’s Francophone community by attending local events, such as Francophone theatre productions and concerts, as well as the similar, more recent 2018 “Passeport Francophile” community passport project [21]. When languages learners attended an Francophone event, they were able to collect stamps for their passport.

In the pilot project, students taking French courses through Campus St. Jean have the option of participating in the study. Their grades are not affected by their participation in the FrancoPass study, which spans over the course of the Fall 2019 semester. The study included a teams competition which was announced to students on October 18, 2019 and closed December 6, 2019.

There are multiple hypotheses being tested with the FrancoPass. Firstly, does the gamified base application enhance the learning experience for users? Secondly, does adding the CF layer - i.e., a teams competition component - further enhance their ability to achieve their language acquisition goals? The hypothesis is that, by emphasizing fellowship and challenge, and playing into psychological needs for relatedness and competence, the CF layer will increase intrinsic motivation. Additionally, system notifications letting students know how much they need to gain to move up in the leaderboards can help students identify *proximal subgoals* towards the abstract goal of second language acquisition.

By attending events in the Francophone community, language learners may form a positive impression of the minority culture and form a desire to integrate themselves into that community [2]. As a result, they will be more likely to continue learning French after they stop using FrancoPass. Attending events may also help students to establish a habit of linguistic risk-taking, the fear of which is a primary roadblock towards language acquisition [36].

### **5.3.1 Integrating the CF layer: FrancoPass Teams**

Three team types included were: Friend teams, Classroom teams, and Department/major teams. Team scores were the average score of all student members. The maximum number of individuals on any team was limited to 30, and students could join up to three teams. FrancoPass teams include ‘admin’ users, whose scores do not count as part of the team score.

Upon signing up for FrancoPass, some students were automatically subscribed to system notifications which would send them an email detailing how many XP points their team needed to move up one spot in the leaderboard. Some students were also subscribed to system ‘Thumbs-up’ messages, which would send a ‘Thumbs-up’ notification from FrancoPass when the CF layer detected that their score had increased. Both email subscriptions are assigned randomly to students via a coin flip.

After the study concluded, members of winning teams were each eligible to receive a gift card to Cafe Bicyclette, a popular cafe in the Francophone community. Winning teams include the top overall team and the top team competing in each team category (the three categories were Friend teams, Class teams, and Departments or Majors).

Team Prizes were as follows:

- **Top Friend Team:** \$5 gift card for each member
- **Top Class Team:** \$10 gift card for each member
- **Top Department/Major:** \$10 gift card for each member
- **Top Overall Team:** Each team member received an additional \$5 at Cafe Bicyclette.

The API (specified in Appendix D) exposes the following information to the CF layer via the ‘/users’ endpoint: username, email, XP points, level, and a flag value which indicating who is an ‘admin’ user. Usernames cannot be changed in the base application and act as a unique identifier in the CF layer. The endpoint is called every hour to add new users to the system and to update existing user scores. The ‘/login’ endpoint exposes the current users’ username, as well as everything the CF layer needs to create a new user (XP score, email, and admin status) in case they are logging in for the first time and have not been added to the layer’s database yet.

## 5.4 The FrancoPass Beta Trial

### 5.4.1 Data Collection

Feedback to assess the effectiveness of FrancoPass was obtained using a two-part questionnaire designed with the help of Dr. Sathya Rao. Answers to the first part of the questionnaire were collected at the beginning of the semester,



and answers to the second part were collected after the end of the team competition. Before and After questionnaires may be found in Appendices B and C.

Data was also collected by the FrancoPass application itself. This dataset includes events attended, level, user XP, ‘Challenge’ and ‘Thumbs up’ messages sent and received, teams created and joined, and team scores. Identifying information such as emails, usernames, and team names were obscured when analyzing the data set.

Similar to the SU Perks survey, students were asked to rate how strongly they agreed with each statement (1= Disagree, 5= Agree) in both the before and after surveys.

Students responding to the pre-trial survey were studying across a variety of different academic programs. There were 23 distinct programs reported, with the majority studying French (9), Elementary Education (6), Mathematics (5) and general studies (5). Most students were in their first or third year of study.

Table 5.1: FrancoPass users were mostly in their 1st or 3rd year of study.

<b>Year of Study</b>	<b>Number of students</b>
1st	14
2nd	9
3rd	16
4th	7
5th and above	4

FrancoPass users also came from a variety of backgrounds in terms of their French language experience. Many were learning it in University, while others were Francophone or attended a Francophone school.

The majority of users reported that they had not used the ‘passeport’ booklet or a course moodle that notified them about events in the Francophone

Table 5.2: FrancoPass users reported their previous background with the French language.

<b>Background Studying French</b>	<b>Number of students</b>
One university year	10
Two university years	8
Three university years	3
Four university years	2
More than four university years	4
I am a French immersion student	10
Since elementary school as a second language	1
I am Francophone or attended a Francophone school	13

community in the past.

Table 5.3: Responses to “Have you used the “Passeport” and or the “Activités dans la communauté” Moodle website in your previous courses?”.

<b>Response</b>	<b>Number of students</b>
No	38
Yes	10
I don’t know	3

Unfortunately, there were only 12 responses to the post-survey, making it difficult to draw solid conclusions about users’ attitudes towards FrancoPass after the trial. It is possible that the students who were more eager to participate in FrancoPass were also more eager to respond to the survey.

### **A note on the statistics**

To evaluate responses to individual statements, a one sample t-test was performed. An unpaired 2 sample t-test was used to compare different demographics (e.g. Francophone/non-francophone). Only t-statistics with corresponding  $\rho$  values less than 0.05 are considered to be statistically significant. For all cases, two-tailed tests were considered.

The statistical tests used make a few underlying assumptions. When students answered both the of the surveys, we expected them to select ‘neutral’ if they had no opinion on a statement, however, we cannot prove that this is what they did. The statistical tests assume that the data comes from a representative and randomly selected portion of the total population, which is not necessarily true of the data set: It is quite possible that there were some unaccounted-for factors which determined who responded to the surveys and who did not (in the case of the after-survey, students who were more engaged by FrancoPass may have been more likely to respond). Finally, we cannot show that the survey data or the data generated by FrancoPass usage are normally distributed, and the number of survey data points for the after survey is very small ( $n=12$ ).

## 5.4.2 Hypotheses and Findings

**Hypothesis: Teams increased user engagement.**

Self Determination Theory proposes [34] relatedness as a key factor in intrinsic motivation. The idea behind including teams in the application is that they are a motivational tool. Teams may help to foster peer learning as students may help encourage each other to use the application and attend francophone events. The results show that students who joined teams were statistically likely to outperform those who did not ( $\rho = 0.000085$ ). Peer pressure may have been a motivational factor: teams were negatively affected by low-scoring teammates. Students who were worried about bringing down their peers may have opted out of joining teams.

Teams that are more coherent and participate in activities as a group are expected to be more highly motivated and thus have a higher score. This is because more interaction within a team indicates more relatedness among teammates, which is associated with higher motivation [34]. Teams which consisted of only admin members were not used in the analysis. The remaining teams were separated into three ‘buckets’ of performance based on their score: low scoring, middle scoring, and high scoring. None of the teams in the lowest

Table 5.4: Comparison of XP score between users who joined teams and those who didn't.

<b>XP attained</b>	<b>Joined teams</b>	<b>Did not join teams</b>
0	10	64
1	4	18
2	0	9
3	1	6
4	0	2
5	0	2
6	2	0
7	0	0
8	0	0
9	0	0
10	0	0
11	2	0
12	1	1
13	1	0
14	0	0
15	1	0
16	0	0
17	0	1
18	0	0
19	1	0
20	0	1
21	1	0
22	0	1

Table 5.5: Comparison of level attained between users who joined teams and those who didn't.

<b>Level attained</b>	<b>Joined teams</b>	<b>Did not join teams</b>
1	17	100
2	7	3
3	1	1

category attended events together, while around 30% of high-scoring teams did. Since there were only three teams in the high scoring category and three in the low scoring category, there was not enough data to draw statistically

significant conclusions. Further analysis might show that attending events as a group results in more highly motivated teams.

Table 5.6: Summary of events with more than one teammate in attendance on high and low scoring teams.

<b>Number of events attended with more than one teammate</b>	<b>Low scoring</b>	<b>High scoring</b>
0	3	2
1	0	0
2	0	2

Students who have teammates in mind before using the application may have a community of friends or peers who are also learning French, suggesting that they already have a feeling of relatedness associated with the activity. This feeling of relatedness should correlate with higher motivation according to [34]. In the pre-trial survey, students were asked if they had anyone in mind that they wanted to be on a team with (see Table 5.7). Most students had a neutral response. It might be interesting to see if the responses to the survey statement change on the second trial of FrancoPass as some students will have been on a team previously.

Table 5.7: Responses to “I have people in mind I would like to be on a team with”.

<b>Response</b>	<b>Low Scoring</b>	<b>High scoring</b>
Disagree	3	2
Neutral	11	5
Agree	1	1

**Hypothesis: Messages act as motivational tools.**

Positive feedback, such as ‘Thumbs-up’ messages, may reinforce the motivational need for competence proposed by Self Determination Theory [34]. Students may find them more motivating and also they may feel more comfortable sending them to others. As with the SU Perks study, users sent con-

siderably more cooperative messages. It should be noted that, in Table 5.8, all of the ‘Challenge’ messages were sent by admin users (such as professors and community organizers), and not by students.

Table 5.8: FrancoPass users sent considerably more cooperative messages than competitive messages. The same was true for SU Perks users.

Message Type	Number of messages
Thumbs Up	24
Challenge	8

Thumbs-up messages are expected to reinforce a motivational need for competence and therefore have a stronger motivational affect. Users were divided into four quartiles based on their XP score. Those with an XP score of 0 were placed in the lowest quartile, and the rest of the users were divided evenly into the remaining three quartiles based on their XP score. Admin users were not considered in the analysis. Users in the top quartile of performance tended to receive more ‘Thumbs-up’ (cooperative) messages from their peers. The results are statistically significant ( $\rho = 0.00011$ ).

Table 5.9: Comparison of number of Thumbs-up messages received by high and low scoring users.

Number of “Thumbs Up” messages received	Low Scoring	High scoring
0	72	11
1	2	4
2	0	1
3	0	0
4	0	1
5	0	1

**Hypothesis: System notifications act as a motivational tool.**

System notifications provide users with a clearly defined goal detailing how many points their team needs to move up one spot in the leaderboard. Ideally,

the notifications help users engage with the application by helping them set attainable goals towards French language acquisition, reinforcing their feelings of competence. SU Perks system notifications were correlated with a lower score, but for FrancoPass users, there is no clear trend. The reasons for this are not clear. Perhaps the messages came across differently for the two contexts; FrancoPass users may have seen the notifications as presenting them with a useful goal, while SU Perks users found them less useful. It could be that the timeframe and locations of activities played a role. FrancoPass users had more time to plan out attending activities than SU Perks users, who may have been more spontaneous when attending events, since the majority of events took place on campus in the span of one week. More data and further study is needed to draw conclusions.

**Hypothesis: System-generated ‘Thumbs-Up’ notifications act as a motivational tool.**

Users who were subscribed to system ‘Thumbs-up’ messages received a system-generated email when their score increased with the same ‘Thumbs-up’ message which can be sent to them by their teammates. This notification was intended to be an extra motivational boost to increase users’ feelings of competence when using the application. Again, we cannot draw any conclusions. It is not clear that the system-generated ‘Thumbs-up’ messages had any effect on user motivation.

**Hypothesis: Students who are comfortable speaking French will score higher on FrancoPass.**

Reporting a high comfort level with French suggests pre-existing feelings of competence, which we would expect to be correlated with higher motivation [34]. Interestingly, students who reported themselves as less comfortable with French scored higher on FrancoPass ( $\rho = 0.000118$ ). This may indicate that students with a relatively low comfort level with French were more engaged by the application and that the activities and events promoted by the application were helpful and at an appropriate level for them. Conversely, students who

Table 5.10: Comparison of XP score between users who received system notifications and those who didn't.

<b>XP attained</b>	<b>Received system notifications</b>	<b>Did not receive system notifications.</b>
0	32	42
1	7	15
2	3	6
3	6	1
4	1	1
5	2	0
6	2	0
7	0	0
8	0	0
9	0	0
10	2	0
11	0	1
12	0	2
13	0	0
14	0	1
15	0	0
16	0	0
17	0	1
18	0	1
19	1	0
20	1	0
21	1	0
22	0	1

Table 5.11: Comparison of level attained between users who received system notifications and those who didn't.

<b>Level attained</b>	<b>Received system notifications</b>	<b>Did not receive system notifications.</b>
1	52	65
2	4	6
3	1	1

were already comfortable with French did not stand to learn much from using the application if the activities were ‘too easy’. It also indicates that the extrinsic rewards alone were not enough to engage with the application.



Table 5.12: Comparison of XP scores between users who received system ‘Thumbs-up’ messages and those who didn’t.

<b>XP attained</b>	<b>Students who received system ‘Thumbs up’ messages</b>	<b>Students who did not receive system ‘Thumbs-up’ messages.</b>
0	42	32
1	7	15
2	1	8
3	1	6
4	1	1
5	1	1
6	1	1
7	0	0
8	0	0
9	0	0
10	0	2
11	0	1
12	1	1
13	0	0
14	1	0
15	0	0
16	0	0
17	0	1
18	0	1
19	0	1
20	0	1
21	1	0
22	0	1

Table 5.13: Comparison of level attained between users who received system ‘Thumbs-Up’ messages and those who didn’t.

<b>Level attained</b>	<b>Students who received system ‘Thumbs-Up’ messages</b>	<b>Students who did not receive system ‘Thumbs-up’ messages</b>
1	64	53
2	8	2
3	1	1

Since Francophone students might have a deeper knowledge of the Francophone community in Edmonton and may identify more strongly with it,

Table 5.14: Responses to “How would you rate your overall comfort level with the French language?”.

<b>Response</b>	<b>Low scoring</b>	<b>High scoring</b>
Low	0	0
Somewhat low	0	3
Neutral	6	3
Somewhat high	4	2
High	8	0

it is reasonable to expect them to feel more comfortable attending Francophone events- and score higher- than their French immersion peers. However, differences between the two demographics were not found to be statistically significant.

Table 5.15: Number of high and low scorers in the Francophone and French immersion communities.

<b>Francophone vs. French Immersion</b>	<b>Number of low scoring students</b>	<b>Number of high scoring students</b>
Francophone	8	0
French Immersion (any level)	5	1

We might also suppose that Francophone students will score higher on the application because they are already highly competent in French. Unexpectedly, Francophone students did relatively poorly on the application and scored significantly ( $\rho = 0.048722$ ) lower than their French-as-a-second-language peers. They may have been less engaged by the application because they did not feel a need to track their progress towards learning French, and-or they did not feel a need to engage with the application to receive rewards.

Students who had a background speaking French (French immersion in school or Francophone students) were also less engaged by FrancoPass than those who began studying French in university. It is possible that the challenges proposed by the application were more appropriate for students learning

Table 5.16: Number of high and low scorers in the Francophone and non-francophone communities.

<b>Francophone vs. Non-francophone</b>	<b>Number of low scoring students</b>	<b>Number of high scoring students</b>
Francophone	8	0
Non-francophone	10	8

French in university ( $\rho = 0.003868$ ), and Francophone students did not see a clear benefit towards interacting with the FrancoPass application.

Table 5.17: Number of high and low scorers who started learning French in university vs. those with previous experience learning or speaking French.

<b>Previous experience speaking French</b>	<b>Number of low scoring students</b>	<b>Number of high scoring students</b>
Began learning before university	13	1
Began learning in university	5	7

**Hypothesis: Positive interactions with the Francophone community will increase student’s motivation to learn French [2]**

Positive interactions with the French language community are expected to increase students’ motivation to learn French according to [2]. Students indeed reported that attending events increased their motivation ( $\rho = 0.00001$ ). The results of the survey data confirm the hypothesis that interacting with a second language community increases motivation in language learners. It should still be noted, however, that the survey respondents only represent a small subset of FrancoPass users.

One of the main hypotheses being tested by FrancoPass is that connecting with a secondary language community boosts one’s motivation to learn that language[2]. Attending community events should make learning French more interesting to students and boost their proficiency as a result. Students who responded to the survey were statistically likely to report that attending activities improved their French language skills ( $\rho = 0.00935$ ). Since only a

Table 5.18: Responses to “Attending events in the Francophone community increased my overall interest for French”.

<b>Response</b>	<b>Responses</b>
Disagree	0
Slightly disagree	0
Neutral	0
Slightly Agree	9
Agree	1

small number of FrancoPass users responded to the survey, it should be noted that a more representative data set may not indicate the same result. The survey indicates that FrancoPass was helpful to students and that events they attended were at the right difficulty level.

Table 5.19: Responses to “The activities I attended in the Francophone community increased my overall proficiency in French”.

<b>Response</b>	<b>Responses</b>
Disagree	0
Slightly disagree	0
Neutral	4
Slightly Agree	5
Agree	1

Ideally, students will form a positive impression of the Francophone community through their interactions with them. Such an impression gives students a higher chance of continuing their language studies, according to [2]. Most students seem to have formed a more positive impression of the Francophone community after using the FrancoPass application (see Table 5.20).

Table 5.20: Users report on how their perception of the Francophone community changed after using FrancoPass.

<b>Response</b>	<b>Number of responses</b>
My perception is more positive.	8
My perception is the same as before.	3

Becoming integrated with the minority language culture could be an important step in language acquisition [2]. The FrancoPass application is intended to improve students' knowledge of Francophone culture. The results indicate that students believed that their knowledge of Francophone culture was improved ( $\rho = 0.00009$ ). Again, it should be noted that these respondents are only a small subset of the total participants; we know from the app-generated data that many who signed up for FrancoPass did not attend any community events. Nonetheless, the above result is still a positive indication that those who participated in FrancoPass benefited from the experience.

Table 5.21: Responses to “The activities I attended improved my knowledge of the Francophone culture”.

<b>Response</b>	<b>Responses</b>
Disagree	0
Slightly disagree	0
Neutral	1
Slightly Agree	8
Agree	1

If students are meeting people by attending events, it is a strong indicator that they are becoming more connected to the Francophone community, which could improve their chances of acquiring French as a second language [2]. Students were asked in the post-survey whether they met new people by attending community activities. The results are not statistically significant. Perhaps a larger trial and more respondents to the survey would show a more complete picture. The results may indicate that students attend events with other students and do not socialize outside of their group - this could be detrimental to their language acquisition as they will get less practise speaking French.

Similarly, students were asked if they met people from the Francophone community. By connecting with Francophones in Edmonton, students may experience an increased sense of relatedness, have more motivation towards participating in FrancoPass activities, and become more interested in learning

Table 5.22: Responses to “The activities I attended in the Francophone community allowed me to meet new people”.

<b>Response</b>	<b>Number of Responses</b>
Disagree	2
Slightly disagree	1
Neutral	2
Slightly Agree	2
Agree	3

French. Again, the survey results are not conclusive. This may mean that students are hesitant to socialize at FrancoPass events, and it may indicate that they have not overcome fear of linguistic risk [36].

Table 5.23: Responses to “FrancoPass helped me meet people from the local Francophone community”.

<b>Response</b>	<b>Number of Responses</b>
Disagree	1
Slightly disagree	0
Neutral	3
Slightly Agree	3
Agree	3

If students find attending events to be a fun experience, this may be an indication that they will keep using FrancoPass and that they will continue to integrate with the Francophone community after the beta trial ends. The result here is significant ( $\rho = 0.000173$ ). This indicates that students may have developed a positive impression of the Francophone community, which will lead them to continue attending events and ultimately boost their chances of acquiring French as a second language.

By interacting with Francophones, students will hopefully overcome fear of linguistic risk (that is, the fear or hesitation associated with speaking a second language in a ‘real’ setting, outside the classroom) [36]. Practising French in an authentic setting indicates that students are engaging in linguistic risk-taking.

Table 5.24: Responses to “Attending events in the local Francophone community was fun”.

<b>Response</b>	<b>Number of Responses</b>
Disagree	0
Slightly disagree	0
Neutral	1
Slightly Agree	7
Agree	2

Table 5.25 suggests that some students overcame linguistic risk while others did not. Perhaps they silently watched movie screenings and went home, or perhaps they spoke English to their peers while attending events. The results of this survey question are relevant to the previous question about meeting new people; in both cases, there was no evidence to suggest that students engaged in a conversation with anyone from the Francophone community at the events they attended.

Table 5.25: Responses to “The activities I attended in the local Francophone community allowed me to speak French in an authentic setting”.

<b>Response</b>	<b>Number of Responses</b>
Disagree	0
Slightly disagree	2
Neutral	1
Slightly Agree	5
Agree	2

If students feel welcome participating in Francophone community events, they may continue attending such events, and they may feel somewhat connected to the Francophone community, which is likely to have a positive effect on their chances of acquiring French as a second language [2]. Fortunately, students did feel welcome attending community events ( $\rho = 0.007063$ ). This relates to the statement that attending events was fun, which also received a positive response.

Table 5.26: Responses to “I felt welcome attending events in the Francophone community”.

Response	Number of Responses
Disagree	0
Slightly disagree	1
Neutral	0
Slightly Agree	5
Agree	3

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Table 5.27: Responses to “Attending events in the Francophone community provided me with the opportunities to apply skills and knowledge learned in the classroom”.

Response	Number of Responses
Disagree	0
Slightly disagree	0
Neutral	2
Slightly Agree	6
Agree	2

Activities that students attend should ideally give them the opportunity to practise either their comprehension or speaking skills. Students reported that they did, in fact, use skills and knowledge that they learned in the classroom while attending Francophone community events ( $\rho = 0.001054$ ). This indicates that attending events did help them practise their French skills in some way.

**Hypothesis: Students are not motivated by extrinsic rewards.**

This hypothesis assumes that students are intrinsically motivated - that is, most of their motivation does not come from points and rewards, and they are instead motivated to attend community events because they enjoy them [33]. Intrinsic motivation is thought to represent a more long-term commitment to an activity that will outlast extrinsic rewards [3], and is often necessary for second language acquisition. Students were asked whether rewards influenced their behaviour in the post survey (Table 5.28) There was no statistical significance found, meaning there was no consensus on how users viewed rewards.



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Table 5.28: Responses to “If the application did not have redeemable rewards, I would still have attained a similar score”.

<b>Response</b>	<b>Number of Responses</b>
Disagree	1
Slightly disagree	1
Neutral	1
Slightly Agree	3
Agree	0

Students may have had a variety of motivations when attending the events - some of which may have been completely extrinsic, intrinsic, or somewhere in-between.

#### **Evaluating how and if FrancoPass provides value to users.**

FrancoPass is expected to act as a tool which allows students to connect with the Francophone community. Without the app, students may not be aware of Francophone events. Survey results show that students felt that the application helped them find things to do in the Francophone community ( $\rho = 0.03$ ). This is a positive indication that FrancoPass served its intended purpose.

Table 5.29: Responses to “FrancoPass allowed me to participate in more activities in the local Francophone community”.

<b>Response</b>	<b>Number of Responses</b>
Disagree	1
Slightly disagree	0
Neutral	1
Slightly Agree	4
Agree	4

FrancoPass activities are intended to be beneficial and educational for students. FrancoPass activities helped students learn about French language and culture ( $\rho = 0.05$  - the result is just barely significant). This indicates that

many students felt that they benefited by participating in FrancoPass.

Table 5.30: Responses to “FrancoPass helped me learn about French language and culture”.

<b>Response</b>	<b>Number of Responses</b>
Disagree	0
Slightly disagree	0
Neutral	1
Slightly Agree	6
Agree	5

The leaderboard is expected to act as a way for students to track their progress while playing FrancoPass. Students are expected to use the leaderboard as a way to set goals when using the application (for example, they may ask themselves, ‘How many points do I need so that my team moves up a spot?’). This question also gauges how students felt about competing with other teams in the application. The respondents to the survey liked the leaderboard ( $\rho = 0.038245$ ) and felt that having competition and challenge in the application was a positive thing. Perhaps students who responded positively to competition were more likely to respond to the survey.

Table 5.31: Responses to “I feel that having competition in the application, such as the leaderboard, is a good thing”.

<b>Response</b>	<b>Number of Responses</b>
Disagree	0
Slightly disagree	1
Neutral	0
Slightly Agree	4
Agree	2

Gamifying the learning experience is supposed to add an element of fun as well as help students track their progress towards the abstract goal of second language acquisition [22]. Students responded positively to the gamification of attending Francophone events in Edmonton ( $\rho = 0.000181$ ), which is good

news for FrancoPass. It would be interesting to see if these results still hold for a larger, more representative sample of users.

Table 5.32: Responses to “The gamified component of FrancoPass made the experience of attending events in the community more enjoyable”.

<b>Response</b>	<b>Number of Responses</b>
Disagree	0
Slightly disagree	0
Neutral	1
Slightly Agree	5
Agree	4

## 5.5 Conclusions

Students who joined teams on the application tended to have a higher score. This underscores the value of peer motivation in game engagement and in second language acquisition, and it replicates the findings of the SU Perks study - suggesting that relatedness plays a role for motivation in both contexts.

‘Thumbs-up’ messages are a form of positive reinforcement from peers, playing into feelings of competence and relatedness. The results demonstrated that receiving messages within a team may have been motivating for users: those who received ‘Thumbs-up’ approval from their peers significantly outperformed those who did not. This also reinforces the findings of the HealthyTogether study [1], where users who received more messages were more engaged. It should be noted that this same correlation was not found in the SU Perks study.

Once again, cooperative messages were more popular with users than competitive messages. Thumbs-up messages were clearly more popular and were sent more frequently than Challenges. Future versions of the application might do away with Challenge messages in favor of different types of cooperative messages.

Similar to the SU Perks findings, the effectiveness of any game mechanics which were intended to introduce feelings of *competence* is not clear. ‘Thumbs up’ notifications which were system-generated did not have the same motivational effect as those that came from peers. There was no trend suggesting that system notifications or system-generated ‘Thumbs-up’ messages were motivating. Additionally, Francophone users were expected to score higher on the application due to pre-existing feelings of competence, but this was not the case. Various factors may have contributed to the relatively low engagement between FrancoPass and Francophone participants. If students are already integrated with the Francophone community and are presumably fluent in French, they may not see a benefit to themselves from engaging with FrancoPass. Secondly, the activities and events promoted by FrancoPass may have been ‘too easy’ to be interesting for them.

It’s interesting that in this context, the behaviour which should have been ‘easy’ could have given Francophone students extrinsic rewards (raffle tickets, etc. were available on the application). Extrinsic rewards, which were highly motivating for SU Perks users, do not seem to be as important to FrancoPass users. This may be because FrancoPass users are more intrinsically motivated, and rewards are not a primary reason for them to engage with FrancoPass [3].

An unfortunate side effect of averaging the team score is that students may have been more hesitant about joining teams, especially if they did not know how they would do on FrancoPass. In the post-survey, one student expressed guilt about bringing their team down.

The hypothesis that attending events in the Francophone community will increase motivation to learn French [2] is supported by the post-trial survey data. Additionally, students benefited by learning about Francophone culture and applying their French language skills outside the classroom. They reported having fun and feeling welcome at the events they attended. Their attitudes towards gamifying the experience were positive and they liked the leaderboard.

Some survey results indicate that they have not yet overcome fear of linguistic risk [36]; students didn't necessarily speak French while they were attending events. However, as the FrancoPass project continues, students may become more comfortable with linguistic risk.

Another trial of FrancoPass began in the Winter 2020 semester. Some students will be returning to the application a second time. It will be interesting to see how survey responses and app usage changes as we get more feedback and the application becomes more widely adopted.

Related research regarding second language acquisition posits that taking on a second language is akin to taking on a new identity for oneself. Community integration with the minority language community ignites this process and leads to an expanded knowledge of language and culture. Overall, FrancoPass may act as a first step towards overcoming fear of linguistic risk-taking, acquiring a second language, and immersing students in Edmonton's french-speaking community.

# Chapter 6

## Conclusion

Self Determination Theory proposes three fundamental components of intrinsic motivation: autonomy, competence, and relatedness. Game designers often leverage these concepts to create fun and engaging user experiences. The Challenge and Fellowship layer proposed in this thesis has a specific emphasis on relatedness, since teams are the primary game mechanic it introduces. It is also intended to trigger feelings of competence by introducing peer recognition ('Thumbs-up' messages) and clear, attainable goals which can be inferred from the leaderboard or received as an email from the application. The layer design also follows the MDA design framework, with the intended aesthetic being a combination of challenge and fellowship.

The contributions include a context-independent gamification layer and two case studies: SU Perks, an application which gamifies the experience of getting to know the University of Alberta campus, and FrancoPass, which gamifies engagement with Edmonton's Francophone community.

SU Perks Teams, the CF layer implemented for SU Perks, tracked user XP scores. Team scores were the sum of the scores of all team members, and teams were limited to 15 members. There were three team categories: Departments/Majors, Student clubs, and Friend teams. Approximately half of beta trial users were automatically subscribed to weekly emails which encouraged them to get ahead in the leaderboard. Winning team members were rewarded with their choice of a Tim Horton's or Starbucks gift card, with members of

the top overall team receiving additional money on their card.

FrancoPass teams were limited to 30 members, and students could join up to 3 teams. Team scores were the average score of all student members. Team types included were: Friend teams, Classroom teams, and Department/Major teams. FrancoPass teams include 'admin' users, whose scores do not count as part of the team score. Members of winning teams were each eligible to receive a gift card to Cafe Bicyclette, a popular cafe in the Francophone community. In the beta trial, some students were randomly subscribed to system generated emails via a coin flip. System notification emails would tell students how many XP points their team needed to move up one spot in the leaderboard. System 'Thumbs-up' messages which would send a 'Thumbs-up' message as an email from FrancoPass when the CF layer detected that their score had increased.

Both of the studies (SU Perks and FrancoPass) established that users who joined teams tended to score higher in the game. For SU Perks, a link was found between coherent teams (teams who send more messages and attend events together) and a higher score, which indicates higher engagement. The layer was a valuable addition to both games. Teams serve as a motivational tool.

It is unclear whether users' sense of relatedness increased after joining teams or if the scores by the users simply reflect the level of relatedness users already felt before using the application. For SU Perks in particular, many users were in their third or four year of studies and were not new to campus. It may be that students who were already highly involved in the campus community were more likely to adopt the application, more likely to join teams since they already know people, and more likely to do well in the game since they were already familiar with campus. Future SU Perks studies will hopefully include more first-year and international students so that the effectiveness of teams for these demographics can be measured.

The effectiveness of game mechanisms which were designed to reinforce a sense of competence is not as clear. It cannot be stated that system notifications and system ‘Thumbs-Up’ messages had a positive impact on user motivation. Future studies may evaluate different motivational messages or means of receiving system notifications.

For FrancoPass in particular, students who were presumably highly competent in the target behaviour were markedly less engaged. It may be assumed that the activities recommended by the application were not interesting or at an appropriately challenging level for them (users were over-competent and had nothing to gain from participating in the game apart from extrinsic rewards).

More data is needed to support the hypothesis that ‘Thumbs-up’ (cooperative) or ‘Challenge’ (competitive) messages are more effective. Cooperative messages were more popular cross-contextually, and FrancoPass users in the top tier of performance received more ‘Thumbs-up’ messages. Future studies will likely find that cooperative messages are more motivating.

It is important to note that, while SU Perks and FrancoPass are two different applications, there is some similarity between the two target behaviours. Both are about social integration. To more confidently assert that the CF layer is effective cross-contextually, a more diverse set of target behaviours should be evaluated.

Another important area that could be studied using the layer is the effect of gamification on motivation over long periods of time. Many studies on gamification run over beta trials and relatively short time spans. Some researchers argue that, depending on how the gamified application is designed, gamification may have a negative impact on users motivation once the ‘newness’ of an application wears off [29]. A cross-contextual long-term study would be an important step towards evaluating whether gamification actually works. As



FrancoPass and SU Perks applications continue to be evaluated, their effects on motivation over time could be assessed.

The CF layer itself could undergo technical improvements for future use. Instead of hosting the ‘teams’ part of an application as separate site to be hosted on its own domain, the software could be rewritten as a plugin. This would give more control to the developers of the base application as well as improve the front-end user experience.

Overall, this thesis contributes a general gamification layer which has been shown to build user motivation towards a target activity. The data gathered reinforces the theory that the principles of Self determination theory proposed by Ryan and Deci [34] can be used to create applications which are motivating and engaging across differing contexts.

# References

- [1] Y. Chen and P. Pu, “Healthytogether: Exploring social incentives for mobile fitness applications,” in *Proceedings of the Second International Symposium of Chinese CHI*, 2014, pp. 25–34. 1, 8, 24, 41, 45, 72
- [2] R. Clement, R. Gardner, and P. Smythe, “Motivational variables in second language acquisition: A study of francophones learning english,” *Canadian Journal of Behavioural Science*, vol. 9, pp. 123–133, 1977. 47, 52, 64–66, 68, 73
- [3] E. Deci, “The effects of externally mediated rewards on intrinsic motivation,” *Journal of Personality and Social Psychology*, vol. 8, pp. 105–115, 1 1971. 9, 27, 69, 73
- [4] A. Decker and E. L. Lawley, “Life’s a game and the game of life: How making a game out of it can change student behaviour,” in *Proceedings of the 44th ACM technical symposium on Computer science education*, 2013. DOI: 10.1145/2445196.2445269. 31
- [5] S. Deterding, D. Dixon, R. Khaled, and L. Nacke, “From Game Design Elements to Gamefulness: Defining ‘Gamification’,” in *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments*, Sep. 2011, pp. 9–15. 1
- [6] D. Dicheva, C. Dichev, G. Agre, and G. Angelova, “Gamification in education: A systemic mapping study,” *Educational Technology and Society*, vol. 18, pp. 75–88, 3 2015. 11
- [7] Z. Dornyei, “Motivation and second and foreign language learning,” *Language Teaching*, vol. 31, pp. 117–135, 1998. 47
- [8] K. Finckenhagen, “Context in Gamification: Contextual Factors and Successful Gamification,” DOI: [https://www.ntnu.edu/documents/139799/1279149990/09+Article+Final\\_karolirf\\_fors%C3%B8k\\_2017-12-08-05-35-05\\_TPD4505.Karoline.Finckenhagen.pdf/4f269657-0e54-4999-9de8-6ba8e109d386](https://www.ntnu.edu/documents/139799/1279149990/09+Article+Final_karolirf_fors%C3%B8k_2017-12-08-05-35-05_TPD4505.Karoline.Finckenhagen.pdf/4f269657-0e54-4999-9de8-6ba8e109d386). ii, 2
- [9] Z. Fitz-Walter, D. Tjondronegoro, and P. Wyeth, “Mobile gamification for increasing motivation and engagement around the campus,” in *Proceedings of the 25th Australian Computer-Human Interaction Conference*, 2012, pp. 138–141. DOI: 10.1145/2414536.2414560. 15, 30
- [10] J. F. F. Flores, “Using gamification to enhance second language learning,” *Digital Education Review*, vol. 27, pp. 32–54, 2015. 13

- [11] A. Francisco Aparicio, F. L. Vela, J. González-Sánchez, and J.-L. Isla-Montes, “Analysis and application of gamification,” in *Proceedings of the 13th International Conference on Interacción Persona-Ordenador*, Oct. 2012. DOI: 10.1145/2379636.2379653. 1
- [12] R. Gardner, *Social psychology and second language learning. The role of attitudes and motivation*. 1985. 27
- [13] R. Gardner, “Attitudes and motivation,” *Annual Review of Applied Linguistics*, vol. 9, pp. 135–148, 1988. 27
- [14] S. Guadet and R. Clement, “Forging an identity as a linguistic minority: Intra- and intergroup aspects of language, communication and identity in western canada,” *International Journal of Intercultural Relations*, vol. 33, pp. 213–227, 2009. 48
- [15] J. Hamari, J. Kovisto, and H. Sarsa, “Does gamification work? a literature review on empirical studies on gamification.,” in *47th Hawaii International Conference on System Sciences*, Jan. 2014. ii, 1, 2, 25
- [16] L. Hassan, “Governments should play games: Towards a framework for the gamification of civic engagement platforms,” *Simulation and Gaming*, vol. 48, 2 Dec. 2016. 14
- [17] N. Houliort, R. Koestner, M. Joussemet, A. Nantel-Vivier, and N. Leke, “The impact of performance-contingent rewards on perceived autonomy and competence,” *Motivation and Emotion*, vol. 26, 4 Dec. 2002. 7, 10
- [18] W. Huang Hsin Yuan and D. Soman, “A practitioner’s guide to gamification of education,” *Research Report Series: Behavioural Economics in Action. University of Toronto - Rotman School of Management.*, 2013. 13
- [19] R. Z. Hunicke Marc Leblanc, “Mda: A formal approach to game design and game research,” *AAAI Workshop - Technical Report*, vol. 1, Jan. 2004. 15
- [20] J. C. G. Jr. and M. S. Garret, “Student participation in a college orientation course, retention and grade point average,” *Community College Journal of Research and Practice*, vol. 19, pp. 117–132, 2 1995. DOI: 10.1080/1066892950190203. 29
- [21] A. canadienne-française de l’Alberta, <https://www.acfaedmonton.ab.ca/mon-passeport>, Accessed: 2020-02-10. [Online]. Available: <https://www.acfaedmonton.ab.ca/mon-passeport>. 49, 51
- [22] E. Locke and G. Latham, “Goal setting theory,” *Motivation: theory and research*, pp. 13–29, 1994. 9, 24, 25, 42, 71
- [23] A. MacFarlane and M. Wesche, “Immersion outcomes: Beyond language proficiency,” *Canadian Modern Language Review*, vol. 51, pp. 250–274, 1995. 48

- [24] K. I. Miyuki, M. B. Barnette, C. Queiruga, and J. Díaz, “Whatsinfo: A gamified mobile application promoting the integration of computer science school freshman to the unlp,” in *XXI Congreso Argentino de Ciencias de la Computación*, 2015, ISBN: 978-987-3806-05-6. 30
- [25] A. Mora, D. Riel, C. Gonzalez, and J. Arnedo-Moreno, “Gamification: A systematic review of design frameworks,” *Journal of Computing in Higher Education*, pp. 1–33, 29 May 2017. DOI: 10.1007/s12528-017-9150-4. ii, 1, 4
- [26] B. Morschheuser, K. Werder, J. Hamari, and J. Abe, “How to gamify? a method for designing gamification.,” in *Proceedings of the 50th Hawaii International Conference on Systems Sciences*, Jan. 2017. 4
- [27] P. Murtaugh, L. Burns, and J. Schuster, “Predicting the retention of university students,” *Research in Higher Education*, vol. 40, 3 1999. 29
- [28] F. F.-H. Nah, Q. Zeng, V. R. Telaprolu, A. P. Ayyappa, and B. Eschenbrenner, “Gamification of education: A review of literature,” *International Conference on HCI in Business*, pp. 401–409, 2014. 11
- [29] S. Nicholson, *A recipe for meaningful gamification*, 2019. 77
- [30] B. Perry, “Effet de l’implémentation d’explorez, jeu basé sur la quête et la réalité augmentée, sur la motivation d’apprenants de français langue seconde(fl2) : Une étude de cas,” Master’s thesis, University of Victoria, 2015. 49
- [31] A. Przybyliski, C. S. Rigby, and R. Ryan, “A motivational model of video game engagement,” *Review of General Psychology*, vol. 14, pp. 154–166, 2 2010. 5
- [32] A. M. Roepke, S. R. Jaffee, O. M. Riffle, J. McGonigal, R. Broome, and B. Maxwell, “Randomized controlled trial of superbetter, a smartphone-based/internet-based self-help tool to reduce depressive symptoms,” *Games for Health Journal*, vol. 4, no. 3, Apr. 2015. 1
- [33] R. M. Ryan and E. L. Deci, “Intrinsic and extrinsic motivations: Classical definitions and new directions.,” *Contemporary Educational Psychology*, vol. 25, pp. 54–67, 2000. DOI: 10.1006/ceps.1999.1020. iii, 4, 6, 21, 24, 25, 69
- [34] R. Ryan and E. Deci, “Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being,” *American Psychologist*, vol. 55, pp. 68–78, Jan. 2000. 1, 4, 6, 35, 36, 42, 56, 58
- [35] R. Ryan and E. Deci, “The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior,” *Psychological Inquiry*, vol. 11, pp. 227–268, 4 2000. 37, 39
- [36] N. Slavkov and J. Seror, *The development of the linguistic risk-taking initiative at a bilingual post-secondary institution in canada*, 2019. 48, 52, 67, 74

- [37] M. Williams, "Motivation in foreign and second language learning: An interactive perspective," *Educational and Child Psychology*, vol. 11, pp. 77–84, 1994.

# Appendix A

## The SU Perks After Survey

**Instructions:** Please answer the following questions regarding the application. Note that all answers are voluntary and any question may be left blank if you choose. Your responses are confidential. Thank you for participating in our study!

1. Rate how much you agree with the following statements on a scale from 1 to 5.
  - What is your current year of study?
  - What is your age?
  - Are you an international student?
  - What is your gender?
  - The application helped me learn about campus resources.
  - The application helped me feel more comfortable on campus.
  - The application had no effect on my comfort level or knowledge regarding the University of Alberta campus.
  - The rewards in the application helped motivate me to get more points.
  - If the application did not have redeemable rewards in the shop, I would have attained a similar score/level.

- I participated in activities encouraged by the application (such as attending campus events) in order to boost my score and get rewards.
- I would have attended the same campus events with or without using the application.
- Using this application was helpful for me.
- I feel that having competition in the application, such as the leaderboard, is a positive thing.
- I liked sending Thumbs-up messages to my teammates more than sending Challenges.
- I liked sending Challenge messages to my teammates more than Thumbs-up messages.
- Receiving a Challenge from someone on my team motivated me to get more points.
- Receiving a Thumbs-up message from someone on my team motivated me to get more points.
- I felt that sending a Challenge message to a teammate would motivate them to get more points.
- I felt that sending a Thumbs-up message to a teammate would motivate them to get more points.
- The 'My Teams' feature of the application encouraged me to meet other students.

2. Students in my team were (select as many as apply):

- Students whom I did not know.
- Students I met at Orientation of Week of Welcome
- Students who share similar interests as me
- Friends of mine
- I did not join any teams.

3. Would you like the UASU to notify you by email in the future when this application becomes available again?
4. What did you find rewarding when using this application?
5. What did you find frustrating when using this application?



# Appendix B

## The Francopass Pre-test Survey

The following survey was available in both English and French.

1. What is your major?
2. What year are you in?
  - (a) 1st
  - (b) 2nd
  - (c) 3rd
  - (d) 4th
  - (e) 5th and above
  - (f) Other (specify)
3. How long have you been studying French?
  - (a) I am Francophone or attended a Francophone school.
  - (b) I am a French immersion student.
  - (c) One university year
  - (d) Two university years
  - (e) Three university years
  - (f) Four university years
  - (g) More than four university years

- (h) Other (specify)
4. How would you rate your overall comfort with the French language?  
(Likert scale, 1-5)
5. How would you characterize your overall perception of the local franco-  
phone community?(select as many qualifiers as apply)
- (a) Friendly
  - (b) Accessible
  - (c) Distant
  - (d) Lively
  - (e) Foreign
  - (f) Other (specify)
6. How would describe your relationship with the local Francophone com-  
munity? (Likert scale, 1-5)
- (a) I am not interested in knowing more about this community.
  - (b) I had no idea there was a Francophone community in Edmonton.
  - (c) I would like to know more about the Francophone community.
  - (d) I would like to be part of the Francophone community.
  - (e) I am acquainted with people from the Francophone community
  - (f) I consider myself part of this community.
  - (g) Do you attend events in the Francophone community (e.g., theatre,  
movie screening, music concerts, and social events)?
  - (h) If yes, which one(s) (select as many as apply):
    - i. Theatre play
    - ii. Music concert
    - iii. Movie screening
    - iv. Community association and board meeting

- v. Conference
- vi. Other (specify)

7. How would you assess your level of involvement in the Francophone community? (select as many as apply)

- (a) I am not involved whatsoever in the Francophone community.
- (b) I get involved in the Francophone community only when I have to (e.g., as part of a course requirement)
- (c) I keep myself informed about events happening in the Francophone community (media.. etc)
- (d) I have several friends in the Francophone community.
- (e) I am involved in one or several Francophone organization(s) (e.g., as volunteer).
- (f) I organize activities in the Francophone community.
- (g) Other (specify)

8. Have you used the “Passeport” and or the “Activités dans la communauté” Moodle website in your previous courses? (Y/N)

9. On a scale of 1 to 5, how much do you agree with the following statements:

- (a) Attending events in the local Francophone community is pointless.
- (b) Attending events in the local Francophone community is a stressful experience.
- (c) Attending events in the local Francophone community will help me improve my proficiency in French.
- (d) Attending events in the local Francophone community will help me improve my knowledge of the Francophone culture.
- (e) Attending events in the local Francophone community is fun.

(f) Attending events in the local Francophone community is an opportunity to meet new people.

10. What is your gender?

(a) Female

(b) Male

(c) I do not identify as male or female.

11. On a scale of 1 to 5, how much do you agree with the following statements:

(a) I feel that having competition in the application, such as the leaderboard, is a positive thing.

(b) I would like to see one of my teams at the top of the leaderboard.

(c) I have a few people in mind that I would like to be on a team with.

# Appendix C

## The Francopass Post-test Survey

The following survey was available in both English and French.

### **C.1 Section A: For Students who completed the pre-test survey but did not use Francopass.**

1. If you have completed the consent form and pre-survey, but did not use Francopass, please tell us why: (select as many as apply)
  - (a) I did not find time
  - (b) I did not get enough information on how to use the Francopass (or information was confusing)
  - (c) I found the Francopass too complicated to use
  - (d) I experienced technical issues trying to use it
  - (e) There were not enough events listed in the Francopass
  - (f) I did not like the events listed on the Francopass
  - (g) Events were too expensive to attend
  - (h) Events locations were too far away
  - (i) I did not feel enough pressure to use the Francopass (e.g., from my instructor)

- (j) Items in the shop were not interesting enough
  - (k) Other (specify)
2. Which factor(s) could have motivated you to use the Francopass?
  3. To what extent do you agree with the following statements about the leaderboard feature on the Francopass?
    - (a) I understand what a leaderboard is.
    - (b) I understood that there was a leaderboard feature on the Francopass.
    - (c) I believe the leaderboard is a useful feature to have on the Francopass
  4. Questions for students who have completed the consent form and pre-survey, and have used the Francopass at least once

## **C.2 Section B: For students who used Francopass at least once.**

1. If you have used the Francopass at least once, tell us if you have used it...
  - (a) as part of a French course (e.g., FREN).
  - (b) as part of an Education course (e.g., EDU).
  - (c) on your own.
  - (d) As part of a course AND on your own
2. If you have used the Francopass as part of a course, please specify the course number (e.g., FREN 212)
3. Which activities did you attend? (select as many as apply)
  - (a) Theatre
  - (b) Movie
  - (c) Academic event (e.g., conference, workshop)

- (d) Social event (e.g., Francopains, café croissant)
- (e) Cultural event (e.g., soirée interculturelle)
- (f) Other (specify)

4. How many community activities have you attended?

- (a) 1
- (b) 2
- (c) 3
- (d) 4
- (e) More than 4

5. How did you choose the activities you attended? (Select as many as apply)

- (a) based on my personal interests.
- (b) based on the course topics.
- (c) based on the instructor's recommendations.
- (d) based on their geographical locations.
- (e) based on my schedule.
- (f) based on my budget.
- (g) based on my level of proficiency.
- (h) Other (specify)

6. Rate how much you agree with the following statements on a scale of 1 to 5.

- (a) The activities I attended in the local Francophone community helped to me improve my proficiency in French.
- (b) The activities I attended helped me to improve my knowledge of the Francophone culture.

- (c) The activities I attended in the local Francophone community allowed meet to new people.
  - (d) Attending activities in the local Francophone community was fun.
  - (e) Attending activities in the local Francophone community increased my overall interest for French.
  - (f) The activities I attended in the local Francophone community allowed me to speak French in an authentic setting.
  - (g) I felt welcome attending activities in the Francophone community.
  - (h) Attending activities in the local Francophone community provided me with opportunities to apply skills and knowledge learned in the classroom.
  - (i) The gamified component (e.g., points to collect, items to redeem, and challenges) of the Francopass made the experience of attending events in the community more enjoyable.
  - (j) Without the gamified component, I would have attended fewer events.
7. If you have not used the leaderboard, please tell us why (select as many as apply)
- (a) I did not understand what a leaderboard is.
  - (b) I did not know how to use the leaderboard (e.g., creating or joining a team).
  - (c) I experienced technical issues that discouraged me from using it.
  - (d) Rewards were not motivating enough.
  - (e) I did not have anybody to be on my team.
  - (f) Nobody asked me to be part of their team.
  - (g) I did not like the idea of competing against other teams or students.
  - (h) Other (specify)



8. Is your general perception of the local Francophone community any different from what it was before using the app?
  - (a) It is more negative
  - (b) It is more positive
  - (c) Not really
  - (d) Other (specify)
  
9. If you are an Education student, did the activities you attended in the Francophone community give you ideas to develop pedagogical material for your future students?
  - (a) Yes
  - (b) No
  - (c) I don't know
  - (d) I am not an education student.
  
10. If you answered yes to the above question, provide one or more examples.
  
11. On a scale from 1 to 5, to what extent do you agree with the following statements: Using the Francopass encouraged me to...
  - (a) ...speak French with more confidence.
  - (b) ...get to know my classmates better.
  - (c) ...participate in more activities in the local Francophone community.
  - (d) ...meet people from the local Francophone community.
  - (e) ...learn more about the French language and culture.
  - (f) ...visit a Francophone country or province.
  
12. Would you recommend the Francopass to other students?
  
13. If you were an instructor, would you use the Francopass with your students?

- (a) Yes
- (b) No

14. What do you like about the application? Why?

15. What do you dislike about this application? Why?

16. What would you change about this application? Why?

17. Please rate how much you agree with the following statements on a scale from 1-5.

- (a) I experienced some technical issues with the teams and leaderboard component.
- (b) I understood the leaderboard competition.
- (c) I felt the competition was fair.
- (d) I liked the prize that was offered by the team competition (Cafe Bicyclette gift card).
- (e) The students in my team are (select as many as apply):
  - i. Students whom I did not know before.
  - ii. Students I knew from other courses.
  - iii. Students who share the same interests, etc.
  - iv. Friends of mine.
  - v. I did not join any teams.
  - vi. Other (specify)
- (f) I feel that having competition in the application, such as the leaderboard, is a good thing.
- (g) If the application did not have redeemable rewards, I would still have attained a similar score.
- (h) The 'My Teams' feature of the application encouraged me to meet new students in the class.

18. If you have sent at least one 'Thumbs-up' or 'Challenge' message to a teammate, please rate how much you agree with the following statements from 1-5:
- (a) I liked sending Thumbs-up messages to my teammates more than sending Challenges.
  - (b) I liked sending Challenge messages to my teammates more than Thumbs-up messages.
  - (c) Receiving a Challenge from someone on my team motivated me to get more points.
  - (d) Receiving a Thumbs-up message from someone on my team motivated me to get more points.
  - (e) I felt that sending a Challenge message to a teammate would motivate them to get more points.
  - (f) I felt that sending a Thumbs-up message to a teammate would motivate them to get more points.

# Appendix D

## API Requirements

In order to integrate the gamification layer, the base application must have two endpoints in place.

### D.1 Accounts and Users

#### D.1.1 GET /userdata/<API KEY>

An endpoint can be called to update the scores of all users at a specified time interval (for example, once an hour). For each user, 3 pieces of data are required:

1. Score Information
2. User email
3. Username

**Score information** Score information may be very simplistic (such as a number indicating XP) or more complex, such as badge information or other scoring metrics.

**User email** Users must be identifiable by a unique attribute in order to identify them on the gamification layer. In both implementations of the layer (described in section 3.3), this attribute is the user email which, in both cases, is used to log in to the base application. When the gamification layer is passed a new email address, a new account associated with that address is created.

**Username** A username for each user is also passed via the same endpoint. The username is visible on the leaderboard as well as to the user's teammates.

### Resource URL

`https://<BASE APPLICATION URI>/api/users/<API KEY>/`

### Headers

None

### Example Request

`https://francopass.artsrn.ualberta.ca/api/users/1 23456789ABSCDEFG/`

### Example Response

```
[
  {
    "username": "johndoe",
    "email": "johndoe@ualberta.ca",
    "points": 15,
    "exp": 11,
    "level": 2
  },
  {
    "username": "ashley",
    "email": "ashley@ualberta.ca",
    "points": 20,
    "exp": 22,
    "level": 3
  }
]
```

## D.2 Authentication

### D.2.1 GET /users/current/<AUTHENTICATION TOKEN>

When a user navigates to the teams layer from the base application, an endpoint is called retrieving the logged in user, and a session is initialized for

them.

### Resource URL

`https://<BASE APPLICATION URI>/api/users/current/<API KEY>`

### Headers

Cookie: sessionid

### Example Request

`https://francopass.artsrn.ualberta.ca/api/users/current/1234567`

### Example Response

```
{
  "username": "johndoe",
  "email": "johndoe@ualberta.ca",
  "points": 110,
  "exp": 11,
  "level": 2
}
```

**Note:** When a user is not signed in to the base application and/or cookie was not passed, a blank username is returned.