Digital Timebanking: Market Analysis for College Students

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Abstract

The recent rise of the COVID - 19 pandemic brought light to the significance of working together as a community around college campuses to help each other. Consequently, the inability of working together in a pandemic led many students to prefer delaying their college start altogether. The MQP team saw an opportunity to develop timebanks on college campuses as an alternate mechanism for working together. Timebanking is a mode of exchange that lets people interchange skills through the exchange of time rather than money. This report focuses on identifying potential target users for a timebanking platform and forms a bridge between user needs and platform specifications. The MQP team collected data through interviewing campus occupants and surveying possible end users. The data was analyzed using Hypothesis testing to develop recommendations for a timebanking platform.

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[1] Director of graduate studies for data science at Indiana University

Executive Summary

University life in the U.S. has mainly been highlighted by the engagement, connections, and experiences presented by college communities. However, colleges around the U.S. are not reaching their max potential in terms of community engagement. The importance of having diversified community engagement alternatives particularly stood out after the emergence of the COVID-19 pandemic. This MQP was completed to analyze the possibility of increasing community engagement through a new timebanking platform. Timebanking is a mode of exchange that lets people interchange skills through the exchange of time rather than money.
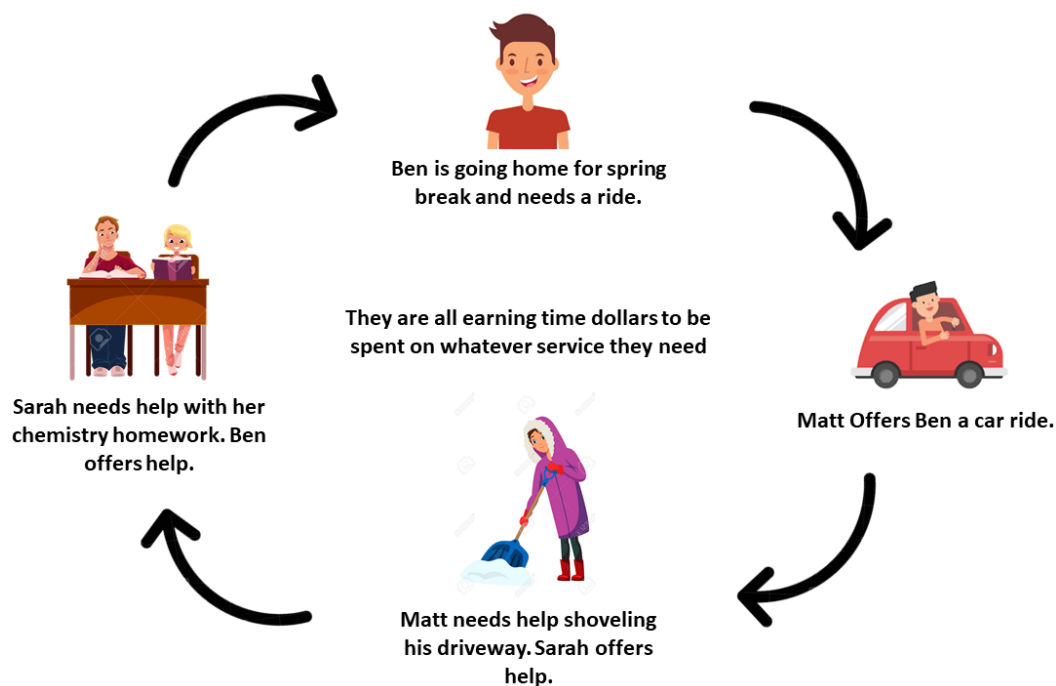
Sample Timebanking Cycle on a College Campus

This project focuses on identifying potential target users for a timebanking platform and forms a bridge between user needs and platform specifications. The MQP team worked with Professor Saberi and Professor Shih to assess the market and propose an implementation plan for a future timebanking platform.

To gain a better understanding of markets, the team started by learning about markets, digital markets, how to analyze a market, and the benefits of doing a market analysis. After that, extensive timebanking research was conducted. The MQP team looked at existing timebanks to identify the benefits and challenges of timebanking. Finally, the target market and users for a potential timebanking platform were identified to conduct further analysis.

The MQP team used interviews and surveys to gather data for a market analysis. The interviews were used to develop hypotheses about market interest, target users and possible features for a platform; all to be validated through the survey. To analyze the information obtained from the survey the team used hypothesis testing. Specifically, confidence intervals, two proportion tests, and ANOVA tests were conducted.

The results from both interviews and the survey showed that university students are interested and could benefit from timebanking. Despite the busy schedules of college students, the MQP team found that students would have enough time to participate in a timebanking platform. The main motivations for students to join this platform were learning new skills, practicing their current knowledge, helping others and receiving help in what they cannot perform on their own. Lack of time and building trust with strangers were the main concerns that could limit the participation of the students. Therefore, the recommendations of the MQP team were based on what would make the participants trust the platform and get their needs fulfilled.

The team utilized the analysis to suggest recommendations for the future development of a timebanking platform. For the short term, the MQP team recommends that the timebanking platform should be developed and advertised in a way that highlights the capability of learning new skills and practicing current knowledge as well as highlighting the potential of having an impact on the community specifically for females. Additionally, the team recommends organizing

workshops on timebanking awareness in order to increase interest in the platform. Moreover, the platform should enable users to have private profiles where friends in common with a user could be viewed under the user's profile. For further improvements, the MQP team recommends focusing on implementing additional features such as showing someone's history of transactions in their profile, having a suggestion system where other members of the platform are suggested to reach out for receiving services. Other features include, having a coordinator who manages exchanges, and having a rating system where every member of the platform has a rating based on reviews received by peers after providing a service.

Introduction

Currently, there are 4298 universities in the United States (Moody, 2019). According to the National Center for Education Statistics, 19.7 million students are projected to attend these universities for the fall semester of 2020 (National Center for Education Statistics, 2019). The United States has a massive community of students and staff either enrolled or employed in these universities. Worcester Polytechnic Institute (WPI) is one of the 4298 universities in this big community.

WPI is a university located in Worcester, Massachusetts. WPI was founded in 1865 to create and convey the latest science and engineering knowledge in ways that are most beneficial to society. Currently, the university's main mission is to offer an education that balances theory with practice (WPI, 2020). WPI has a medium-sized community with 4650 undergraduate students and 2220 graduate students. Its moderate size makes the university large enough to have people from various backgrounds but small enough that students can develop meaningful relationships with the faculty (WPI, 2020). WPI has over 235 student organizations that support a wide spectrum of student interests (WPI, 1970).

Despite what universities can offer, there is still a massive opportunity to increase community engagement. The recent emergence of COVID-19 has shown that college campuses around the U.S are not reaching their potential in terms of providing services to their community. According to an article by CBS News, 40% of incoming college students in the U.S are considering taking a gap year in the hopes of avoiding going to college during a pandemic (Runcie, 2020). Most colleges in the U.S have decided to close their campuses for the academic year of 2020/21 or canceled all non-academic-related activities on campuses such as clubs and sports. The research shows that one of the main reasons incoming Freshmen are deciding to opt-out is that they don't want to miss out on college experiences such as clubs and sports. Due to the cancelation of college

activities, it could be said that colleges might profit from an alternative tool for campus involvement to not be reliant solely on clubs and sports.

College students are not financially independent as most college students either take loans or rely on their parents to finance their tuition. According to a study led by Jeff Grabmeier at the Ohio State University, 7 out of 10 college students in the United States are stressed about their finances. Through a survey, Grabmeier also found out that 64% of college students in the U.S use loans or scholarships to help pay for college (Grabmeier, 2015). This situation is further explained through a website called "prnewswire"[2]. This website states that most college students are cash-strapped, meaning that they are financially struggling (Scholly, 2020).

Considering how most students are either not engaged or are struggling financially, there can be another alternative that will benefit everyone: Timebanking. Timebanking is a mode of exchange that lets people interchange skills through time rather than money (Cahn & Gray, 2015). At WPI, 98% of students receive some form of a grant or financial aid (Prepscholar, 2020). This shows that just like other universities in the U.S., WPI is an attractive medium to establish a platform such as a timebank that can help people spend less. Other than helping students spend less, timebanks can also help them explore their talents to the maximum and develop new ones.

The goal of this project is to analyze whether the idea of "Timebanking" can be introduced into universities, starting at WPI, to increase student engagement and introduce opportunities for student development. Timebanking empowers students' engagement by channeling the collaborative spirit at universities and fostering communities that are actively engaged. This idea

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[2] https://www.prnewswire.com/news-releases/study-college-students-cash-strapped-due-to-covid-19-are-applying-for-scholarships-at-unprecedented-rates-301132583.html

offers students and other members of universities an avenue to practice leadership skills while experimenting in a convenient low-risk setting. Timebanking benefits the people who receive services and enable them to fulfil their needs and learn new skills. Similarly, it allows the people who provide the service to practice their skills. On the larger scope timebanking facilitates human transactions while building and making stronger communities.

Background

This project analyzes the feasibility of applying timebanking on college campuses through market analysis. To conduct a market analysis, it is important to have a clear understanding of concepts related to this project before conducting a methodology. For that reason, this section frames an in-depth comprehension of the main concepts and contexts of the project. Additionally, the section thoroughly explains the notions of market analysis and timebanking in detail and shows the connection between the MQP team's target market and timebanking.

Market Analysis

Market

Any setting where two or more parties engage in an exchange of goods, services, or information can be characterized as a market (MSG, 2020). The party offering the goods is the seller and the party accepting the goods is the buyer. If there is more than one seller and buyer then the market is competitive, if there is a single seller and multiple buyers then that is a monopoly, and if there are multiple sellers but one buyer that is a monopsony. Some examples of market types include physical markets, virtual markets, and knowledge markets. In a physical market, both the seller and buyer physically meet to complete the transaction, whereas, in a virtual market transactions are done online. A knowledge market is where the exchange of information is carried out as compared to an exchange of goods.

Market analysis

A market analysis is a process of gathering information about a market within an industry (Kappel, 2019). A market analysis is used to gain insights about the potential market and target customers, to help make important business decisions. A market analysis helps answer many important business questions to ensure that the business is starting in the right direction. Some questions a market analysis can answer include:

- Who is the target customer?

- How large is the target market?

- If the market is growing?

- Who are the competitors?

- What are the strengths and weaknesses of the competitors?

Since there are many reasons as to why a company should conduct a market analysis, a good first step is to clearly define the purpose of conducting the market analysis. Next, the market could be analyzed to figure out the total size and to quantify the market growth or the market decay. A market analysis helps determine who the target customers are and what qualities they value in their product. The analysis also provides essential information regarding the competition, for example, it aids in finding the weaknesses of competitors which can be focused on while trying to enter a market.

Benefits of doing a market analysis

By conducting a market analysis, a business can ensure it is making informed unbiased decisions and increase the likelihood of success. With the insights gained through market analysis, a business can minimize investment risk, identify potential threats and opportunities, spot emerging trends, estimate possible revenue, and make sure it is focusing on the needs of the customer (10 key benefits of market research, 2018). Gaining a deeper perspective of the target customers helps the business ensure that it is offering a product that the customer values and also helps make sure that the business is set up for future growth. The business can ensure that the product it offers stands out from its competitors by analyzing the value of the competitor's product. By studying the market size and growth, the business can estimate the potential market available and the potential revenue. Overall, a market analysis can help make sure that the product is valuable in the eyes of the customer and assists in determining what aspects of the product the company can focus on to have the highest chances of success.

Digital Markets

With the discovery and expansion of the internet, new markets started to emerge and impact industries. These are called digital (or Internet) markets. Some examples include financial trading, job matching, job searching, online media, classified advertisements website, car ride applications, online bartering systems and many other activities conducted through new internet platforms. Digital markets are successful because they all "take advantage of how the internet has lowered a range of economic costs: the cost of creating and distributing certain types of services, the cost of acquiring information about these services, and the cost of collecting and using data on consumer

preferences and behavior. These changes have helped make internet platforms particularly dynamic and innovative, and inspired a great deal of economic research." (Levin, 2011).

This section focuses more on classified advertisement websites, car ride applications and online bartering systems as those platforms are the closest examples to digital timebanking platforms. One good example of a classified advertisement website is "Craigslist". Craigslist is an "Internet-based classified advertising Web site that is free for most users". First of all, Craigslist is a good example because most of its postings are for free besides some exceptions. Considering how the purpose of a timebanking platform is to use time as its currency instead of money, some of Craigslist's methods can be followed while developing a timebanking platform.

Another advantage of Craigslist is that "users sort themselves into narrow categories of interest". The option of being able to sort themselves into their category of interest is very important because it directly leads the users to complete their needs or desires. This is exactly what the timebanking platform aims to do where users can post their needs or search for other users who can provide them with the service they need.

Furthermore, Craigslist has a very simple website. This simple website was a decision made by Craigslist founders to show that Craigslist just wants its users to directly get to the point without any additional media. This is another similarity between timebanking platforms and Craigslist. Similar to Craigslist, timebanking platforms should also be formed to get directly to the service exchange process. People should not get lost with other media and be able to immediately post or accept a service request because sometimes the requests could be time sensitive such as driving someone to somewhere else.

Finally, Craigslist totally depends on user feedback. This is one of the most important characteristics of Craigslist. As seen in many other companies and industries, user feedback and

implementation is critical for the success of a platform because those changes are what the customer wants. If a company doesn't address their customers' requests, then the customers will no longer stay as their customers and start to look for alternative options. This is the worst option for a company as they not just lose a customer but also let their competitors get another customer. Timebanking platforms should also prioritize user feedback as the main idea of the platform is to complete user requests by providing the services they need.

Even though Craigslist has many advantages that could be taken as an example while developing a timebanking platform, it is not a perfect website. Craigslist also has some disadvantages that should be noted. First of all, Craigslist has a lot of scams. Unfortunately, due to how the website is designed, some people try to take advantage of the system and scam other users. This is a huge concern and definitely something to be considered while developing a timebanking platform. There should be extra precaution while accepting users and a detailed background check has to happen before allowing a user to join the platform.

On top of the scams, Craigslist also includes so many offers that are too good to be true. Even if it is not a scam, some offers may look like one just because of how profitable it is for the user who takes the offer. These offers are very unrealistic and rarely happen. Therefore, people tend to not believe them. This is another concern to be addressed. For example, someone might post a request to learn how to cook a certain dish and ask for 4 hours worth of service where the dish could easily be prepared in 30 minutes. If users come across with a request like this, they will be very hesitant to accept the request unless they trust the platform and the other users in it.

Finally, Craigslist also keeps track of the posts and when they notice that an ad has been reposted, they are allowed to delete that ad. It is called "toplisting". Users sometimes try to do this to have their "ads stay at the top of a category list." This is another concern to be looked for because

timebanking platforms should allow re-postings. If a service request is not met by the given time but is still available, then the user should be allowed to repost that request. For example, if a user is moving out of their apartment and still hasn't received a service after the request deadline on the platform has passed, that same user should be given the chance to repost the same request until their move out deadline (Heindl & Sanapala, 2009).

One good example for a car ride application is Uber. Uber is a technology company that started their operations as a rideshare application and expanded their business to other markets such as food delivery, package delivery and freight transportation. First of all, Uber is a good example because it focuses on carpooling. Carpooling could be an example of a service that could be included in a timebanking platform. Even though Uber uses a monetary payment for the service, the type of the service is very similar to the one that could be used in a timebanking platform.

Moreover, Uber "leverages technology to connect people and create the infrastructure to support transactions with common social goals." This is a key characteristic of Uber to be used as an example as timebanking platforms would be created for the same reason, with the exception of using time for transactions instead of a monetary payment.

Finally, Uber is a great example when it comes to understanding how users connect with strangers. Uber has a rating system where every driver is rated on a scale of 1 to 5 star after providing their service where 5 is the best service and 1 is the worst. Similarly, every user is also rated by the drivers. The average ratings of every driver and user are shared while connecting them with each other. Through this feature, the drivers and users can identify the feedback given by others that have either provided a service to a user or received a service from a driver. This is very important for a timebanking platform as the users will only prefer to exchange a service with

another user if they are comfortable with that person. Looking at the feedback from other users will help people trust the other users and the platform itself.

Even though Uber has many advantages that could be taken as an example while developing a timebanking platform, it is not a perfect application. First of all, Uber only has car rides as a service. Timebanking platform will entail many other services rather than sticking to just one service. Also, Uber uses monetary payment for their transactions where timebanking platforms are designed to get rid of using money for a service (Calo & Rosenblat, 2017).

Finally, another similar market to timebanking platforms is online bartering systems. Bartering systems are the oldest method of exchange. They were used way before money was even invented. Through the bartering systems, people exchanged goods or services to receive other goods or services in return. With the discovery of money, bartering systems were shut down until the development of the internet. When the internet was developed, people started to use bartering systems again through websites. Now, these websites are defined as online bartering systems. A good example to use for an online bartering system is Simbi[3]. Simbi operates pretty much like a timebanking platform where users can exchange services without using a monetary payment. Also, Simbi has very similar user interactions to what a timebanking platform could have. Users reach out to other users to propose exchanges based on what they want to receive. This could sometimes be a direct exchange where two people provide and receive a service from each other. However, it could also not be a direct exchange where once a user provides a service, they earn Simbi credits that they can use at another time. This is exactly how timebanking platforms will work but instead of a Simbi credit, time will be used as the currency. What makes Simbi a unique platform is that users post about what they can provide as a service instead of requesting for a specific service.

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[3] https://simbi.com

This is advantageous because users have a variety of services to choose from while searching for what they need. However, it is also not advantageous because there are so many offers to go through and find what a user actually needs. Being able to post a request would make that process much easier than what it currently is (Lampinen, et al., 2013).

Overall, Craigslist, Uber and Simbi are just three examples that were used on this section to highlight some of the characteristics, advantages, and disadvantages of classified advertisement websites, car ride applications and online bartering systems as they are very similar to how timebanking platforms can and should operate.

Timebanking

General overview/Importance of timebanking

The notion of timebanking became popular in the early 1980s by professor Edgar Cahn to be used as a tool for social justice (Thorpe, 2018). Timebanking is a concept that organizes people in a system where they exchange or trade skills and expertise using time credits as a medium of exchange rather than money (Willey & Ugga, 2011). To date, there exist over a thousand timebanks in about 30 countries and are most prominent in the United Kingdom and the United States where they could be found in 40 different states. The idea of timebanking was initially developed to be used for social justice in an attempt to reduce re-arrest rates. Nowadays, timebanks have evolved to help build communities and organizations. Timebanks build social networks of people from different backgrounds who grow relationships by giving and receiving. Aside from giving and receiving, people end up forming friendships and connections strengthening what is known as social capital. Timebanks have proven to be the most beneficial for people who do not have a large amount of income and can benefit from using their time as an exchange rather than using capital.

Benefits of Timebanking

Timebanking poses many benefits in terms of proving to boost mental health and improve the well-being of people by reducing isolation. A study made by the New Economics Foundation (NEF), shows that timebanking helps people who are unemployed and spend most of their time at home. The study demonstrates that timebanking can improve mental health because it gives people something to do and to get out of the house which could be depressing for many people.

Timebanking also brings people together, leading to the birth of new relationships which could go a long way for a person who lives on their own and does not have much to do with their time (Ryan-Collins, Stephens & Coote, 2008). The study backs these claims by giving out two examples of timebanks that were set up with the main purpose of improving the well-being of people in areas with high levels of unemployment and mental ill-health. Another study led by Monica M. Whitham from the department of Oklahoma State University and Hannah Clarke from the School of sociology at the University of Arizona demonstrates that timebanks empower people by enabling them to meet their needs. Members of a timebank feel empowered because they can purchase help rather than the norm where people are usually recipients and could feel that people are just helping them out of pity or as a charity (Whitham & Clarke, 2016). Lastly, timebanking could benefit individuals in gaining access to more diverse skill sets as they are exposed to different people with different backgrounds and experiences.

Challenges of timebanking

Despite all the benefits that come with timebanks, there exist some challenges in being able to maintain the durability of a timebank and maintain the networks and connections built. According to Ed Colom, a sociologist at California State University, Fullerton timebanks do not last long because there is not enough leadership available resulting in the petering out of the networks. Colom also states that digitizing timebanking and the creation of the apps can help revitalize the timebanking movement as they make it easier to find good services using rating systems that can help build trust (Matchar, 2018). Research conducted by Lucie K Ozanne at the University of Canterbury highlighted another difficulty in implementing timebanks. Since timebanks use a different mode for exchanging than what people are used to, users had difficulties in grasping the concepts of the exchanges made through timebanks. One of the users was

discouraged to spend any time units before gaining any stating that "you don't normally spend money that you don't have" (Ozanne, 2010). Ozanne stated that what people struggle to understand is that timebanking is based on principles of trust and reciprocity. However, once people started using timebanks frequently, those principles became clear and people were encouraged to participate, increasing their confidence in timebanks.

Timebanking in the world

All of the benefits and challenges provided above come from past experiences. This section will highlight some of the timebanking experiences conducted around the world.

The Volunteer Labour Bank in Osaka, Japan is one of the world's first known timebanks (TSIT, 2014). It was formed in 1973 and later became the hub of a national network of timebanks, called the Volunteer Labour Network. The network expanded to the US in the 1980s, making it the world's first international timebanking organization. The network combined volunteer work with time exchange making it a unique combination. The timebank in Japan focused on caring for the elderly; however, with time, the elderly population increased and new timebanks emerged that offered mixed-currency payment methods, decreasing the popularity of the Volunteer Labour Bank.

In 2004, Dr. Gill Seyfang published a study talking about one such timebank (Singh, 2107). The timebank was located in the Gorbals area of Glasgow, Scotland, an area that had high levels of poverty, unemployment, and poor health. The Gorbals timebank was run by a local charity to tackle society's problems by allowing people access to services such as home repair, gardening, and tuition assistance. For three years, the timebank was successful; however, due to lack of funding the timebank had to shut down.

The next example comes from Hampshire, United Kingdom. The project began in 2016 when Hampshire County Council was awarded a grant through Timebanking UK (Timebanking UK, 2019) with the aim of planning and implementing a network of timebanks. Timebanking UK began by looking for target areas (towns, districts, etc.) that would benefit from timebanks. The target areas included regions where there was a local need and communities where similar projects existed. The next step for the Hampshire project was to come up with a project plan that considered the following aspirations:

- The timebanks should be set up by the community, for the community

- A Working Group would co-produce the timebank in each area

- Funding would be sought to employ a part-time Broker to run each timebank

- A Host Organization would be sought to "own" each timebank

- The timebanks would start small and grow organically

- The timebanks would be set up with strong foundations to be sustainable

When the project plan was developed, six key stages were identified: 1) Launch, 2) Local Workshops, 3) Working Groups, 4) Host Organization, 5) Resources, and 6) Fledgling timebanks (TimeBanking UK, 2019). The launch stage is the part where two workshops on "Introducing Timebanking" were held. These workshops were just to get people to be familiar with the concept of timebanking. The MQP team believes that holding workshops is also necessary since the target users are not familiar with the idea to be introduced. The local workshops stage is the next step, where a wide range of local organizations and people are invited to workshops. The first half of this workshop explained timebanking generally, and the second half explored how a timebank might be set up in that particular location. The MQP team thinks that this could be very beneficial

for the implementation of timebanking after the market analysis is done. Therefore, this stage would be applicable for a future project. Similar to the Local Workshops stage, the other 4 stages (Working Groups, Host Organization, Resources, and Fledgling timebanks) are also not applicable for this project and could be beneficial for a continuation project. However, the MQP team is planning to make use of the first stage identified in this research when trying to implement timebanking into WPI and then other universities.

Another timebanking example from the world comes from a more relatable setting. A classroom-based, experiential timebanking project was conducted as an innovative community practice teaching strategy for the students enrolled in a Master of Social Work community practice course, spanning two academic years at the University of Georgia. This course offered students to participate in a 7-week timebanking project. The project focused on two primary course objectives: "(i) engage in and reflect upon experiential learning activities; and (ii) explore community assessment techniques attune to both needs and assets" To bring the attention to how a timebanking works, "Both classes collaboratively prepared a brief community summary, findings from the community belonging survey, inventoried assets and needs, and types and an overall number of exchanges." The interesting part of this project was that "across both classes, the most common types of exchanges involved transportation (e.g., providing rides), cooking and meal sharing, and companionship, which were offered via member-to-member or member-to-group exchanges." (Matthew, 2020). Considering the primary focus of the MQP team is university students, the team will make use of this example to understand how the target users can be engaged and interested in the idea of timebanking in their community.

A more relevant international timebank was done at the Dharma Drum university in Taipei, Taiwan. The 2009 global economic crisis severely affected Taiwan with the national

unemployment rate reaching an all-time high of 5.8%. Due to the recent rise in unemployment rates the Dharma Drum university looked at implementing on-campus timebanking practices in the hopes of delivering greater stability to the campus community's quality of life during times of financial disturbance (Lee, 2009). The goals of the timebanking program included helping students with financial difficulties by offering them an opportunity to exchange volunteering services for a tuition waiver, promoting learning by doing, and providing volunteers with recognition and rewards. The timebank was set up in a way where students would earn time credits by performing on-campus jobs such as being a research or teaching assistant, operating the university website, or working at the campus library, and in return, students would receive deductions in their tuition.

One timebank that tackled the problem of community engagement was the Welsh timebank (Gregory, 2013). The timebank was founded on the idea that engaging the local people and empowering them could help redevelop local communities. One stark difference between this timebank and others was that instead of building connections within communities on a person-to-person basis like most timebanks, the Welsh timebank employed a person-to-agency model. In such a model the agency sets up the timebank with the intention of utilizing it to develop and expand its organizational goals. The agency would provide the locals with the opportunity to earn credits by taking courses that would have benefits for the wider community. The locals could then use these credits to make use of other services and this method was innovative as it allowed people to join the timebank without having to worry about what the participants could offer in return.

One can learn a lot from the way timebanks have progressed in Spain. In a few years, the number of timebanks in Spain has considerably increased as the political parties have committed to building timebanks in their agendas to fight against the deteriorating economic situation. Timebanks in Spain are an interesting case study as even though there has been a push to promote

timebanks on a national level, they have not been successful as one would expect. In most cases people never made a transaction after joining the timebank, in some cases they only joined a timebank to get a specific chore done, in some cases people joined to offer services but would never request any, treating it as charity rather than a timebank, proving that timebanks in Spain are mostly symbolic (Valor, 2016).

The examples above show that several experiments regarding timebanking are being conducted around the world and the idea of timebanking is progressing at a fast pace. However, when it comes to timebanking, the United States is not able to make progress at the same speed.

Timebanking in the U.S.

This section of the report will point out some timebanking experiences conducted around the United States. The history of timebanking in the United States has been an evolving one and thus the timebanks can be categorized into two major categories which are traditional and digital timebanks. Traditionally, the timebanks were within small communities where each community member knew each other (Matchar, 2018). In this setting, the size of the timebank was limited to only people within certain regions or certain communities. Additionally, these timebanks were started with a specific goal after identifying one specific need in those communities. However, as time moved on and technology became an attractive medium for all human interactions, timebanks caught up with the digital world. Timebanks started utilizing more websites and mobile apps which greatly expanded the opportunity for the population to grow and the diversity to increase in the timebanks. Henceforth, the number of skills and services that can be shared within a timebank increased accordingly.

Traditional Timebanking in the U.S.

To demonstrate the operation of traditional timebanks in the U.S, Edgar Cahn and Christina Gray conducted deep research on timebanking. Cahn is the founder of TimeBanks USA, which served as an incubator for new timebanking initiatives. One of these initiatives happened across 13 neighborhoods in Los Angeles by The Arroyo SECO Network of TimeBanks (ASNTB). There was an established dual-currency loan fund for people to start small businesses and payback in time credits. Borrowers are more likely to repay their loans when they are accountable to their community. ASNTB takes this principle one step further by emphasizing values such as reciprocity and "paying it forward." Another initiative happened in Rhode Island, where "a group of parents who have children with bipolar disorder, schizophrenia, or autism use timebanking to create a kind of extended family." Parents earn time credits for "providing child care, coaching, transportation, and personal support to each other" whereas children earn time credits by "participating in their mutual support group." After that, parents and children can spend the earned time credits on outings that the group network sponsors. A benefit of this system was that it "enabled parents to prevent the institutionalization of their children, and it has saved the state government millions of dollars that would otherwise be spent on support services." (Cahn & Gray, 2015) The article includes many more examples like the two provided above. These examples all demonstrate community efforts to benefit from the use of timebanking. The MQP team will consider these examples as different ways to engage people in participating in the timebanking system that will be created in the future.

Digital Timebanking

Throughout this section, a variety of digital timebanking apps will be introduced. The apps were identified as possible competitors for the team's final product. The features of these apps will be examined to identify the most suitable features for a possible implementation of a timebanking platform for college campuses.

An example of digital timebanking comes from a study conducted with actual members of web-based timebanks to understand the value behind timebanking. To be precise, "50 randomly selected timebanks affiliated with TimeBanks USA" were used in the study. The same organization mentioned above that Edgar Cahn founded. However, the study was very selective of its members. "Only those members who have recently (within the last 3 months) either received or provided service through timebanks were invited to respond." The study used online surveys to understand more about timebanking experiences from different people and conducted a detailed analysis to understand the responses. For example, "Factor analysis was performed on the combined data set obtained from the users to establish the validity and reliability of the measures used in the study. Further, the correlation matrix and internal reliabilities of the measures were also examined. The widely recommended Moderated Hierarchical Multiple Regression (MHMR) was used for testing the direct and interaction effects of independent variables. MHMR analyses were conducted on the data set using IBM© SPSS© Statistics Version 19. In the first step of MHMR analysis gender, age, and length of user experience with timebanks of the subject were included. In the second step the values derived by members - Utilitarian Value, Hedonic Value, and Social Value - were included." This detailed analysis proved two ideas initially hypothesized: 1) Timebanking services will provide Utilitarian, Hedonic and Social value to its members. 2) The behavioral intention of members to participate in timebanking will be positively influenced by the value derived by them in both receiving and providing services through timebanks (Kakar, 2020).

The results from this study showed the MQP team that the focus should be on making the target users identify the values of the proposed system.

Another digital timebanking example and probably one of the more relevant examples comes from a study conducted around the Northeastern U.S. area. This is an important example because this study focused on building a timebanking smartphone application for a university town in the Northeastern U.S. region and had its target users as university students. Therefore, it is very relatable to the work that the MQP team will do for this project. For this example, 32 university students were recruited. The experimental process was then divided into three distinct steps: 1) Pre-study survey. 2) A five-week application use. 3) Post-study survey. The pre-study survey was focused more on "the smartphone usage of students to understand their technology affinity and two scenarios of mobile timebanking activities to set expectations and initial attitudes toward the timebanking concept." For the second step, participants were instructed to download the app and start posting according to their free will. The only major thing to note for this case was that participants were allowed to post even if they didn't have time credits. Finally, the last step had the post-study survey, where the participants were asked to provide their overall experiences in terms of "the tasks (e.g., reasons for posting and taking a task, how the task was completed, etc.), their satisfaction after completing transactions, familiarity with the person involved in the transactions, and open-ended questions including a sense of community attachment and challenges encountered." The study also had interesting results as during the five-week application use, 116 tasks were posted and only 44% of them (51 tasks) were completed. However, the study also showed some common results such as the tasks that included items that had more posts. Students were more inclined to give away or trade their items with each other (Han, Shih, Belotti & Carroll, 2015).

One of the best tools to stay updated about timebanks is a website called community.timebanks.org. This website constantly provides an update about the activities of different timebanks around the world. The team found it captivating how every time the website was checked, the United States timebanks were found the most active competing with the ones in New Zealand mostly. For example, the Crooked River Alliance located in Kent, Ohio records 85082 hours which is about 247 hours per each of their 345 members. This timebank is an eminent example of how an active timebank can benefit its members. The Neighbor-2-Neighbor Timebank in Allentown, Pennsylvania has a total record of 210283 hours which makes about 838 hours per each of their only 251 members (community. timebanks, nd). Finally, there is a timebank located in North Central Massachusetts. This timebank is located near WPI. The best part of this timebank is that participants are given step-by-step instructions on how to be involved with and efficiently use the system (Werner, 2008). There are a lot more very active timebanks in the US including some in Massachusetts such as Cape Ann Timebank in Rockport, Boston Ujima Timebank in Boston, and many more. All these active successful timebanks around should give the MQP team hope that the project will prosper.

With the upcoming digitalization of timebanks, it is also relevant to study the different features used in timebanking applications. Hourworld, a mobile application developed by researchers at Pennsylvania State University was developed in the hopes of digitizing pre-existing timebanks. On the other hand, YingMe[4] aims to create new timebank communities to strengthen social capital and connect people. YingMe was created by Karla Ballard who was always interested

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[4] https://yingme.co/

in the concept of timebanks and was inspired by the rise of the "Sharing Economy" to digitize the concept (Matchar, 2018). After completing a task, users on YingMe could rate their experience. This creates a sense of trust as users would want to maintain high ratings to build a good reputation and ensure people would want to exchange with them in the future. SevaX is another application that aims to create new communities through timebanks. As opposed to most timebanks SevaX charges a 15$ fee per month for people who want to join a community. SevaX strongly believes in creating communities through timebanks and encourages people to make connections by having a "feed" feature on their application where people can post messages and photos to either celebrate their volunteering accomplishments or share articles about events. SevaX is more than just a platform for timebanking. It is also a way to make connections and is used as a form of social media. Trustlines also aims to create new timebanks and focuses mainly on building a sense of trust between users to make sure that no one is exploiting the system. Through Trustlines, users can be assigned a mutual credit limit. The limit starts at 25 and cannot go lower than -25 this is used to make sure people are not only requesting services but are also providing services in return. Users must set a credit limit which is the number of hours they expect to contribute over a set period. Trustlines have also been used across Europe in situations where some businesses such as convenience stores would allow people to spend some of their time credits for discounts on purchases and in return, the store would receive some services (Trustlines, n.d).

Professors at the Pennsylvania State University examined different timebanking platforms for over a year to determine what characteristics would be useful for a timebanking platform to have (Han, Shih, Belotti & Carroll, 2014). They collaborated with 'Hourworld' to figure out what fundamental functions a timebanking smartphone application should include. They learned that the Hourworld app supported a seamless user experience between the web and mobile platforms,

which enabled real-time timebanking as an extension of the web-based asynchronous model that has been available so far. Another important feature of the app was its use of location information: it allowed users to pin the location where they want services and also suggested users transactions based on the location. The app also allowed users to add expected expiration dates for tasks which could be used as an indicator for task urgency.

During their research, the researchers learned that apps focus mostly on tracking timebanking credits and debits and do not "dispel some members' discomfort with asking for help", which can make it harder for users to participate (Han, Shih, Belotti & Carroll, 2014). They suggested that highlighting "broader social and personal rewards" for new and old users might help alleviate that problem. One way that could be done is by encouraging relationship formation between people who exchange services which would help build a stronger community. To do that, instead of simply recommending someone who has the right skills to complete a task, the app can recommend someone who is in the "same age range or with similar interests described in their personal profile." They also suggested that gamification of apps, for example by adding badges for special appreciation, could increase user engagement. Another suggestion included showing the history of the task completions by a specific user and also showing task completion time so that others looking at that user for potential exchange can have confidence in their exchange. According to their research, these additions in future timebanking apps would boost engagement and allow the apps to last longer.

Market Analysis for Timebanking

What is our market?

The MQP team identified its market to be a two-sided market. A two-sided market is defined as a platform through which buyers and sellers can meet to exchange a product or service (Kagan, 2020). In a two-sided market, the platform helps in bringing buyers and sellers together. Through the timebanking platform, students will be able to act as buyers and sellers to exchange services with each other.

The MQP team's principal target users are university students. These students will either be within one university campus or from different universities located apart. The initial market that the MQP team will presume is the Worcester Polytechnic Institute student body. As mentioned before, there are 4650 undergraduate and 2220 graduate students (WPI, 2020). This community can benefit from a platform such as a timebank as these students come from very diverse backgrounds. The diversity at WPI or most other universities can make it difficult for some students to be well integrated into the community. Thus, when students need help, it can be hard for them to find it. About 19% of WPI students are international (Collegefactual, 2020) and a timebank would at least help them address some of their needs, even if they haven't found any friends. Through the use of timebanks, students can receive services while avoiding monetary payments, reducing the financial burden on them, and making it more likely for students to reach out for help.

Conclusion

Although timebanks aren't popular in college environments, it is without a doubt that they have been successful and popular across different parts of the globe. Timebanks are also becoming

popular in the US but have not been implemented in many university settings yet. However, the MQP team cannot ignore the challenges that timebanks have faced over time, and the methodology and market analysis will work towards addressing and avoiding such challenges. There is already hope for success since there is a presumed connection between the MQP team's target market and timebanking, based on very eagerly social and continuously growing communities in universities. The MQP team hopes that the observations from the analysis methods will aid in scrutinizing the proposed hypothesis.

Methodology

The MQP team relied on interviews and surveys as their main method of conducting market research. First, the team interviewed fellow peers at random to gather market interest regarding timebanking, and to narrow what areas to focus on as per market demand. Then, the MQP team built a survey based on the information gathered in the interviews to scale the number of people the team is approaching for market research. Once the data collection steps were completed, the MQP team used hypothesis testing focusing on confidence intervals, two proportion tests, and ANOVA to analyze the collected data. By conducting the market research through these methods, the team expected to determine the viability of introducing timebanking to the market and to anticipate and tackle any hurdles that may come up.

Interviews

The team organized a series of interview questions (Appendix A) to further investigate the perception of the target market to the idea of timebanking. Due to COVID-19 circumstances, the team identified that it is important to conduct interviews both in-person and online as despite having a significant number of students on campus, there was still a good portion who were studying remotely and the team believed that their opinions mattered. Moreover, the online interviewing option allowed the team to interview people from other universities, such as Indiana University.

The team was hopeful that the interviews would help confirm whether timebanking would be suitable for college campuses and if so who are the target users, what would they be looking to gain and exchange through timebanking, and what would be the most suitable implementation for a timebanking database. The team came up with hypotheses that answered the preceding questions

based on the information received from the interviews. The results of the interviews conducted by the team were used to draw up the following hypotheses:

- Hypothesis 1: Timebanking interest comes from students who are socially active on their campuses.
- Hypothesis 2: Students will not be enthusiastic about participating in timebanks since the idea was still relatively new to them.
- Hypothesis 3: Female students will be more engaged than males and other genders in a potential timebanking platform.
- Hypothesis 4: Freshmen and Sophomores will be more engaged than other students in a potential timebanking platform.

The data gathered through the interviews was used to create a survey to obtain further information on this matter. The survey influenced by the interviews will further aim at validating the team's initial hypotheses.

Survey

Other than interviews, the MQP team conducted a survey (Appendix B) to gather data for this project. The surveys were created through Google forms before distribution. Google forms allowed the team to ask different types of questions like multiple-choice, short answer, paragraph, checkbox, dropdown, and linear scale. The variety of possible questions made Google forms advantageous for the MQP team's use. To distribute the survey, the team used Sona Systems. Sona Systems is a cloud-based participant management software that allows students to sign up to participate in the survey and helps the team reward credit to the students who participated in the

survey. To further increase the number of participants, the MQP team considered sharing the survey with acquaintances, asking them to share it as well. The team believed that this would be an easy and quick way to distribute the survey and therefore, get additional responses.

In terms of the content of the survey, the MQP team made use of the interviews to narrow down key aspects for interrogation. The purpose of conducting the surveys was to see whether people are interested in timebanking or not. The questions aimed at identifying interest, hobbies, and campus involvement tried to determine what students do in their free time. The survey also aimed to further pursue the interview efforts in identifying how timebanking would be used at universities as well as possible users for an end product. Additionally, the team aimed to identify possible skills or activities for people to exchange through timebanking.

Hypothesis Testing

Hypothesis testing was used as the method to analyze the data collected from the survey, to validate the initial hypotheses developed by the MQP team through the information gathered from the interviews. The analysis mainly included three hypothesis tests: Confidence Intervals, Two-Proportion Test, and ANOVA.

Confidence Intervals

"A confidence interval is usually interpreted as the range of values that encompass the population or 'true' value, estimated by a certain statistic, with a given probability." (Nakagawa & Cuthill, 2007) The MQP team used 95% confidence intervals to determine:

1) The average free time in a day of possible end-users of the timebanking application.

2) Whether the possible end-users would be interested in using a timebanking mobile application after the information they gained from the survey.

3) The anonymity level of the timebanking platform.

The responses received for each question were coded before applying the method.

To determine the average free time in a day of possible end-users, the MQP team used this question: "On average how much free time do you have in a day? (in hours)". For this question, there were four possible answers that someone could give: 1-2 hours, 2-4 hours, 4-6 hours, and more than 6 hours. The MQP team determined that the best way to code this data would be to assign a value of 1 if somebody selected the 1-2 hours answer, a value of 3 if somebody selected the 2-4 hours answer, a value of 5 if somebody selected the 4-6 hours answer, and a value of 6 if somebody selected the more than 6 hours answer. After the coding process was completed, the MQP team began the calculation for the confidence interval. For the calculation process, the following formula was used:

$$CI = \bar{x} \pm z\frac{s}{\sqrt{n}}$$

For this formula, CI stands for Confidence Interval, the x bar stands for the mean of the data, the z value stands for the confidence level value, the s stands for the standard deviation of the data, and finally, n stands for the sample size. For a 95% confidence interval, the z value is always taken as 1.96.

To gain knowledge about the respondents' interest in the platform, the MQP team used this question: "Would you use a timebank system if there is a mobile app designed for that?". For this question, there were four possible answers that someone could give: yes, need to get a better understanding of what a timebank is, maybe, and no. A similar coding procedure was followed where an answer of yes was assigned a value of 4, an answer of need to get a better understanding of what a timebank is was assigned a value of 3, an answer of maybe was assigned a value of 2 and an answer of no was assigned a value of 1. Finally, the formula provided above was also used for the confidence interval calculation of this question.

Finally, the third statement was used to determine the anonymity level of the timebanking platform, the MQP team used this question: "When exchanging services through a timebank would you prefer to know the person in order to build a relationship or would you rather it be a more anonymous and simply receive the service. (Rate from 1 to 5 according to relevance with 1 being anonymous and 5 being personal)". For this question, there were five possible answers that someone could give: 1, 2, 3, 4, and 5 where 1 was fully anonymous and 5 was fully personal. Since these were numerical values already, no coding procedure was conducted. The formula provided above was used for the confidence interval calculation of this question.

Two-Proportion Test

The two-proportion test method is used to test a null hypothesis in which two population proportions are equal to each other (Petrucelli, Nandram & Chen, 1999). The MQP team used this test twice on the obtained data to look for certain differences between gender as well as the academic year. Specifically, the test was used to determine whether there was a difference between:

1) the average free time in a day for males versus females and Freshmen and Sophomores versus juniors and older participants

2) how each of the motivators was valued by males versus females and Freshmen and Sophomores versus juniors and older participants

3) how each of the limitations would affect the participation of males versus females and Freshmen and Sophomores versus juniors and older participants

4) how each of the proposed features would affect the comfort levels of males versus females and Freshmen and Sophomores versus juniors and older participants

The responses received for each question were coded before applying the method. Initially, the responses were coded by gender, and then they were coded by academic year.

As mentioned in the confidence interval section, the question that was used to determine the average free time in a day of possible end-users was: "On average how much free time do you have in a day? (in hours)". This question had four possible answers that someone could give: 1-2 hours, 2-4 hours, 4-6 hours, and more than 6 hours. Once the sample was collected, the MQP team coded the data to look at the percentage of females that answered the question as 2-4 hours or above. The same procedure was also conducted for the male population. After this calculation, the MQP team also calculated the total males and females who answered the question as 2-4 hours or above and divided that number by the total male and female respondents of the survey. After these initial calculations were completed, the MQP team used the following formula to conduct the two proportions test:

$$z^* = \frac{(\hat{p}_1 - \hat{p}_2) - \rho_0}{\sqrt{\hat{p}_p(1 - \hat{p}_p)}\sqrt{\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

The z* represents the normal value to be found by the calculation. For a 95% confidence level, the z* value has to be greater than 1.96 or lower than -1.96 to reject the null hypothesis. The P1 and P2 values represent the percentage of males and the percentage of females that answered the question as 2-4 hours or above. Since the null hypothesis always states that the two proportions are equal, the P0 value for this case becomes 0. The Pp value is the total males and females who answered the question as 2-4 hours or above divided by the total male and female respondents of the survey. Finally, N1 and N2 values represent the number of male and female populations of the survey respondents.

After the two proportion test for gender was completed, the next step was to apply the same procedure for the academic year. The MQP team coded the data to look at the percentage of Freshmen and Sophomores that answered the question as 2-4 hours or above. The same process was also conducted for the juniors and older participants of the population. After this calculation, the MQP team also calculated the participants who answered the question as 2-4 hours or above and divided that number by the total respondents of the survey. The same formula provided above was used to make the final calculation.

To determine how each of the motivators was valued by the respondents, the MQP team used this question: "What would you be looking to gain from a timebank?". After collecting answers from the respondents, the MQP team coded the data to look at the percentage of females that answered the question as very important or extremely important. The same procedure was also conducted for the male population. After this calculation, the MQP team also calculated the total males and females who answered the question as very important or extremely important and divided that number by the total male and female respondents of the survey. After these initial calculations were completed, the MQP team used the formula provided above to conduct the two proportions test. The same procedure was also applied for the academic year calculations.

To determine how each of the limitations affected the participation of the respondents, the MQP team used this question: "How would the following limitations affect your participation with the timebank?". After collecting answers from the respondents, the MQP team coded the data to look at the percentage of females that answered the question as to some extent or to a great extent. The same procedure was also conducted for the male population. After this calculation, the MQP team also calculated the total males and females who answered the question as to some extent or to a great extent and divided that number by the total male and female respondents of the survey. After these initial calculations were completed, the MQP team used the formula provided above to conduct the two proportions test. The same procedure was also applied for the academic year calculations.

To determine how each of the proposed features would affect the comfort levels of the respondents, the MQP team used this question: "What would make you feel more comfortable while exchanging services through a timebank?". After collecting answers from the respondents, the MQP team coded the data to look at the percentage of females that answered the question as

comfortable or extremely comfortable. The same procedure was also conducted for the male population. After this calculation, the MQP team also calculated the total males and females who answered the question as comfortable or extremely comfortable and divided that number by the total male and female respondents of the survey. After these initial calculations were completed, the MQP team used the formula provided above to conduct the two proportions test. The same procedure was also applied for the academic year calculations.

ANOVA

ANOVA, also known as analysis of variance, is an extension of two-sample hypothesis testing used to compare the means of data with more than two samples (Zaiontz, 2021). ANOVA compares means to determine whether there are any significant statistical differences in the data set. ANOVA also makes use of sample sizes, standard deviations, variance weights, and a p-value. If the analysis returns a p-value larger than 0.05 it could be said that the different samples in the data set, do not have any statistical differences.

The MQP team used ANOVA through Microsoft Excel StatTools add-on to determine:

1) Which limitations play the biggest role in students' participation in a timebank.

Understanding this was important to determine how to make timebanking more suitable to college campuses. The possible limitations that the MQP team came up with included being too busy, not feeling comfortable asking other students for help, feeling that other students might not respond, or not being able to get the services needed through timebanking.

2) Which features could be used to make students feel the safest while participating in a timebank.

Features included using a rating system, allowing users to see friends in common, being able to create a profile and see others profiles, using a suggestion system (where the platform could suggest users who could aid or could perform the services needed), or having coordinators who monitor transactions being made through the platform.

3) Which benefits have the most significant role in motivating students to participate in a timebank.

The possible motivators that the MQP team has determined included creating a better campus society, expanding purchasing power through an alternative currency, giving back to the community, meeting new people, gaining satisfaction from helping others, obtaining needed services, practicing skills, or learning new skills.

To perform the ANOVA test through Excel, the team had to convert the answers to the survey using a Likert scale. A Likert scale is a rating system used in questionnaires in which people choose from a range of possible responses. The scale aims to measure people's attitude, perception, or opinions by considering the extent to which they agree or disagree, relate or not relate to the topic at hand (Jamieson, 2007). Likert scales assume that the level of agreement or disagreement to a topic is linear and are scaled by numbering the extent to which a person agrees by scaling the results in descending order of agreements. For instance, the team used the following scale to perform the analysis on the features to be used in the platform:

1 = Not comfortable at all

2 = Not too comfortable

3= Neutral

4 = Comfortable

5 = Extremely Comfortable

Conclusion

To conclude, the process began by conducting online and in-person interviews with students across the WPI campus. The results of the interviews were then used to develop a survey. The survey served the purpose of validating the findings of the interviews. Once the data collection step was completed, hypothesis testing was used to analyze the data.

Results and Analysis

Interviews

The MQP team interviewed a total of 33 students. Out of these 33 students, 19 of them were females and 14 of them were males. Also, 18 students were either a Freshman or a Sophomore and 15 students were either a junior or older in terms of their academic year. Finally, these students comprised 3 major groups: 17 of these students were American students studying in the U.S, 9 were International students studying abroad, and 7 were international students studying in the U.S.

The MQP team started by interviewing local students around the WPI campus. Most students thought that timebanking was a relevant and innovative way for students to help each other. While asking students what type of skills or services they were willing to exchange through timebanking, most of the responses revolved around academics and helping each other in classwork. The students also said that they would rather exchange solely with WPI students rather than branching out with different people from the area, stating that knowing where the person comes from and what they do would make them feel more comfortable. Along with this, the MQP team received feedback in terms of using friends in common, a rating system, or being able to see people's profiles as suggestions that could be used to ensure that users feel safe while exchanging services. Local students all agreed that timebanking could be beneficial in terms of meeting new people, testing out or practicing skills as well as helping financially. Freshman students seemed to be focused on the social aspect of timebanking stating that they are finding it harder to meet different people because of the impact of COVID - 19 and having online classes.

The interviewees under the category of international students studying abroad had very interesting responses to the interviews. To start, international students studying abroad were more enthusiastic about the possibility of participating in a timebanking system. For example, during the interview of a student from Istanbul, Turkey, the MQP team even received more questions from the interviewee himself. The team was surprised and intrigued by this attitude. International students studying abroad were more open to the idea of exchanging services with people from various universities and exchanging services with a stranger compared to local students. When asked about their financial situation, local students shared a feeling of having financial stress and hardship throughout college which is what the MQP team expected. Contrary to that, international students studying abroad stated that although they believed college students struggle financially, they were not in that position themselves.

As presented above, 21% or 7 of the team's total interviewees were international students who attend universities in the United States. This category of students was very welcoming to the idea of introducing timebanks in universities. One of their main motives was that they have financial struggles, especially coming from countries that are relatively cheaper than the United States. Therefore, paying for various services in the United States becomes a heavy burden to them and according to their responses, a medium that can help them use their time resourcefully to pay for services can be of great help. Moreover, living in a foreign country and coming from different cultures, these students struggle to make friends and thus tend to have very small circles of friends. This narrows their network of receiving help from others either in academics or while trying to broaden their skill set. Therefore, international students in the United States see timebanking as an opportunity to expand their friend circles and their network, and a platform where they can get the necessary assistance.

Survey

Sample Demographic Presentation

The team's survey was completed by 100 students of whom 45% were males, 52% were females, while 3% did not prefer to state their genders (Figure 1). Most survey respondents (78%) were WPI students. However, there was a small representation of a few other schools either in the United States or abroad (Figure 2). The juniors and seniors had a greater representation of about 64% of the team's sample population compared to the Freshmen and Sophomores who only represented about 33% (Figure 3). Very few graduate students completed the survey; therefore, in the team's analysis, the graduate's cases were combined with the juniors and seniors as they are likely to face the same circumstances. In general, the survey respondents had very diverse backgrounds, including people of different majors and schools. All of those respondents were considered very active on their campus. The average number of involvements on campus per each respondent is 2.25. This means that each of the respondents had at least more than 2 extracurricular activities they were involved in on their campuses. Ultimately, this validated the MQP team's project Hypothesis 1 that socially active students would be interested in a timebanking platform. Similarly, the respondents also had a diverse range of interests and hobbies. This shows that there would be a great range of activities or services people would be able to offer if they joined a timebank. The survey was predominantly completed by white students, almost 63%. However, the 37% remaining were students from different backgrounds which comprised other demographics (Figure 4). The figures below represent the demographic information presented above:
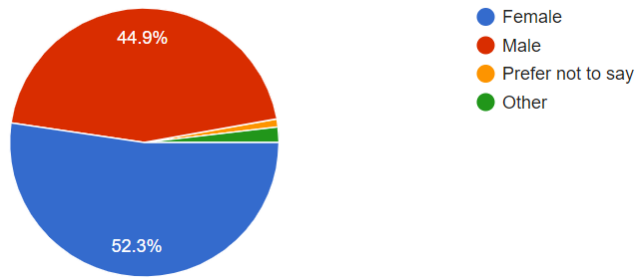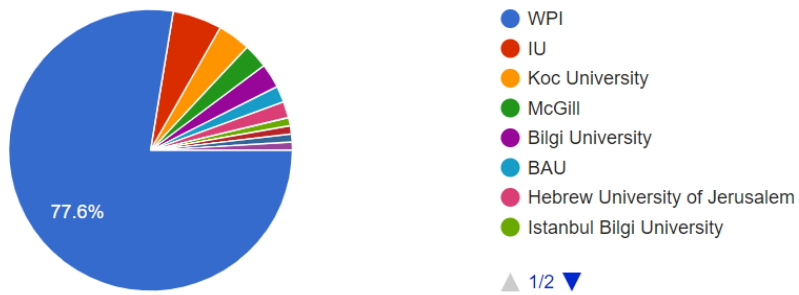
Figure 1: Gender

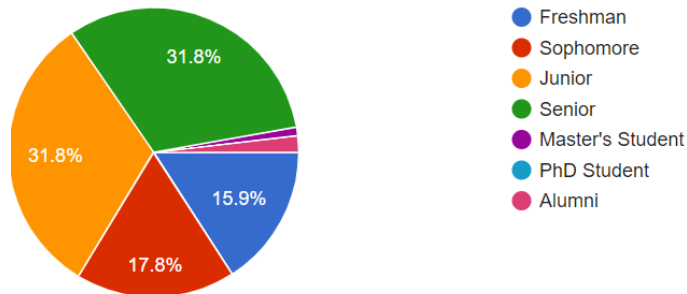**Figure 2: Schools that respondents attend**
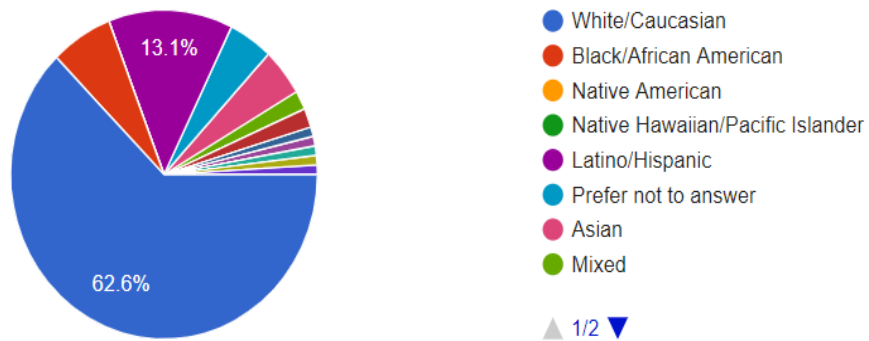

Figure 3: Academic Year

Figure 4: Ethnicity

Students' Timebanking Availability, Knowledge, and Willingness

In general, the survey showed that students did not have enough prior knowledge about timebanking. Only 11% of students affirmed that they knew what timebanking was before completing the team's survey. Despite the lack of knowledge of the concept in the beginning, by the end of the survey, a substantial number of students showed a willingness to join a timebank if one were established. The initial question to be analyzed was: "Would you use a timebank system if there is a mobile app designed for that?". Compared to the 89% of the students who previously confirmed that they had no knowledge about timebanking before the survey (Figure 7), 39% said yes to joining, 36% answered maybe to joining, 24% said they needed to get a better understanding of the timebanking concept and only 1% said no (Figure 8). This made it clear that the concept of timebanking captured the attention of university students. The team found these results compelling as they showed more interest than previously hypothesized. The initial hypothesis was: Students will not be enthusiastic about participating in timebanks since the idea was still relatively new to them (Hypothesis 2).

Additionally, the team aimed to identify whether gender had a significant impact on the interest in timebanking through the question: "Would you use a timebank system if there is a mobile app designed for that?" (Figure 9). As opposed to Hypothesis 3, the team learned that there was no significant difference between the responses from males and females.

Furthermore, based on the confidence interval analysis, the mean was found to be 3.03, while 2.86 and 3.20 were the lower and upper bounds of the confidence interval. The results of this calculation state that if people were allowed to learn more about a timebank, they would have a better idea about whether they would want to participate in one. Even though the concept of timebanking still needs to be developed at WPI, there is a potential for timebanks to be successful, as people have the free time to participate in one.

The team assumed that if one has 2 hours or less free time per day, they wouldn't have time to invest in a timebank. 85% of the students showed that they had more than 2 hours per day. This shows the potential for a timebank being utilized. 44% of the students claimed to have between 2-4 hours while 41% had more than 4 hours (Figure 5). Also, 50% of the males who claimed to have 2-4 hours of free time were the highest percentage of students interested in joining a timebank based on their gender and their available free time. For those who claimed to have more than 6 hours of free time, 100% of the female students and 71.5% of the male students in this population were hesitant to join a timebank despite having the most time available (Figure 6). Additionally, a two proportion test was conducted to analyze whether gender and the academic year of the survey respondents had an effect on their free time. The Z-score obtained from the two proportion test for gender was -1.27. This result shows that the MQP team cannot be 95% confident that gender has an effect on students' free time. Therefore, gender does not have a significant impact on the free time of students. Similarly, the z-score found for the academic year two proportion test was 0.25.

Therefore, the MQP team could not be 95% confident that the free times of students are affected by their academic year in the university. This shows that a students' academic year does not have an impact on how much free time they have.

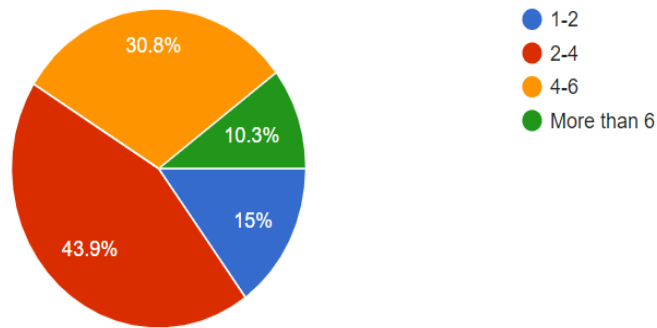The pie and bar charts below show a brief presentation of the information presented above:
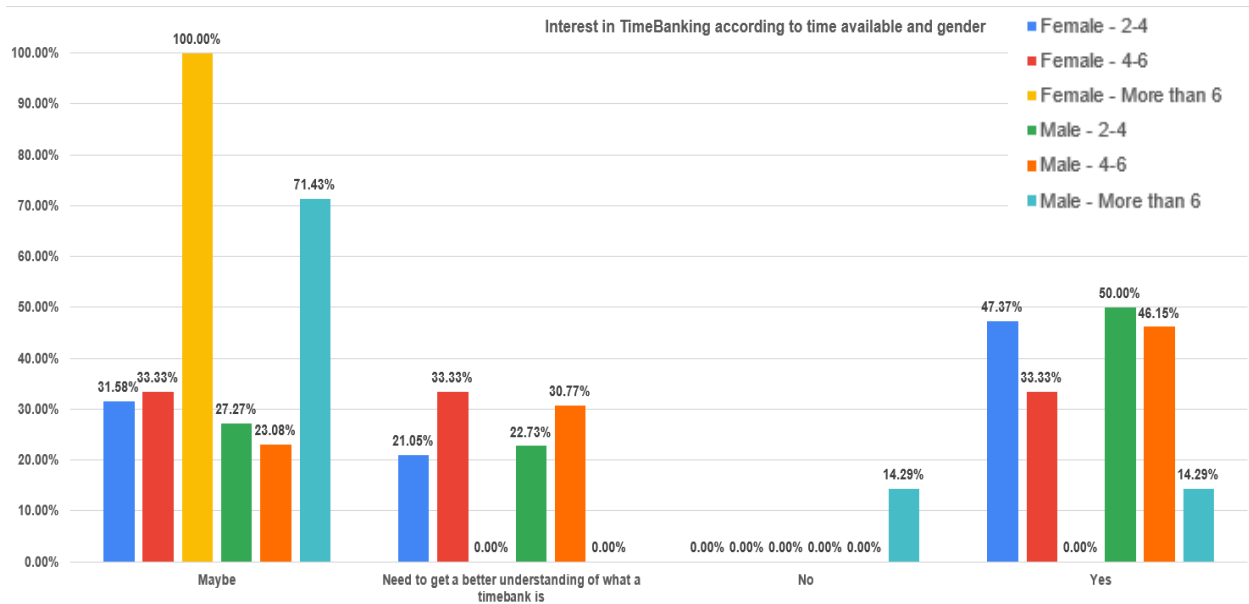

Figure 5: Average free time per day (in hours)

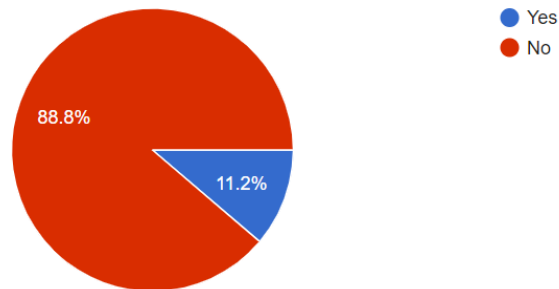**Figure 6: Gender and time available chart for interest in joining a timebank**

Figure 7: Previous knowledge of
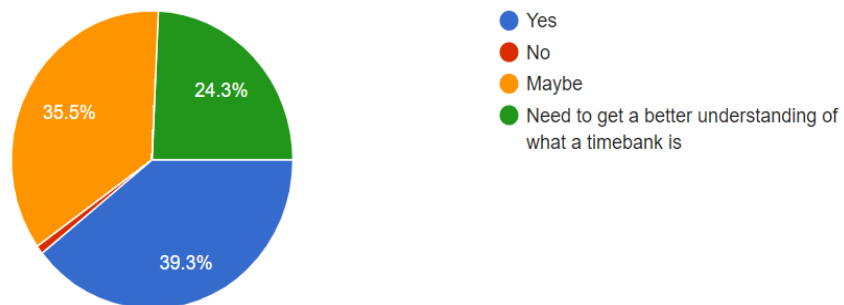**Timebanking before taking this survey**

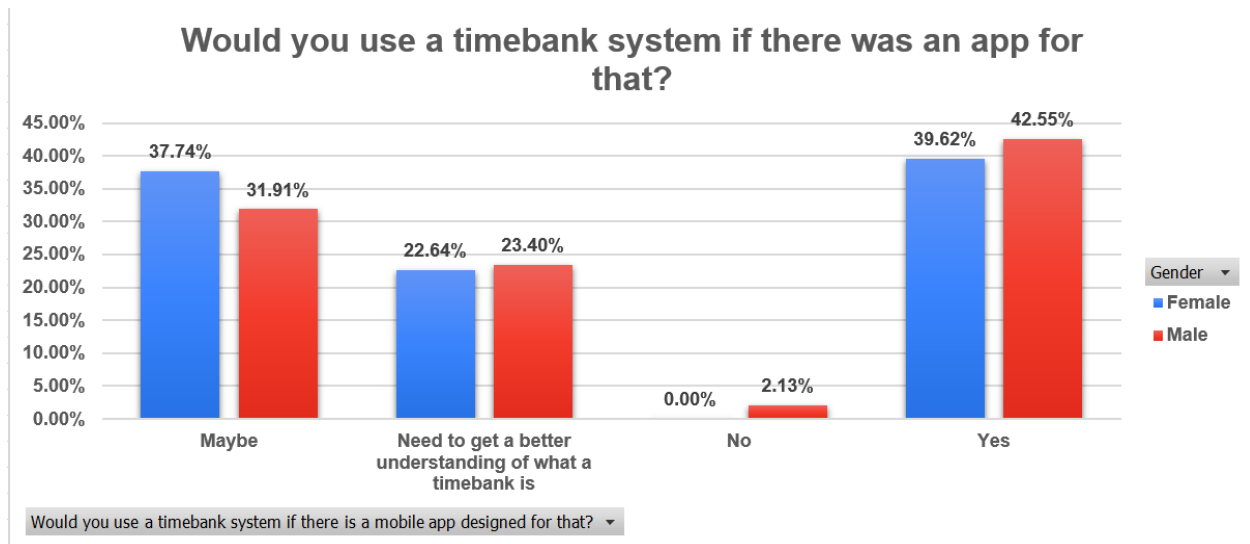**Figure 8: Desire to join a timebank if a mobile app is introduced**

Figure 9: Gender chart for interest

Services, Motivators, and Comfort

The team used the survey to assess the variety of services that the audience could be interested in. The respondents were asked to provide examples of services that they might be interested in exchanging in a timebank. The mean number of services mentioned by each respondent is 2.20, which infers that in general, each respondent expressed more than 2 services of interest in a timebank if one is established. The services ranged from academic services to non-academic services. This proved to the group that the audience has a wide variety of services to exchange if a timebank is to be successfully started. One of the group's concerns during the interviews was that people focused a lot more on the academic works, but it was interesting to see that the survey responses went broader to even non-academic services.

Another aspect that the team wanted to assess was what factors would motivate people to join a timebank (Figure 10). The team wanted to understand what would motivate people to join a timebank in the first place. As mentioned earlier in the methodology, the team predefined the

reasons that would motivate the students to join the platform. On average, 74% of the survey respondents ranked each of the predefined motivators to be either very important or extremely important. However, the group went on to analyze whether gender or academic year affected each factor. Based on the two proportion test for gender, all presumed factors had z-scores between -1.96 and 1.96 except for "create a better campus society" and "give back to the community" which had values of 3.57 and 3.78 respectively. Therefore, the MQP team cannot be 95% confident that gender has a significant impact on all factors except the two aforementioned. For those two factors, the MQP team is 95% confident that females found those factors to be more important compared to the males. Timebanking has been known for creating stronger communities and building relationships. As seen from the results above female's value creating better campus societies and giving back to the community more than other genders and are more aware of the benefits of timebanking. Based on the two proportion test for the academic year, all presumed factors had z-scores between -1.96 and 1.96 except for "learn new skills from others" which had a value of 2.27. Therefore, the MQP team cannot be 95% confident that the academic year has a significant impact on all factors except the factor mentioned above. For that factor, the MQP team is 95% confident that students in their early years of their study value learning new skills more than the upperclassmen. This result confirms Hypothesis 4 that Freshmen and Sophomores will be more engaged in a potential timebanking since they are more eager to learn new skills from others.

Additionally, the MQP team performed the ANOVA test (see Appendix C for a summary chart) on the motivating factors to assess if all factors were valued equally by the participants. As the P-value was smaller than the alpha value ($\rightarrow$ <0.0001 < 0.05), the means for all motivating factors are not equal. This indicates that not all motivating factors were equally valued by the

respondents. According to the sample means, the most impactful motivating factors were (in the most impactful to least impactful order):

1. Learning new skills from others

2. Practicing your skills

3. Gaining satisfaction from helping others

4. Obtaining needed services that one cannot perform

5. Meeting new people

6. Meeting peers from your classes

7. Giving back to the community

8. Having something worthwhile to do in free time

9. Having an alternative currency

10. Creating a better campus society

The analysis shown in Figure 10 shows that learning new skills from others, practicing your skills and gaining satisfaction from helping others are the biggest motivators for the students to join a timebank. The bar chart below represent the motivators predefined by the MQP team and their respective averages based on the ANOVA test:
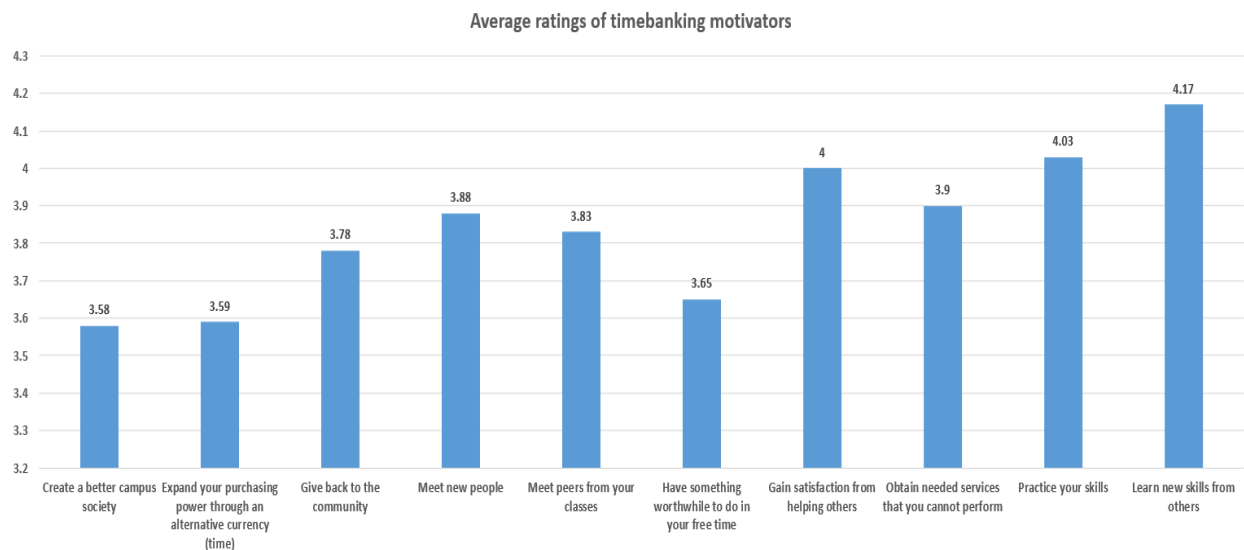
Average ratings of timebanking motivators

Figure 10: Average rating for each of the motivators

After assessing what factors would motivate the students to join a timebank, the MQP team analyzed what possible features could make the participants more comfortable if they join the platform. The question stating "What feature would make you comfortable while exchanging services in a timebanking platform? "was used for the analysis. On average, above 80% of the sample population seemed to be either comfortable or extremely comfortable with each defined feature (Figure 11). However, the team wanted to also analyze how each factor was affected by gender, as well as the academic year of the participants. The Z values for each factor were all found to be between -1.96 and 1.96 for the two proportion test conducted for gender. This means that the team could be 95% confident that gender has no effect on all the possible features defined to be more comfortable with a timebanking platform. For the academic year, the results seemed to be different. The ability to see mutual friends, being able to see people's full profiles, and having a suggestion system had z-scores that were in the range of -1.96 and 1.96. This means that the MQP team cannot be 95% confident whether the academic year had an effect on those features.

However, the rating system and having a coordinator had z-scores of -2.44 and 2.07 respectively. Thus, for those factors, the team is 95% confident that the academic year affects the comfort level of those features. For the rating system, the MQP team found that upperclassmen value ratings more than the Freshmen and Sophomores. For the coordinator feature, the MQP team found that the Freshmen and Sophomores value this feature more than the upperclassmen.

As aforementioned, the project aims to create a timebanking application. Therefore, the team found it important to evaluate what app features should be included in the app and how important they are expected to be to the future potential end-users. The ANOVA (see Appendix C for a summary chart) test was performed using the results from the question "what features would make students more comfortable to use the timebank". The responses were used to determine if all features were valued equally. As the P-value is smaller than the alpha value ($\rightarrow$ <0.0001 < 0.05), the means for all factors are not equal, meaning that not all features were valued equally. According to the sample means the most impactful factors were (in the most impactful to least impactful order): "being able to see friends in common, seeing other people's profiles, a suggestion system, a coordinator, a rating system." Seeing friends in common was the most popular choice among the students but the rating system was the least desired option among the possible features.

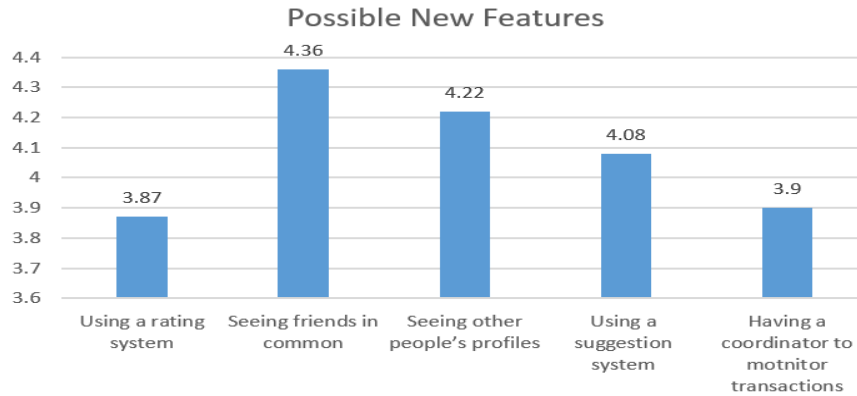The chart below is a representation of the responses:

Figure 11: Possible New Features

Limitations and Anonymity

The team used the survey to inquire about the limitations faced by the students that could affect their participation in the timebank (Figure 12). The question stating "How would the following limitations affect your participation with the timebank?" was used to conduct the analysis. Every factor that might limit the participation of the respondents was analyzed to find out whether gender or the academic year of the respondents affected it. Based on the two proportion test, all the Z* values were between -1.96 and 1.96 for all these categories. Therefore, the MQP team cannot be 95% confident that neither gender nor academic year limits students more in a certain category. This shows that gender or academic year do not have a significant impact on what limits student participation.

Then, the MQP team performed the ANOVA test (see Appendix C for a summary chart) on the responses to determine if all limitations affected the survey participants on the same level. As the P-value was smaller than the alpha value ($\rightarrow$ <0.0001 < 0.05), the means for all limitations are not equal. This shows that not all limitations had the same effect on the participants. According to the sample means, the most impactful limitations were (in the most impactful to least impactful

order): "I'm too busy, I do not feel comfortable asking help from people that I don't trust, I can't get the services I need from timebank, People do not respond to me." "I am too busy" was the most popular choice among the students while "people do not respond to me" was the least desired option among the possible limitations.

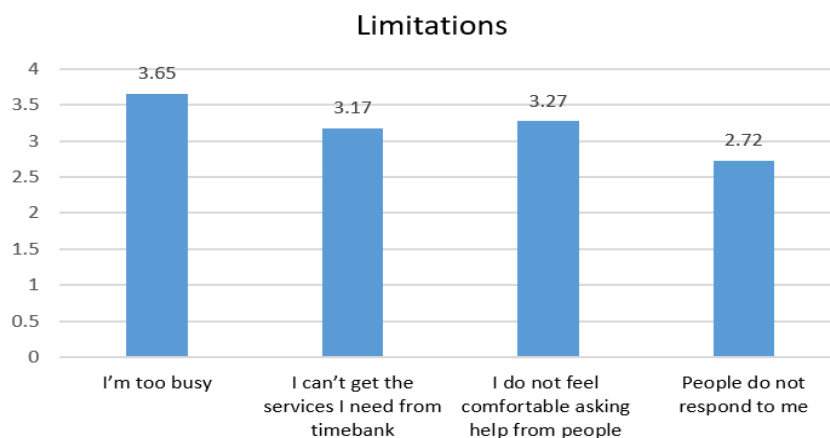The chart below is a representation of the responses:

Figure 12: Limitations

To help minimize the barriers to entry, the survey question stating "When exchanging services through a timebank would you prefer to know the person to build a relationship or would you rather it be a more anonymous platform and simply receive the service?" was used. (Figure 13) Based on the 95% confidence interval analysis, the lower bound was found to be 3.2 and the

upper bound was found to be 3.6. This shows that the respondents want the platform to be somewhat personal but not too personal. The chart below is a representation of the responses:
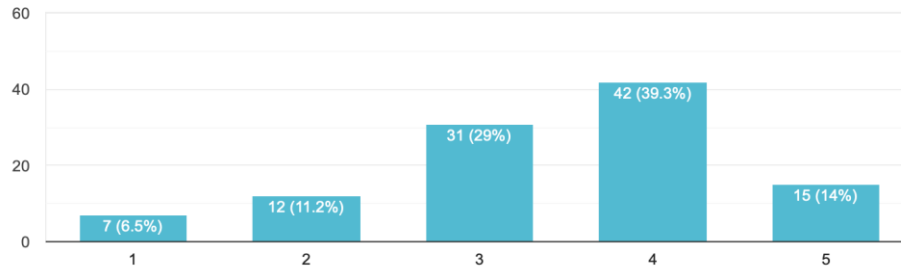

Figure 13: Anonymity

Recommendations

Through conducting interviews and surveying potential end-users, the MQP team was able to develop recommendations for the development of a future timebanking platform. Recommendations include recognition of a target market and possible features for a platform to be used across college campuses.

Based on the data collected and analyzed, the MQP team identified that college community members were interested in a potential timebanking platform. The team's initial hypothesis (Hypothesis 1) was also validated to confirm that the interest came from individuals who are socially active at their college campuses. Consequently, the team believes that the future development of a timebanking platform would be pertinent.

Survey respondents were enthusiastic about timebanking as it provides the opportunity to learn new skills as well as practice and share their current knowledge. This suggests that the timebanking platform can have diversified exchanges, benefiting every party involved in the process. Furthermore, female respondents were motivated by the idea of giving back to the community and creating a better campus society, making them more aware of the benefits of timebanking. Therefore, the MQP team recommends the timebanking platform to be advertised in a way that highlights the potential of learning new skills and practicing current knowledge for the target users as well as highlighting the possibility of having an impact on the community specifically for females.

Additionally, students who were not interested in timebanking were reluctant because of their busy schedules. However, timebanking is known to help with time management. In fact, most of the student population have at least 2 hours of free time in a day which they could spend on

timebanking. Consequently, the MQP team recommends planning workshops on timebanking awareness to increase interest in the platform.

Finally, friends in common seemed to be the most desired feature to be included in the platform. On the other hand, students preferred to have moderately personal transactions through timebanks. Based on these findings, the team recommends enabling users to have private profiles where friends in common with a user could be viewed under the user's profile. For possible further improvements, the MQP team recommends focusing on implementing additional features such as showing someone's history of transactions in their profile, having a suggestion system where other members of the platform are suggested to reach out for receiving services, and having a coordinator who organizes and negotiates the exchange systems to make sure that people work effectively. Specifically, the coordinator feature will be beneficial for the Freshmen and Sophomores and the rating system will be beneficial for the upperclassmen. Another feature that could be added is having a rating system where every member of the platform has an average rating based on reviews provided by users who received services.

Conclusion

The goal of this MQP was to conduct a market analysis to assess the feasibility of introducing timebanking to college campuses. During the initial stage of the MQP, the team conducted interviews to learn about the perception of timebanking within the target market and learned that there was a general interest in the idea if certain concerns were tackled. The MQP team then developed a survey using the interview responses and knowledge of prior timebanks to hone in on the hurdles and quantify the interest of students regarding timebanking. The survey was filled out mostly by a wide variety of WPI students with some responses from other schools and countries.

Overall, the results from the survey showed that there was a potential market for timebanking on college campuses if a viable platform was developed. The team learned that the ability to learn new skills and practice current knowledge were the most significant motivators for students to utilize a timebank. One substantial insight that the team gained through the survey process was that some barriers should be kept in mind while developing a timebanking platform, which if tackled would make it easier for students to utilize a timebank. In conclusion, the recommendations provided above should be considered while developing a timebanking platform as the next step, with testing in one college campus and eventually rolling out to other campuses.

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Appendix:

Appendix A: Interview Questions

Basic intro:
Hi! How's your week?
(intro about ourselves and what we are trying to do?)

Warm-up questions:
1. What's your major?
2. What clubs/activities/campus involvements do you have?
3. How's your workload? What do you do during your free time?

Actual questions:
4. Are you comfortable with asking for help from other people?
    a. Why?
    b. Why not?
5. Has there ever been a time where you needed help from other people?
    a. If yes, please explain.
    b. If no, how would you ask for help?
    c. How helpful would the provided services be?
6. Would you like to respond if others reached out to you for help in your strong skills?
7. Are there any skills you would like to offer for exchange (photography, coding, etc)?
8. Would you be interested in exchanging your skills using time rather than money?
    a. Why?
    b. Why not?
9. Would you be okay with making exchanges with people from different universities or just stick to your own?
    a. Why?
10. Besides just dealing with others from the WPI community, is there anything else that would make you feel comfortable about exchanging services with people using this service?
11. Do you think exchanging skills can increase community engagement and provide opportunities for personal development?
    a. If you were able to teach skills to others, do you think it would help you become more confident in your leadership skills?
12. According to a survey by prnewswire, most college students are cash strapped, from your experience would you agree with the statement?
    a. Why?
    b. Why not?

Bonus questions:

13. How easy did you find it to meet people / make friends in Freshman year?
14. Do you ever wish you knew more people in your university or other universities? Did you try reaching out to get to know more people?
    a. If not, what was the hesitation?
        i. If there was a place where peers from your courses sign up to offer help, how likely would you be to use it?
    b. If yes, how helpful would it be if you knew more people in your courses?

Appendix B: Survey Questions

Survey for Timebank

Welcome to our survey! We are a group of WPI students conducting market research to see whether the idea of timebanking is favorable for college campuses and your willingness to complete this survey is much appreciated. We need your feedback to learn more about the potential market for Timebank platforms on college campuses.

Timebanking is a mode of exchange that lets people interchange skills or services through time rather than money. For example, the types of services exchanged could include providing or getting help with studying, providing or asking someone for a ride, learning or teaching how to play guitar etc. Providing services would earn you time credits to be used for a service that you will obtain from different people.

Please understand that your responses will be strictly confidential. We will not be linking any names with survey responses and any summaries or reports that result will treat all members anonymously. Additionally, you will be entered into a raffle to win one of ten $20 amazon gift cards!

* Required

Gender *

○ Female

○ Male

○ Prefer not to say

○ Other

What school do you go to? *

○ WPI

○ IU

○ Other: _____

Academic Year *

○ Freshman

○ Sophomore

○ Junior

○ Senior

○ Master's Student

○ PhD Student

○ Alumni

Major *

Your answer

What is your class workload on a semester base? *

○ 12-14 credits

○ 15-17 credits

○ 18-21 credits

○ 21+ credits

Organizations that you are involved on campus (Please separate your answers by using commas.) *

Your answer

Interests and hobbies (Please separate your answers by using commas.) *

Your answer

On average how much free time do you have in a day? (in hours) *

○ 1-2

○ 2-4

○ 4-6

○ More than 6

Did you know what a timebank was before starting this survey? *

○ Yes

○ No

If you answered yes to the above question, how did you first hear about it? *

○ Not Applicable

○ From a family member or friend

○ From the Internet

○ Other:

What would you be looking to gain from a timebank? *

	Not Important At All	Low Importance	Neutral	Very Important	Extremely Important
Create a better campus society	○	○	○	○	○
Expand your purchasing power through an alternative currency (time)	○	○	○	○	○
Give back to the community	○	○	○	○	○
Meet new people	○	○	○	○	○
Meet peers from your classes	○	○	○	○	○
Have something worthwhile to do in your free time	○	○	○	○	○
Gain satisfaction from helping others	○	○	○	○	○
Obtain needed services that you cannot perform	○	○	○	○	○
Practice your skills	○	○	○	○	○
Learn new skills from others	○	○	○	○	○

If you have any other options besides the ones mentioned above, please list them in this question. (Separate your answers with a comma.)

Your answer

How would the following limitations affect your participation with the timebank?
*

	Not Applicable	Very Little	Neutral	To Some Extent	To A Great Extent
I'm too busy	○	○	○	○	○
I can't get the services I need from timebank	○	○	○	○	○
I do not feel comfortable asking help from people that I don't trust	○	○	○	○	○
People do not respond to me	○	○	○	○	○

What would make you feel more comfortable while exchanging services through a timebank? *

	Not Comfortable At All	Not That Much Comfortable	Neutral	Comfortable	Extremely Comfortable
A rating system	○	○	○	○	○
Being able to see friends in common	○	○	○	○	○
Seeing other people's profiles	○	○	○	○	○
A suggestion system (where you can see suggestions of people to reach out for receiving services)	○	○	○	○	○
A coordinator (a person who organizes and negotiates the exchange systems to make sure that people work effectively)	○	○	○	○	○

Would you use a timebank system if there is a mobile app designed for that? *

○ Yes

○ No

○ Maybe

○ Need to get a better understanding of what a timebank is

When exchanging services through a timebank would you prefer to know the person in order to build a relationship or would you rather it be a more anonymous and simply receive the service. (Rate from 1 to 5 according to relevance with 1 being anonymous and 5 being personal) *

	1	2	3	4	5	
Anonymous	○	○	○	○	○	Personal

What are some examples of services you might be interested in exchanging through a timebank? (Provide as many as possible) *

Your answer

Are there any further comments or questions you have for us? *

Your answer

What is your ethnicity/race? *

- ◯ White/Caucasian
- ◯ Black/African American
- ◯ Native American
- ◯ Native Hawaiian/Pacific Islander
- ◯ Latino/Hispanic
- ◯ Prefer not to answer
- ◯ Other: _____

If you want to be entered in the raffle mentioned above please provide us with your email

Your answer

Submit

Appendix C: ANOVA Test Summary Charts

StatTools Report

Analysis:	One-Way ANOVA
Performed By:	Delareyna, Berkan
Date:	Friday, March 26, 2021
Updating:	Live

One-Way ANOVA for Selected Unstacked Variables

ANOVA Summary

Total Sample Size	500
Grand Mean	4.0860
Pooled Std Dev	0.7886
Pooled Variance	0.6220
Number of Samples	5
Confidence Level	95.00%

ANOVA Sample Stats	Rating sytem Features	see freinds in common Features	See peoples profiles Features	Suggestion System Features	Coordinator Features
Sample Size	100	100	100	100	100
Sample Mean	3.8700	4.3600	4.2200	4.0800	3.9000
Sample Std Dev	0.8367	0.6745	0.6603	0.7342	0.9898
Sample Variance	0.7001	0.4549	0.4360	0.5390	0.9798
Pooling Weight	0.2000	0.2000	0.2000	0.2000	0.2000

ANOVA Test Summary Chart for Possible New Features

OneWay ANOVA Table	Sum of Squares	Degrees of Freedom	Mean Squares	F-Ratio	p-Value
Between Variation	17.4320	4	4.3580	7.0069	< 0.0001
Within Variation	307.8700	495	0.6220		
Total Variation	325.3020	499			

p-Value for ANOVA Test Summary Chart for Possible New Features

The p-Value for ANOVA Test Summary Chart for Possible New Features figure is a closer look to the figure provided above. The closer version of the same figure is presented to highlight the p-Value obtained from the ANOVA Test conducted for possible new features. When the p-value is lower than alpha (for a 95% confidence interval, alpha is equal to 0.05), there is a significant statistical difference between the means of the possible new features.

Confidence Interval Tests	Difference of Means	No Correction Lower	Upper
Rating sytem-see freinds in common	-0.4900	**-0.709132785**	**-0.270867215**
Rating sytem-See peoples profiles	-0.3500	**-0.569132785**	**-0.130867215**
Rating sytem-Suggestion System	-0.2100	-0.429132785	0.009132785
Rating sytem-Coordinator	-0.0300	-0.249132785	0.189132785
see freinds in common-See peoples profiles	0.1400	-0.079132785	0.359132785
see freinds in common-Suggestion System	0.2800	**0.060867215**	**0.499132785**
see freinds in common-Coordinator	0.4600	**0.240867215**	**0.679132785**
See peoples profiles-Suggestion System	0.1400	-0.079132785	0.359132785
See peoples profiles-Coordinator	0.3200	**0.100867215**	**0.539132785**
Suggestion System-Coordinator	0.1800	-0.039132785	0.399132785

Pairwise Mean Comparison for ANOVA Test Summary Chart for Possible New Features

After finding out that there is a significant statistical difference between the means of the possible features, the bottom section of the ANOVA Test Summary Chart for Possible New Features figure was used. This new figure takes a closer look at what is going on there. Basically, the difference of means values were used to identify the possible new feature with the highest mean. This result was used to rank the importance of each possible new feature.

StatTools Report

One-Way ANOVA for Selected Unstacked Variables

ANOVA Summary

Total Sample Size	1000
Grand Mean	3.8400
Pooled Std Dev	0.9639
Pooled Variance	0.9292
Number of Samples	10
Confidence Level	95.00%

ANOVA Sample Stats	Create a better campus society Data Set #1	and your purchasing power through an alternative currency (ti Data Set #1	Give back to the community Data Set #1	Meet new people Data Set #1	Meet peers from your classes Data Set #1
Sample Size	100	100	100	100	100
Sample Mean	3.5800	3.590	3.7800	3.8700	3.830
Sample Std Dev	0.9231	1.093	0.9165	0.9914	1.025
Sample Variance	0.8521	1.194	0.8400	0.9829	1.052
Pooling Weight	0.1000	0.1000	0.1000	0.1000	0.1000

ANOVA Test Summary Chart for Motivators

OneWay ANOVA Table	Sum of Squares	Degrees of Freedom	Mean Squares	F-Ratio	p-Value
Between Variation	34.5000	9	3.8333	4.1254	<0.0001
Within Variation	919.9000	990	0.9292		
Total Variation	954.4000	999			

p-Value for ANOVA Test Summary Chart for Motivators

The p-Value for ANOVA Test Summary Chart for Motivators figure is a closer look to the figure provided above. The closer version of the same figure is presented to highlight the p-Value obtained from the ANOVA Test conducted for motivators. When the p-value is lower than alpha (for a 95% confidence interval, alpha is equal to 0.05), there is a significant statistical difference between the means of the motivators.

Confidence Interval Tests	Difference of Means	No Correction	
		Lower	Upper
Create a better campus society-Expand your purchasing powe	-0.0100	-0.277514347	0.257514347
Create a better campus society-Give back to the community	-0.2000	-0.467514347	0.067514347
Create a better campus society-Meet new people	-0.2900	-0.557514347	-0.022485653
Create a better campus society-Meet peers from your classes	-0.2500	-0.517514347	0.017514347
Create a better campus society-Have something worthwhile t	-0.0700	-0.337514347	0.197514347
Create a better campus society-Gain satisfaction from helping	-0.4200	-0.687514347	-0.152485653
Create a better campus society-Obtain needed services that y	-0.3200	-0.587514347	-0.052485653
Create a better campus society-Practice your skills	-0.4500	-0.717514347	-0.182485653
Create a better campus society-Learn new skills from others	-0.5900	-0.857514347	-0.322485653
Expand your purchasing power through an alternative currenc	-0.1900	-0.457514347	0.077514347
Expand your purchasing power through an alternative currenc	-0.2800	-0.547514347	-0.012485653
Expand your purchasing power through an alternative currenc	-0.2400	-0.507514347	0.027514347
Expand your purchasing power through an alternative currenc	-0.0600	-0.327514347	0.207514347
Expand your purchasing power through an alternative currenc	-0.4100	-0.677514347	-0.142485653
Expand your purchasing power through an alternative currenc	-0.3100	-0.577514347	-0.042485653
Expand your purchasing power through an alternative currenc	-0.4400	-0.707514347	-0.172485653
Expand your purchasing power through an alternative currenc	-0.5800	-0.847514347	-0.312485653
Give back to the community-Meet new people	-0.0900	-0.357514347	0.177514347
Give back to the community-Meet peers from your classes	-0.0500	-0.317514347	0.217514347
Give back to the community-Have something worthwhile to d	0.1300	-0.137514347	0.397514347
Give back to the community-Gain satisfaction from helping otl	-0.2200	-0.487514347	0.047514347
Give back to the community-Obtain needed services that you	-0.1200	-0.387514347	0.147514347
Give back to the community-Practice your skills	-0.2500	-0.517514347	0.017514347
Give back to the community-Learn new skills from others	-0.3900	-0.657514347	-0.122485653
Meet new people-Meet peers from your classes	0.0400	-0.227514347	0.307514347
Meet new people-Have something worthwhile to do in your f	0.2200	-0.047514347	0.487514347

Pairwise Mean Comparison for ANOVA Test Summary Chart for Motivators

After finding out that there is a significant statistical difference between the means of the motivators, the bottom section of the ANOVA Test Summary Chart for Motivators figure was used. This new figure takes a closer look at what is going on there. However, since there are so many motivators, only a portion of the pairwise comparisons were highlighted on this figure

specifically. Basically, the difference of means values were used to identify the motivator with the

highest mean. This result was used to rank the importance of each motivator.

StatTools Report

Analysis: One-Way ANOVA
Performed By: Delareyna, Berkan
Date: Friday, March 26, 2021
Updating: Live

One-Way ANOVA for Selected Unstacked Variables

ANOVA Summary	
Total Sample Size	400
Grand Mean	3.203
Pooled Std Dev	1.124
Pooled Variance	1.264
Number of Samples	4
Confidence Level	95.00%

	I'm too busy	I can't get the services I need from timebank	Io not feel comfortable asking help from people that I don't tru	People do not respond to me
ANOVA Sample Stats	Limitations	Limitations	Limitations	Limitations
Sample Size	100	100	100	100
Sample Mean	3.650	3.170	3.270	2.720
Sample Std Dev	1.175	1.025	1.109	1.181
Sample Variance	1.381	1.052	1.229	1.396
Pooling Weight	0.2500	0.2500	0.2500	0.2500

ANOVA Test Summary Chart for Limitations

OneWay ANOVA Table	Sum of Squares	Degrees of Freedom	Mean Squares	F-Ratio	p-Value
Between Variation	43.868	3	14.623	11.564	<0.0001
Within Variation	500.730	396	1.264		
Total Variation	544.598	399			

p-Value for ANOVA Test Summary Chart for Limitations

The p-Value for ANOVA Test Summary Chart for Limitations figure is a closer look to the figure

provided above. The closer version of the same figure is presented to highlight the p-Value

obtained from the ANOVA Test conducted for limitations. When the p-value is lower than alpha

(for a 95% confidence interval, alpha is equal to 0.05), there is a significant statistical difference

between the means of the limitations.

Confidence Interval Tests	Difference of Means	No Correction Lower	Upper
I'm too busy-I can't get the services I need from timebank	0.480	0.167358466	0.792641534
I'm too busy-I do not feel comfortable asking help from people	0.380	0.067358466	0.692641534
I'm too busy-People do not respond to me	0.930	0.617358466	1.242641534
I can't get the services I need from timebank-I do not feel com	-0.100	-0.412641534	0.212641534
I can't get the services I need from timebank-People do not re	0.450	0.137358466	0.762641534
I do not feel comfortable asking help from people that I don't	0.550	0.237358466	0.862641534

Pairwise Mean Comparison for ANOVA Test Summary Chart for Limitations

After finding out that there is a significant statistical difference between the means of the limitations, the bottom section of the ANOVA Test Summary Chart for Limitations figure was used. This new figure takes a closer look at what is going on there. Basically, the difference of means values were used to identify the limitation with the highest mean. This result was used to rank the importance of each limitation.