

# Suitability of Gamification methods in a lifestyle application against obesity and diabetes

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Obesity and diabetes are more common than ever. In particular, younger adults aged 18-25 are becoming more susceptible to obesity through the abundance of fastfood, the popularity of online gaming and other factors. This combined often leads to unhealthy lifestyles. For treatment or prevention of these unhealthy behaviors, lifestyle apps have shown to have big potential. Current lifestyle apps mainly focus on monitoring activity and eating patterns but keep a rather passive stance when it comes to changing users behavior. To change this, gamification could help greatly to actively change users behavior and thus, encouraging healthy lifestyles. Some current lifestyle apps vaguely use gamification methods such as goals or sometimes even achievements. This motivates the user to change certain behaviors such as walking 5000 steps a day. Gamification has proven to be advantageous for changing user behavior, but gamification is broad and there is little to no research done on what sort of gamification works best. This research aims to fill that gap by researching the suitability of different gamification methods in lifestyle applications. This study mainly focuses on gamification used in lifestyle applications for users between 18-25. The research is done alongside plans for a lifestyle application against obesity and diabetes so the gamification methods will be evaluated according to these plans.

Additional Key Words and Phrases: gamification, lifestyle application, obesity, diabetes, gamification methods

## 1 INTRODUCTION

Gamification is an upcoming method to change users behavior. It uses game elements to stimulate and engage people to do something. Gamification can be used in many sectors, a well-known example being education. Using games or game elements to motivate students to learn is becoming a popular method in schools and universities. Concerning lifestyle apps that also focus on changing behaviors, gamification can be of great value. Although many lifestyle apps already use minimal forms of gamification [1], the effectiveness of gamification in lifestyle apps has been shown undeniably [2]

While gamification is an effective tool to change users behavior, insufficient research has been done for a decisive conclusion concerning the effectiveness of different gamification methods. There are lots of different ways to use gamification. Modern lifestyle apps like Samsung Health and Apple Health mainly use passive methods [3] such as goals or badges but a more active presence of gamification might prove to be more effective such as a game that uses your own lifestyle as input. Therefore, this research studies the suitability of different gamification methods used in lifestyle apps.

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Although mainly focused on a lifestyle app against obesity and diabetes, this research could also provide a better overview of different gamification methods and their respective usability in other settings.

There are many different approaches to gamification and many variations possible. For possible gamification methods used in mobile applications, Cechetti[3] has shown there are many different methods with different uses, the one more popular than the other. By identifying different elements and their respective popularity, we cannot conclude their effectiveness or suitability in a lifestyle application. For this purpose, During this research, a survey will be conducted to better understand the suitability of different methods and what methods are most effective at stimulating users to learn certain lifestyle behaviors. The survey will follow from the results of a literature review that will study relevant literature regarding gamification in mobile applications.

### 1.1 Research Question

The research question for this paper is:

*"How can gamification elements make lifestyle apps against obesity and diabetes more effective for people between 18-25?"*

To answer this question, A literature study will be performed to identify different gamification elements. With this, A survey will be conducted according to the literature to strengthen the results from the literature study.

## 2 METHODOLOGY

To identify different gamification elements, a systematic literature review will be conducted that follows the grounded theory approach by Wolfswinkel et al[9]. This method includes 5 steps with sub steps to perform a legitimized and in-depth analysis of the chosen literature. These steps are shown in Appendix A. From this systematic literature review, a survey will follow that will contribute to answering the research questions. The survey will be backed up by the literature to have the most value.

### 2.1 Identifying gamification elements

Following the 5 stages for a systematic literature review from Wolfswinkel's grounded theory method[9], A literature study will be conducted to identify different gamification elements and their effectiveness in mobile applications.

### 2.2 Conducting a Survey

Following from the results of the literature review, a survey will be conducted. This survey will focus on the target group for young adults between 18-25. The survey will compare different gamification elements and will ask the respondents to answer which elements are more effective or more stimulating/engaging to them.

Following from the results of the survey is a ranking of gamification elements for which are the most suitable and effective. Using these results, the research question will be answered.

### 3 LITERATURE REVIEW

The grounded theory approach for a systematic literature review from Wolfswinkel et al. [9] is used to conduct this literature review. This includes a Five stage process to identify relevant articles and analyze them correctly. Also shown in Appendix A.w Google Scholar is used as a scientific database for articles.

Because there is no abundance of literature on the topic, literature including gamification and lifestyle will be used but this will not necessarily include weight loss. literature that best fits the topic and has the best value for this research will be used. For the study, no literature from more than a decade ago will be considered. Possible search terms for this research are: Gamification, Lifestyle (App), Effectiveness, Weight Loss, Game\*, Suitability, E-Health. The search string: "Gamification AND Lifestyle AND Weight Loss" was used to find relevant literature. Google scholar was used as database. From this search, Multiple good articles come up that are specific enough to contribute to this research. [1,2,3,4,5,6,7,8] Some articles were used to identify different game elements [3,4] and the rest concerned the use of gamification elements and their effect and suitability.

#### 3.1 Identification of different game elements

For identifying the different game elements to compare and check for suitability, a systematic review for gamification strategies by Cechetti et. al(2019) was used[4]. Another article concerning an m-health application[3] was used to confirm the different elements. From these articles, multiple gamification methods showed to have potential in a lifestyle application against obesity, This research focuses on the most popular and well-known gamification methods that are suitable for lifestyle applications. The following gamification methods will be considered in the literature review and survey:

1. Points and Levels: This is one of the most popular gamification methods. Points are awarded for successful completion of tasks or activities, and levels are achieved when certain points thresholds are reached. This system encourages users to go above and beyond to reach the next level.
2. Badges/Achievements: Badges are a way to reward players for completing certain achievements or goals. They serve as a visual representation of progress and can be used to show off accomplishments to other players.
3. Leaderboards: Leaderboards are a great way to add an element of competition to the game. Players can compare their scores and rankings with other players to motivate themselves to keep playing and strive to reach the top.
4. Goals/Quests: Quests are objectives or tasks that players must complete in order to progress in the game. These can range from simple tasks like collecting items to more complex tasks such as completing puzzles or mini games.
5. Penalties: Penalties are the opposite of rewards. Penalties are used when a user does not meet a goal or commits an error. This can give a negative reward or other repercussions in the app.
6. Virtual Currency: Virtual currency is a common game element

but less common as a gamification element although not less useful. Players can earn virtual currency as a reward for tasks or goals and use this virtual currency to purchase items or upgrades in the game, which can make the game more enjoyable. This can also be used in lifestyle apps as a form of reward with which they can customize the app.

7. Feedback: This gamification element mostly occurs in the form of compliments or other forms of positive feedback with the intention of motivating and engaging users to continue good behavior. Simple compliments like: "you're halfway there" can be a big stimulation for users to keep up with good habits.

These gamification methods will be used in the survey to consider their suitability and effectiveness in lifestyle applications.

#### 3.2 Results

Using the relevant articles, a concept matrix was made as shown in Appendix B. The results of the concept matrix agree with Appendix C which show the popularity of different gamification elements. The popular gamification elements occur more often in literature as expected. The occurrence of the gamification method "Penalties" was more than expected, however, multiple articles had a negative stance towards this method which does correspond with the initial expectations. Because the concept matrix only shows occurrence and not negative or positive attitude towards the gamification elements, this largely explains the deviation in the concept matrix. Daniel Johnson[1] found that rewards in the form of points and achievements lead to improvements in the desire to exercise. The trial of S. Patel[5] also used Points and levels to achieve step goals or weight targets but also feedback in the form of a leaderboard was used to encourage the participants. This showed that the use of competition and social interaction had a significant effect on the physical activity but only when used on a group of friends or family. This theory suggests that using gamification alone may not have significant effect but when combined with social interaction or other means of stimulation, it can be of great additional value. The prototype suggested by Heejin Chae[6] also contained gamification elements like competition And points that are used as virtual currency. This prototype also showed that without social interaction like a leaderboard or collaboration, motivation through gamification is hard to achieve. All in all, the literature suggests that gamification can be an effective tool for encouraging users but it should be use alongside other forms of stimulation or in combination with social aspects. If used correctly it can greatly strengthen the effectiveness of lifestyle apps. In the next section, The results following from the survey will be discussed in relation to the results following from the theory.

### 4 SURVEY

This section will go over the results of the survey and build up to the conclusion. For every different gamification element, The results will be discussed including suggestions or other findings from the survey. The survey had a total of 32 participants of which most people were of average weight. The survey(Appendix D) consists of a few questions for personal information. These are asked to check for any correlation between preferred gamification methods and age, BMI and previous knowledge. The rest of the questions is about

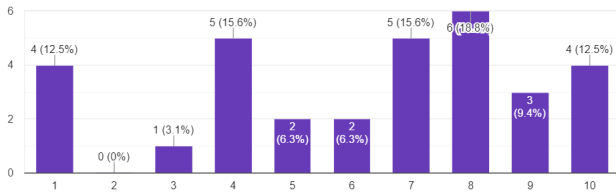


Fig. 1. Survey results for Leaderboards.

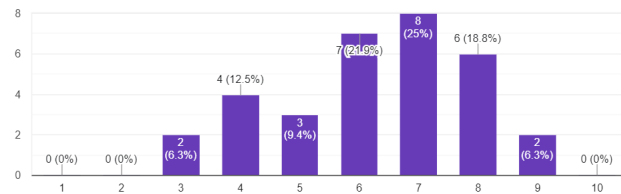


Fig. 2. Survey results for Points & Levels.

the effectiveness of different gamification methods. This is done by asking the respondents to grade each method on a scale of 1-10. Afterwards, this should give an expectation of which gamification methods most effective when used in a lifestyle app.

At the end of the survey, an open question will be given to ask the respondents what they think would stimulate them the most within a lifestyle app. The respondents can respond freely to this question. This is asked to check if any method stands out or if the survey missed a survey that many respondents expect to be effective. This can also give us more insight in the details of certain methods and how the respondents would want certain methods to be implemented.

#### 4.1 Points & Levels

This methods is seen as most popular in the literature and also one of the most commonly used gamification methods in mobile applications. The survey shows a clear result where most people find Points & levels effective. It has an average score of 6.3 on a scale of one to ten which is around average compared to the other methods. as seen in Figure 1, this method is not disliked by many people which so adding this method to a lifestyle app will likely be beneficial without any disadvantages.

#### 4.2 Badges & Achievements

While having an average score of 6.4, this gamification method is seen very different by respondents. The responses were inconclusive with a slight lean to the positive side. Although this is the most popular game element used in lifestyle applications, it is probably also the most known gamification leading to very different opinions. All in all, Badges & Achievements is considered suitable for a lifestyle app but as visible in Figure 2, the effectiveness is somewhat indecisive. This is possibly due to the large amount of badges used in the Samsung health application. This lifestyle application was the most used among the respondents thus, it seems some respondents do not like the Samsung health app.

#### 4.3 Leaderboards

Looking at Figure 3, the results of Leaderboards are very indecisive. While it has an average score of 6.2, the individual responses are very different with many respondents stating Leaderboards as highly ineffective as well as respondents stating leaderboards as very effective. We can conclude that the suitability of this gamification element highly differs per user. It has potential for certain users but will be ineffective for others. This gamification element is suitable but will not be effective for every user. A positive side note is that this method is often mentioned in the open question alongside social interaction. A plausible reason for disliking leaderboards as a stimulating method is that a leaderboard can be confronting so some users do not like to be confronted when they aren't doing very well in comparison to other users. The fact that leaderboards can be confronting, can on the other hand, show great effectiveness for other users that do not find the leaderboards as confronting but rather as a big stimulation to try to get as high as possible. Hence, leaderboards can be very effective but can also show a negative effect so a good option would be to make leaderboards optional or at the minimum, add an option to disable the leaderboards.

#### 4.4 Goals/Quests

With the highest average of 7.5 as can be seen in Appendix D.2, Following from the survey, Goals & Quests is the most suitable gamification element according to users. The survey shows no negative responses which suggests that this method is suitable for nearly every user and according to the survey, also the most effective method of this research. This method is also mentioned often in the open question where respondents can answer freely about which method they would prefer.

#### 4.5 Penalties

Shown in figure 4, this gamification method showed an average score of 3.2 which is the lowest score of the survey. The results clearly

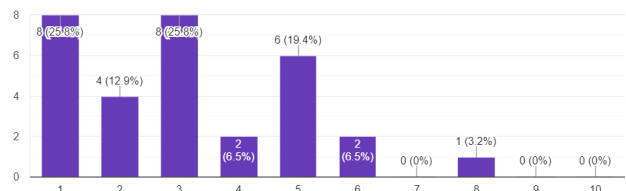


Fig. 3. Survey results for Penalties.

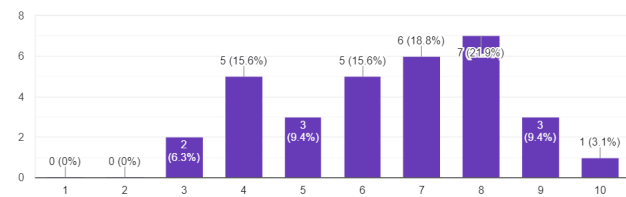


Fig. 4. Survey results for Badges & Achievements.

suggests that penalties are not suitable for lifestyle applications. This gamification method was also mentioned negatively in the literature, thus the survey follows the theory that penalties are not effective as a stimulation for a healthier lifestyle. Penalties can be compared to negative rewards. This means that for living less healthy, you get a negative reward. This method is based on the idea that users tend to avoid negative rewards and thus live healthier. This however, can have reversed effect on people that are already living less healthy. These users will not get any positive reward but only a negative reward which does not lead to effective stimulation to a better lifestyle.

#### 4.6 Virtual Currency

Virtual currency showed an average score of 6, however, the individual results are indecisive. A possible explanation is that Virtual currency is a less known gamification method. As can be seen in Appendix D.3, Virtual currency came out as mostly unknown to the respondents of the survey. Apparently, most respondents have few experience with this method leading to neutral or deviating results. From the survey alone, no decisive conclusion can be drawn on whether Virtual Currency is effective for a lifestyle app. Although the results show no incentive that it is not suitable. The chart following from the results can be found in Appendix D.2

#### 4.7 Positive Feedback

Positive Feedback being one of the more subtle methods of gamification showing an average score of 6.5 suggests that users highly prefer positive feedback over negative feedback. The results show only positive responses next to some neutral responses. From the survey, we can conclude that Positive Feedback is highly suitable for lifestyle applications and likely to be effective for most users. The results can also be seen in Appendix D.2

#### 4.8 Overall Results

This section will discuss the results in contrast to each other as well as providing an insight to the answers given to the open question at the end of the survey. While the main questions show that the methods: Goals & Quests and Positive feedback are likely to be most effective in a lifestyle app, the open question returns very diverse results that highly depend on personal preferences. While Goals & Quests are mentioned multiple times, Positive feedback is not mentioned. Many responses from the open question also suggest Social interaction and leaderboards as most effective. While not showing a decisive result in the main question, Virtual currency is mentioned several times as their preferred method to stimulate them. Furthermore, Most methods were widely known except for penalties which was a less known method but this is explainable because it is also a less popular method in the literature. To the question of which lifestyle apps the respondents used, Samsung health stood out particularly and Apple health was less used than expected. A possible explanation for this would be financial situation because young adults might not be able to afford apple devices to use Apple Health. Strava, which is a tracking app for walking or running was also popular among the respondents, this app already uses a form of social interaction and comparison by the ability to show your

routes and other statistics. All in all, social interaction stands out as an answer to the open question. Social interaction is included in the method leaderboard but not excluded to. Also different methods including social interaction are proposed. From the open question it becomes clear that a lifestyle app can be a great tool to stimulate user behavior, it is not the most effective way if not combined with social interaction.

## 5 CONCLUSION

In this section, the results from the literature study and the survey will be discussed together. This will give an overall conclusion to the research question and thus which gamification method is most suitable for a lifestyle app. Looking at the results from the literature study, The concept matrix suggests that both points & levels and leaderboards are the most popular gamification method and thus the most suitable. The concept matrix also shows that penalties occur in most of the articles used. However, most occurrences of penalties were negative and thus the articles state that penalties are not effective in a lifestyle app. This statement is fully backed up by the survey which also shows that penalties are the least liked gamification method thus penalties can be considered not suitable for a lifestyle app.

Looking at the survey, which shows that Goals & Quests are perceived as most effective and Leaderboards as well as Points & levels, Badges & Achievements and Positive feedback are also said to be suitable by the respondents. While the theory and the results from the survey differ slightly, most conclusions are similar. The survey also shows that Social interaction is an important factor in stimulating users. This is however not suggested in the literature study. All in all, when making a lifestyle application with gamification, a good starting point would be to include goals and quests which could then reward the users with Points/Levels or Badges/Achievements. These rewards can be made measurable to create a leaderboard that adds a competitive edge that effectively motivates certain users. To add more social interaction, one could add functions to or compare a users accomplishments.

### 5.1 Answering the research question

If we look back to the question *"How can gamification elements make lifestyle apps against obesity and diabetes more effective for people between 18-25?"*, We can now conclude that gamification elements have added value in lifestyle apps to stimulate user's behavior. However, the most effective way to use gamification elements would be to combine them with social interaction which could be in the form of leaderboards which adds competition or in the form of collaboration or comparison. When used together with social interaction and the right elements are implemented correctly, gamification can have a significant effect on making lifestyle apps more effective in stimulating a healthier lifestyle.

## 6 LIMITATIONS

The systematic literature review was done over the seven most relevant articles. This means that the review excluded multiple articles. Google scholar was used as database for the articles and only

articles written in English were considered. This means that any other articles not included in this were not considered. Next to that, seven gamification methods were considered in the literature review and survey. These methods followed from literature that identified different game elements in mobile applications. Because not every gamification method can be used in a lifestyle app the most popular methods that have potential in a lifestyle app were considered. Hence, there is a limitation on what methods were researched. Furthermore, The survey was performed in the Netherlands with the contacts of one person so the results from the respondents might be similar and thus skewed. The survey got 32 responses so one could question how viable this research would be without additional research. Because the gamification methods were researched particularly in the context of a lifestyle app against obesity and diabetes. This study can give an insight on gamification used in other sectors but does not give a decisive result outside lifestyle applications. Lastly, this research focuses on the effect of gamification methods under young adults between 18-25. Because of this, The research has questionable value for purposes that concern other age groups. It would still be a good guideline but requires additional supporting research to prove a decisive result. Amongst the respondents of the survey, very few respondents suffered from obese or diabetes, hence the research results are mainly based on the results from people with normal weight and health.

## 7 FUTURE WORK

Following from the limitations, additional research can be done to support and further develop this research's results. Next to a systematic literature review, possible research could be to perform extensive interviews among lifestyle app users to gather more details and specifics about the gamification methods. Next to performing more research on different or more gamification methods, one could also research the details and requirements of certain gamification methods. This could be done to create a better insight on specific gamification methods and how they can be implemented efficiently. Following from this future work, A prototype could be made of a lifestyle app that uses all the gamification methods that are most suitable according to this research. The ultimate goal would then be to create an actual lifestyle app that combines all this research to make an effective app that has a decisive influence on improving user's lifestyles, in particular users with obese or diabetes. Future research could also be to create more insight into the particular opinions of users with obese or diabetes, this could be done through extensive interviews but a trial using prototypes with different gamification methods or different variations of these methods could also be valuable to gain insight in the effectiveness of gamification methods under users suffering from obese or diabetes.

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### A WOLFSWINKEL'S SYSTEMATIC LITERATURE REVIEW

Number	Task
<b>1. DEFINE</b>	
1.1	Define the criteria for inclusion/exclusion
1.2	Identify the fields of research
1.3	Determine the appropriate sources
1.4	Decide on the specific search terms
<b>2. SEARCH</b>	
2.1	Search
<b>3. SELECT</b>	
3.1	Refine the sample
<b>4. ANALYZE</b>	
4.1	Open coding
4.2	Axial coding
4.3	Selective coding
<b>5. PRESENT</b>	
5.1	Represent and structure the content
5.2	Structure the article

### B CONCEPT MATRIX FOR GAME ELEMENTS MENTIONED IN THE LITERATURE

	Points and Levels	Badges /Achievements	Leaderboards	Goals/Quests	Penalties	Virtual Currency	Feedback
Johnson, D et al. (2016)	x				x		
Timpel, P. et al. (2018)	x		x	x			x
Patel, M. S. et al. (2021)		x		x	x		x
Chae, H. (2022)	x		x		x		x
Schulz, L. et al. (2020)	x		x		x		
Edwards, E. A. et al. (2016)	x		x	x	x	x	x
Checetti, P. et al. (2019)	x	x	x		x		

### C IDENTIFIED GAMIFICATION ELEMENTS



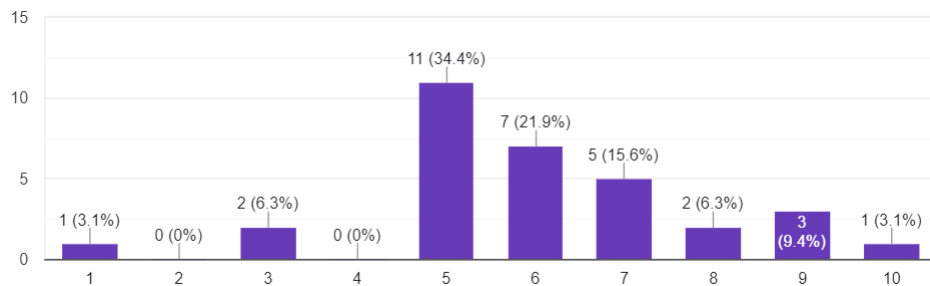
## D SURVEY

Survey Link

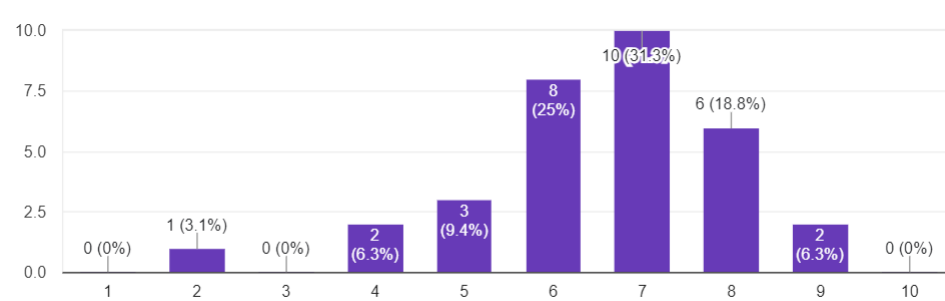
### D.1 Answers to the open question

- "An overview of my progress which motivates to continue a trend, For me, feedback from people instead of apps is most effective."
- "Something with achievements with reachable goals."
- "I find goals and achievements the most effective way to motivate myself for a better lifestyle."
- "For me, Competition and social interaction works best for me to motivate me to exercise more."
- "Other people that inspire or help me with improving lifestyle."
- "After every activity, A new goal or plan should be given by the app"
- "Challenges, for example, Biking 10 km."
- "Virtual currency would be effective for me"
- "When the app gives info about healthy scores or gives tips."
- "Weekly or monthly challenges"
- "Competition/leaderboard with friends and family"
- "A recap of your year or month"
- "A rewarding system."
- "Goals and quests."

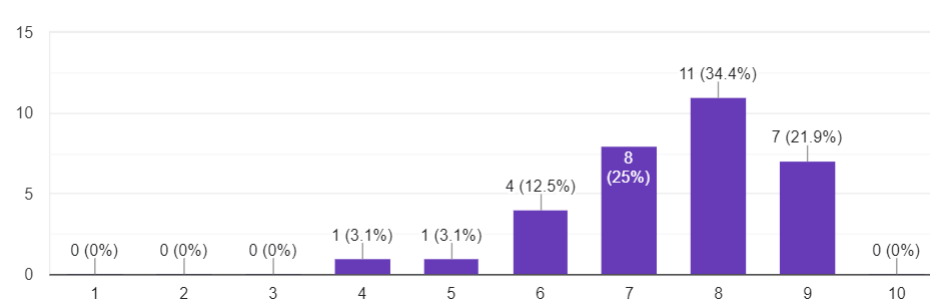
### D.2 Survey results for Virtual Currency.



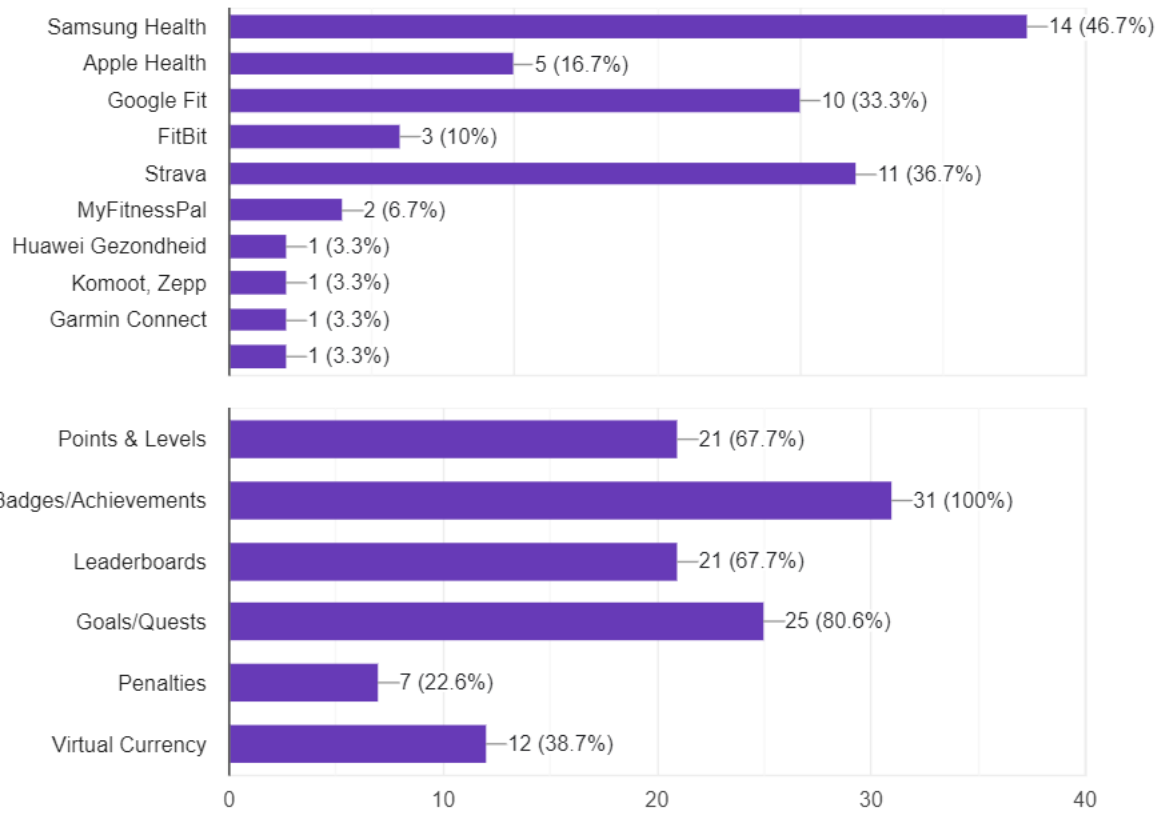
### D.3 Survey results for Feedback



### D.4 Survey results for Goals



### D.5 Most used lifestyle apps and known gamification methods



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