## Introduction

For our final project we focussed on player types, in particular the relationship between the player’s behavior and their characteristics.

First we decided on what kind of behavior we could define a player type. One feature in Oefenweb is that players can choose the difficulty level for the games. This choice is already meaningful because it could influence other behaviors of the player. For instance, choosing a low difficulty level may suggest that the player is not confident in their abilities, or that they are not motivated and do not want to put in much effort. To represent this, for each player we extracted their most often chosen difficulty level. We also considered taking the mean or the maximum but decided that the mode is the best indication for our question.

Second, we decided on the characteristics that we are interested in, namely the player’s Q-score and their login count. The Q-score represents a player’s overall ability in a specific game, whereas the login count may be related to a player’s motivation. For both, we are mainly interested in the different difficulty levels within the same grade. We extracted these variables from the Oefenweb database itself.

We decided to only look at the addition game in the rekentuin application as examining more games would result in many crowded visualizations on one page. In Dutch primary schools, addition is taught in the third grade. Therefore we selected data from students in grades two, three, and four for upward and downward comparison.

## Results and discussion

First, to get an overall impression of the chosen difficulty levels, we simply plotted their proportions per grade (plot A). We also included the number of students within each group to emphasize these differences. We were surprised that relatively more students choose a low difficulty level while and after learning addition (third and fourth grade), compared to before learning it (second grade). We either expected that most students choose the default difficulty level independent of their grade, or that students choose the highest difficulty level when they are older, to challenge themselves. However, it is important to keep in mind that these results may be skewed because there are only few students in the second grade who are already playing this game, and therefore this finding may not be representative.

Second, we looked at the relationship between the chosen difficulty level and the Q-scores (plot B). We purposely chose a violin plot to visualize the distributions, instead of simple measures, such as the means. In the third grade, there are slightly more students who choose the high difficulty level in the expected range compared to students who choose the easiest or medium level. Within the second and fourth grades, the distributions are very similar across difficulty level: In the second grade almost no students reach the expected Q-score range whereas in the fourth grade many students do. This may show that especially in the grade where students first learn addition, there are differences in ability between player types but not in the grades before and after learning it.

Lastly, we looked at the chosen difficulty level and login count (plot C). In all grades, on average, the students who choose the highest difficulty, also log in the most. This is followed by those who choose the easiest level, and then those who choose the default level. Since we take login count as a measure of motivation, we may conclude that students who are least motivated also are not making the effort to change the difficulty level from the default to a more fitting one. A multiple linear regression on login count confirmed our visual inspect and showed a significant effect of grade (*β*= -.19, *p*<.005). Therefore we conclude that whether or not students change the difficulty level may predict motivation in the addition game.

## Explain your visualisation; why was this the best visualisation

We dedicided to visualise two variables that could be predicted by the difficulty level chosen by players. To get an overview, we used a stacked bar chart to visualise the relative proportions of the most frequently chosen difficulty levels per grade. To visualize the Q-scores, we decided against a boxplot because we already know where in the Q-score range to expect the players per grade. Therefore, we chose a violin plot to display the density: it shows how the Q-scores are distributed per difficulty level. Finally, we chose a boxplot for the login counts because this is a visually effective way of viewing a clear summary of the data and it’s easy to compare. Also, a box plot is one of the few statistical graph methods that shows outliers. The outliers are easy to determine and to remove. Moreover, the boxplots illustrates the large variance of login counts in grades 2 and 4.

To conclude, we have shown that player types can be defined by examining the chosen difficulty level, students’ motivation (login count) and their expected performance (Q-score) We recommend to apply our visualisations on the other games in Oefenweb, while also keeping in mind in what grade the students are taught that related topic.