

# Behavioural Patterns in a Computerized Training Program for Individuals with Intellectual Disabilities

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## Abstract

Little is known about behaviour of individuals with intellectual disabilities (ID) in computerized training programs; knowledge that is important to design effective programs. This study used log data from a computerized program for improvement of planning skills to investigate patterns of behaviours in individuals with ID and mental age-matched controls. Here we present results from the two behaviours playing actively and ability to learn. These behaviours were measured in the data as clicks per minute and error rate.

The results showed that individuals with ID overall played less active than the TD individuals. Especially in the early sessions the individuals with ID had a much lower playing activity than the TD individuals. However, after a passive beginning the ID group started to play more actively. Looking at the ability to learn the application there were no significant differences, both groups improved.

From this we conclude that the participants with ID did improve by using the application and that they were more careful, scared of wrongdoing, or less motivated to play when first introduced to the application. These findings matched similar findings about executive functions in individuals with ID.

Keywords: Intellectual disabilities, training, behavioural patterns.

## 1 Introduction

Children with intellectual disabilities (ID) have problems with many aspects of executive functions including inhibition (Danielsson, Henry, Messer, & Rönnerberg, 2012). It is reasonable to think that problems with those abilities would affect the behaviour in computer games. More specifically, we think that it would lead to more time to succeed, more irrelevant mouse clicking, and more mistakes. This leads to less learning in the game and a lower playing pace (van de Sande, Segers, & Verhoeven, 2015). The present study sought to investigate patterns which would help designing an application for individuals with intellectual disability (ID) to better handle such behaviours. Several aspects of behaviour of individuals with ID were investigated, including non verbal intelligence, cognitive flexibility and playing performance. We compared the patterns of the ID group to the data of a control group of typically developing (TD) children with approximately the same mental age.

## 2 The Application

The application PLANERAMERA<sup>1</sup> is a game that helps the user train planning by helping an alien to learn how to plan everyday tasks such as making breakfast or doing the dishes. For example, to make breakfast you need to collect juice, bread, butter and cheese. They are then to be ordered correctly, such as putting butter on the bread, not the bread on the butter. The tasks had different levels of difficulty, from collecting and sorting two items up to six. Solving a number of such task gives the player an item to put in the alien's rocket. These items can be inspected at all times.

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<sup>1</sup>Planera mera is Swedish for plan more.

### 3 Participants

Seventeen individuals with ID, from different schools in Sweden participated in the study. The mean age of the participants was 18.1 years ( $SD = 1.54$ ).

The study also included 27 TD children as a control group. The mean age of the TD group was 8.02 years ( $SD = .79$ ). The TD group were matched on mental age. All participants played the application for 15 minutes every school day for one month.

### 4 Playing behaviour

We explored two types of playing behaviour by analysing log data. Activity level were measured by looking at how many clicks per minute the participant performed in the beginning compared to the end of the training period. Learning in the application was measured as the improvement rate for each sorting condition. A comparison within each group was made. The mean error-rate of the last 25% was subtracted from the mean error-rate of the first 25% and then divided by the mean error rate of the first 25%. This was done for two different difficulty levels.

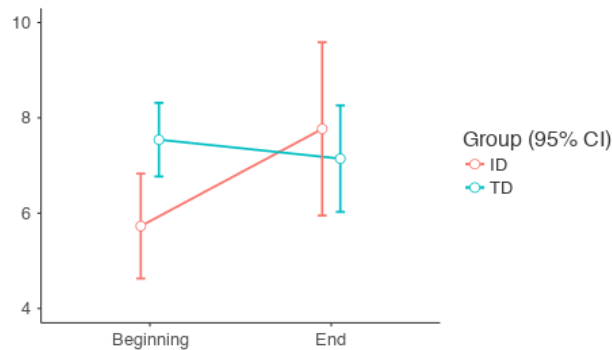


Figure 1: Clicks per minute for the intellectual disabilities (ID) and typically development (TD) groups in the beginning and the end of the training period

### 5 Results and discussion

Three repeated measures ANOVAs were conducted. The first showed a non-significant main effect for group ( $F(42, 1) = 0.61, p = .44$ ), and a significant effect on clicks per minute in the beginning and in the end ( $F(42, 1) = 4.42, p = .04$ ), and a significant interaction time between group and time ( $F(42, 1) = 9.75, p = .003$ ).

The participants with ID started with less clicks per minute than TD, but in the end, they were using the same amount of clicks per minute, see Figure 1. This tells us that the participants with ID are more careful and play less actively than the TD participants in the beginning but catches up in the end of the training period.

A second repeated measures ANOVA investigating learning on the easier Level 1 showed a close-to, but non-significant group effect ( $F(42, 1) = 3.65, p = .063$ ), a significant effect on error rate in the beginning and in the end ( $F(42, 1) = 40.93, p < .001$ ), and a non-significant interaction time between group and time ( $F(42, 1) = 1.85, p = .18$ ). The ID participants solve on average slightly less tasks than the TD participants, and both groups improved in the end of the training period, see Figure 2.

The same pattern can be seen in the third ANOVA on the more difficult Level 3, with a smaller, still non-significant group effect ( $F(37, 1) = 0.31, p = .58$ ), a significant effect on error rate in the beginning and in the end ( $F(37, 1) = 5.66, p = .02$ ), and a non-significant interaction time between group and time ( $F(37, 1) = 0.01, p = .91$ ). Both groups improved in the more difficulty level, see Figure 2.

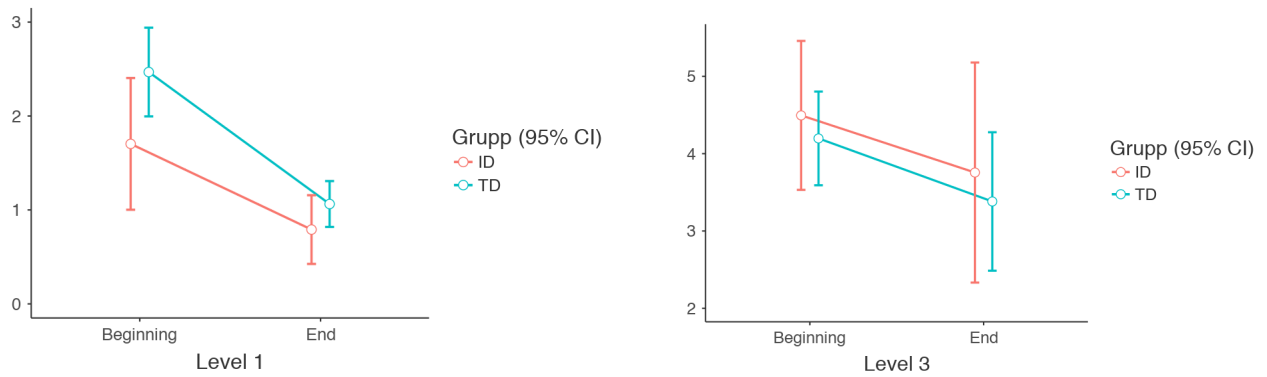


Figure 2: Error rate level 1, left and error level 3, right, for the intellectual disabilities (ID) and typically development (TD) groups in the beginning and the end of the training period

For learning in the application, we can conclude that both groups did improve on most of the tasks, but mostly in the easier tasks. Both groups improved as much. There was also a change in how actively the ID group played which could be a sign of adapting a new strategy of trail-and-error.

The results from the study helped to create a better understanding of how individuals with ID behave in applications, and will contribute to the design and development of applications that aim to provide aid to these individuals in their everyday life.

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## References

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