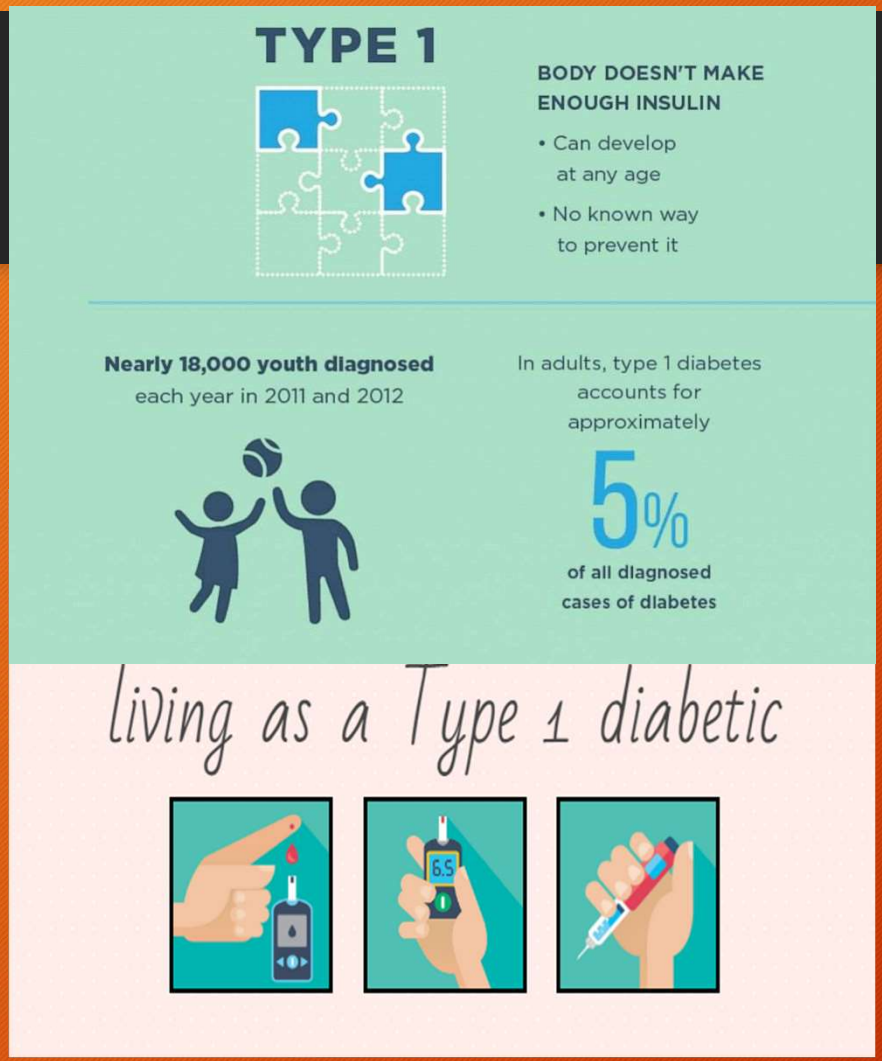
Developing a Serious Game for Children with Diabetes

Cecilia Sik-Lanyi[1], György Erdős[1] and Andras Sik[2]

[1] University of Pannonia, Veszprem, Hungary
[2] Prolan Innolab Kft., Budakalasz, Hungary

lanyi@almos.uni-pannon.hu



Content

A Serious Game has been developed for preschool-age children who have been newly diagnosed with type 1 diabetes. The name of this game is “for kids with diabetes” the shorter version is “4KidsDiab”. The 4KidsDiab program consists of two parts, an editor and a game part.

- Introduction
  - Background
  - Aim of the development
- Method
- The „4KidsDiab” software
  - Games for the children
  - Editor for the parents
- Evaluation
- Conclusion

Background / 1

- In the United States, diabetes is increasing in prevalence, and it is now the seventh leading cause of death; if today's trends continue, by the year 2050, an estimated 48.3 million people in the United States will have type 1 or type 2 diabetes—almost double the current number.
  - **The type 1 diabetes disease develops in childhood and the number of patients has tripled in the last thirty years.**
  - Currently, the estimated number of children with type 1 diabetes in the world is close to 601,000.
  - All six-hundredths of children under the age of 15 are affected, and it is a particularly worrying phenomenon that the incidence of the disease in the youngest (under 6 years) age group increases disproportionately even compared to older children.
  - **Type 1 diabetes has become one of the most common chronic childhood diseases these days.**

Background / 2

- Lifestyle factors do not play a role in the development of type 1 diabetes unlike it is common in type 2 diabetes due to poor eating habits.
- Type 1 diabetes is an autoimmune disease caused by a disorder of the immune system. The cause of type 1 diabetes has not been revealed in medicine in recent decades.
- Diagnosis at the earliest possible stage would be extremely important.

Aim of the development /1

- Despite modern tools, in the case of type 1 diabetes, the lives of children need to be organized on an extremely strict agenda.
- There is no special diet, the recommendations are in line with the principles of healthy eating, only certain fast-absorbing carbohydrates are on the ban list, but the time, number and amount of meals are predetermined.

Aim of the development / 2

- The treatment of diabetes is real teamwork, in collaboration between
  - the pediatrician,
  - the educator nurse,
  - the dietitian,
  - the psychologist,
  - but civil society also has a prominent role to play.

Aim of the development / 3

- **The lifestyle of diabetic children and their families changes drastically at a glance after the diagnosis. Not only parents but also children need to learn a lot.**
- Those children need guidance and knowledge near to diagnosis and during ongoing management in order to cope with their condition.
- It was our motivation to develop a Serious Game to help kids with type 1 diabetes learn the new knowledge they need.

Method, 1st step: literature review

- We have found some video games e.g.:
  - Carb Counting with Lenny℠ game is downloadable from the AppStore. In spite of the fact that the developers recommend it for age rating 4+ the screens contain several text pieces of information and it is available only in English, moreover the overall rating is 2.9 out of 5.
  - MyDiabetic game is a very complex game, however, this complexity can be a disadvantage for our target audience. The game tries to cover as many aspects of diabetes as possible. The game is a result of three years of research. Unfortunately, this game is not available in Hungarian either.
- Then we have realized the lack of age-appropriate education for younger children with type 1 diabetes.

Functional requirements

- **We have followed a user-centered design approach. Therefore, we have consulted pediatric dietitian on how to educate newly diagnosed children with type 1 diabetes**. The consultations have helped in formulating the scope and we have defined the functional requirements which can be summarised as follows:
  - …
  - The controls of the game should be clear and simple so that anyone who uses it can handle it without any difficulty.
  - Age group would be preschool children who do not have literacy skills and thus cannot access written information.
  - …
  - The game will focus on four mini-games for children and an editor program for parents and pediatric dietitians, which can be used to expand the game's database.

Development tools

- The 4KidsDiab program consists of two parts, an **editor** and a **game part**. The two parts have different constraints and functional functions, so we have chosen development tools that better specialize in the tasks.
- The editor has been created in QT Creator, the game has been created in a development environment called Game Maker Studio.

4KidsDiabGame

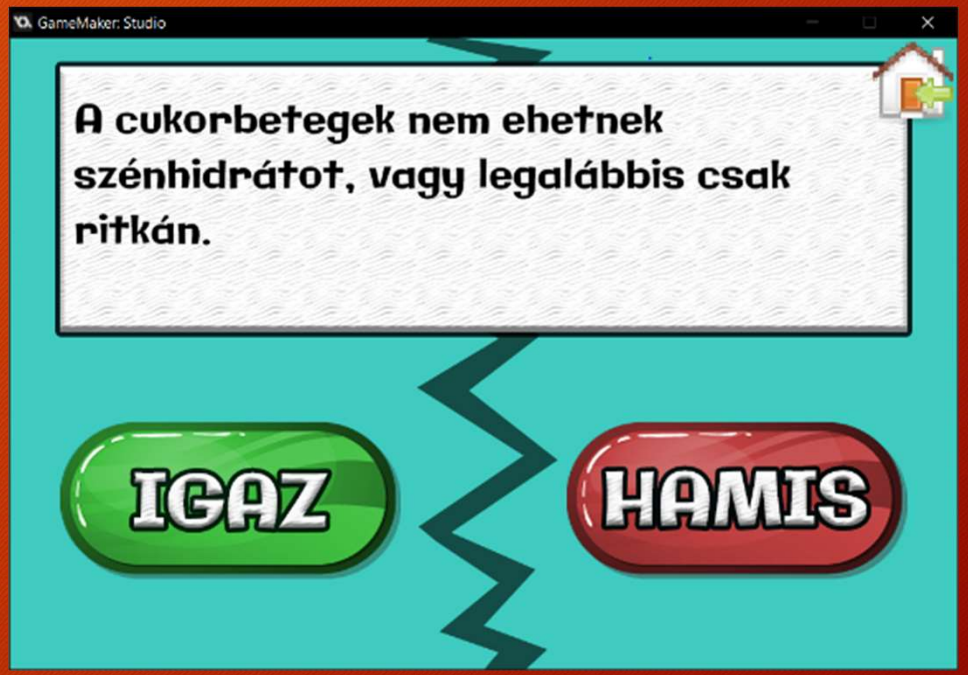
- The mirror translation was impossible:
  - „Diab” is a shorter version of diabetes
  - „okosodó” means: somebody be smarter and smarter
- The game part contains four games:
  - “True/False quiz”,
  - “Which food has more / fewer carbs”,
  - “Take it to your plate”
  - “Feed the figure (snake)”

"True/False quiz"

The task in the "True/False quiz" is to choose the right answer for the question. It means that the statement of the question is true or false. E.g.:

- I always have to have some carbs with me. (True)
- I have to drink at least 2 dl of milk every morning. (False)
- Honey should not be eaten. (True)

These sentences and instructions are read by children's voices in the game.



“Which food has more / fewer carbs” game

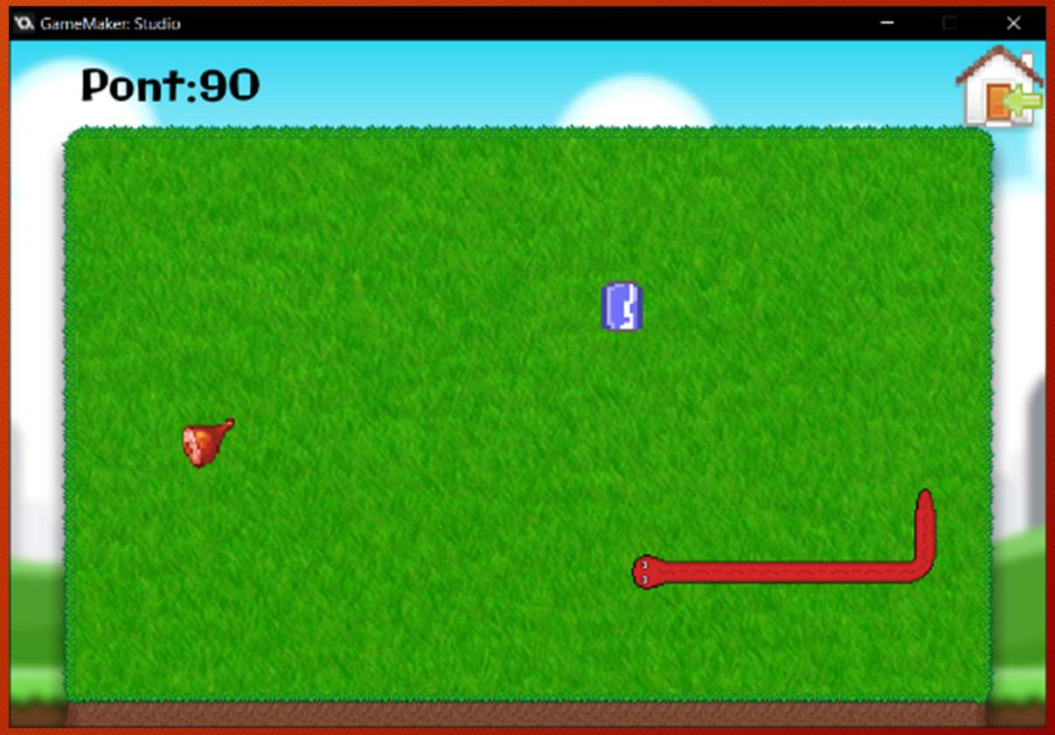
- The photos of two foods are on the screen in the “Which food has more / fewer carbs” game.
- Children have to choose the picture based on the right answer to the question.
- Icons in the left and right down corners of the photo indicate gluten free and lactose free of the food.

“Take it to your plate” game

- Children have to choose food for a meal in the “Take it to your plate” game.
- They can choose foods for breakfast, lunch, dinner, etc. from the database.
- The carbohydrate is calculated based on their allowable value which had been uploaded by their parents in the editor mode.
- It is a very hard game for little kids.

“Feed the figure” game

- The fourth, reward game is the “Feed the figure” game.
- It is a traditional snake game.
- If the child gives a portion of good food for the snake the snake will be longer.
- If the child gives bad food for the snake, it will be shorter and sick.

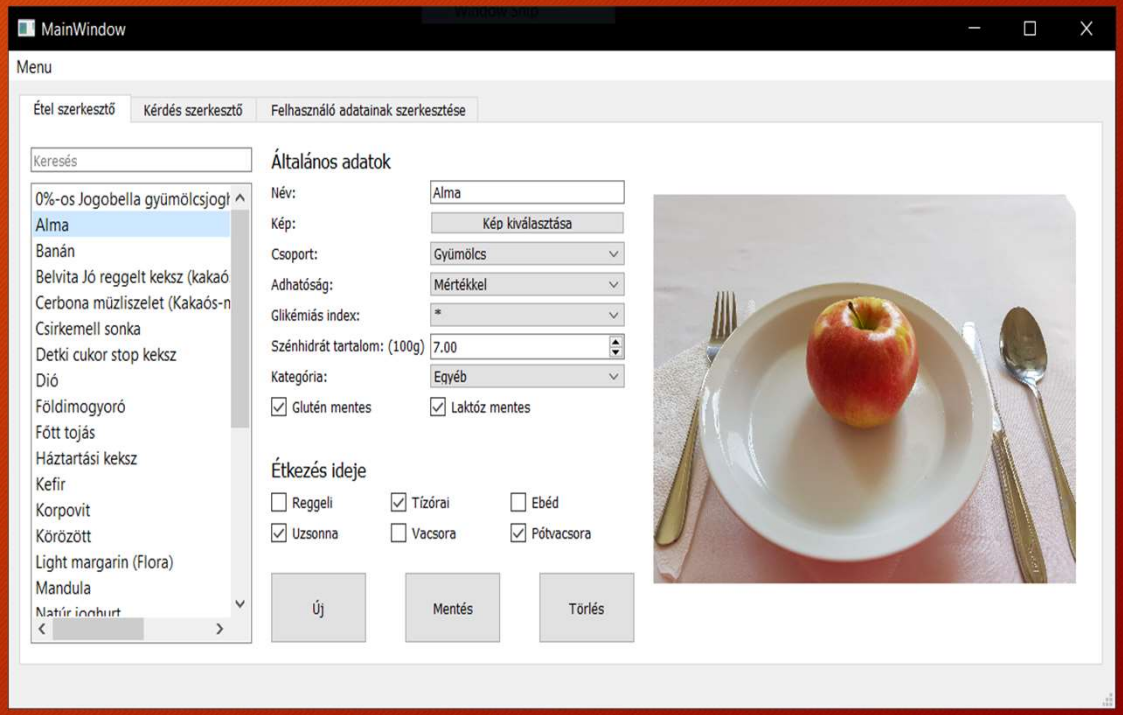


Editor for the parents - 1

Parents can upload pictures and data of meal/food into the game database.

These data are:

- name of the food
- category of the food (fruit, meat, vegetables, baked goods, etc.),
- the carbohydrate content of the food
- the food is usually serviced for (breakfast, lunch, snack, dinner, supplementary dinner),
- it contains fast or slow absorbing carbohydrate,
- it is allowed to eat anytime, it is forbidden to eat, children can eat but parents have to calculate its carbohydrate content,
- does it contain gluten or lactose?



Editor for the parents - 2

Parents can upload questions for “True/False quiz” game e.g.:

- I can drink milk at any time. (False)
- I can never drink milk. (False)
- I can drink milk when there is a meal and mom/dad calculate the carbohydrate content. (True)
- I can drink tea made with sweetener at any time. (True)
- I can get a teaspoon of honey at any time. (False)

- Parents can upload pictures and food date for the “Which food has more / fewer carbs” and “Take it to your plate” games. The necessary and eatable carbohydrate is adjustable based on the children needs by the parents in the editor mode.

Evaluation - 1

We have asked little preschool-age children and their parents and pediatric dietitians to test our game.

- For testing, a modified version of System Usability Scale (SUS) was used in the Google Form.
- Users have had to answer the questions on a Likert scale of 1 (strongly disagree) to 5 (strongly agree). In our modified SUS questionnaire, there are 15 instead of 10 questions.
- The first 10 questions of the test are for parents and the remaining 5 questions (questions 11-15) are for children.

Evaluation – 2

Questions for the parents

1. The operation of the editing program is simple and straightforward.
2. The editing program is unnecessarily overcomplicated.
3. Managing the editing program is easy to learn.
4. I need the help of an expert to be able to manage the editing program.
5. Using the editor is fast and problem-free.
6. The user interface of the game does not correspond to a child's play.
7. The game is useful for young children.
8. The sub-games are too complicated.
9. Game management is easy to learn.
10. The game is difficult to use.

Questions for the children

1. I will play the game often.
2. The game is too simple.
3. I can learn a lot from the game.
4. I don't like the game.
5. I can play the game alone.

Evalaution – 3

- The modified System Usability Scale (SUS) questionnaire was filled by 10 users (7 adults and 3 children).
- The results' evaluation based on the SUS Interpreting Scores. The maximum scores are 100.
- In our case, **the parents' score was 81.25 and the children's score was 80.5.**
- So we can state that both the parents' and children's scores are "Excellent" based on the SUS evaluation. (SUS score above 80.3, the letter grade is "A", the adjective rating is "Excellent".)
- Athough there were some remarks, we have corrected and modified the software based on those remarks yet.

Conclusion

- A Serious Game has been developed for preschool-age children who have been newly diagnosed with type 1 diabetes.
- The game has been designed on the children's needs and conceptions and implemented based on the knowledge of pediatric dietitians.
- It contains a database with photos and data of several foods and meals.
- It has been evaluated for its learning effectiveness and usability.
- **Our game is an innovative game not only because it is for preschool-age children, but it contains allergic information for children who have gluten or lactose intolerance.**

Ancknowledgement

- We would like to thank Dóra Henn, Anna Mesterházi-Kövecses and Márta Molnár-Nemes, dietitians of the Ferenc Csolnoky Hospital in Veszprém for their professional advice.

- THANK YOU FOR YOUR KIND ATTENTION!

- Cecilia Sik-Lanyi[1], György Erdős[1] and Andras Sik[2]

[1] University of Pannonia, Veszprem, Hungary
[2] Prolan Innolab Kft., Budakalasz, Hungary

- lanyi@almos.uni-pannon.hu