Identifying User Preferences for a Digital Educational Solution for Young Seniors With Diabetes

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ABSTRACT

The Eindhoven Diabetes Education Simulator project was initiated to develop an educational solution that helps diabetes patients understand and learn more about their diabetes. This article describes the identification of user preferences for the development of such solutions. Young seniors (aged 50–65 years) with type 2 diabetes were chosen as the target group because they are likely to have more affinity with digital devices than older people and because 88% of the Dutch diabetes population is >50 years of age. Data about the target group were gathered through literature research and interviews. The literature research covered data about their device use and education preferences. To gain insight into the daily life of diabetes patients and current diabetes education processes, 20 diabetes patients and 10 medical experts were interviewed. The interviews were analyzed using affinity diagrams. Those diagrams, together with the literature data, formed the basis for two personas and corresponding customer journey maps. Literature showed that diabetes prevalence is inversely correlated to educational level. Computer and device use is relatively low within the target group, but is growing. The interviews showed that young seniors like to play board, card, and computer games, with others or alone. Family and loved ones play an important role in their lives. Medical experts are crucial in the diabetes education of young senior diabetes patients. These findings are translated into a list of design aspects that can be used for creating educational solutions.

Diabetes education may help to reduce A1C in the long term (1,2), which lowers the risk for complications (3,4). Consequently, education plays an important part in diabetes treatment. Diabetes education in The Netherlands is mainly provided verbally, in one-on-one sessions between patients and health care providers (HCPs). This takes time and offers little room to practice with gained knowledge.
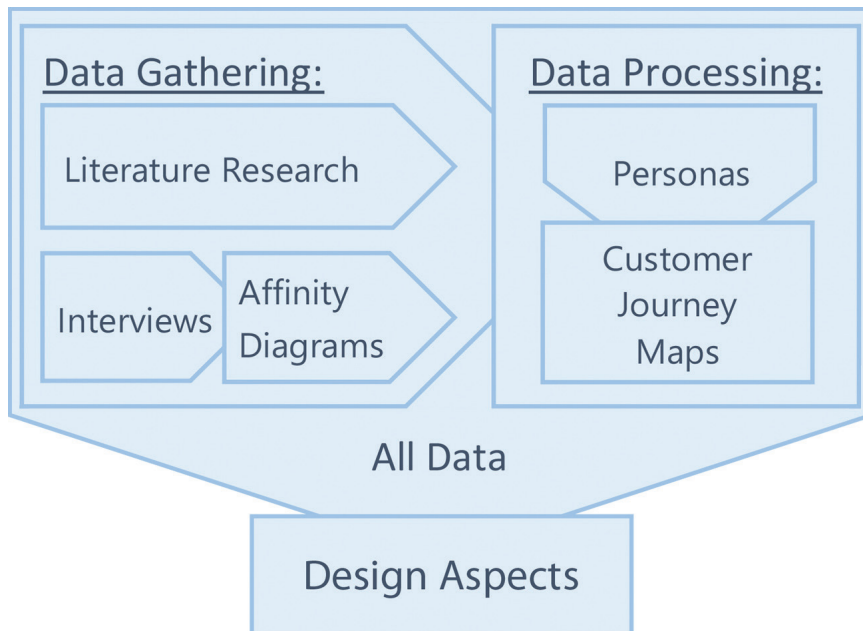
The Eindhoven Diabetes Education Simulator (E-DES) project (5) was started to support patients and HCPs in the education process. The aim of this project is to develop a digital educational solution that helps patients understand more about their diabetes by practicing with aspects that influence their glucose level in a noninvasive way.

To create user-friendly solutions, it is crucial first to understand potential users. This study aimed to identify the lifestyle and behavior preferences of Dutch senior diabetes patients that can be taken into account in developing educational diabetes tools.

Methods

In this study, information was gathered through literature research and semi-structured interviews (6). This information provided input for personas (7) and customer journey maps

Data Gathering:

Literature Research

Interviews → Affinity Diagrams

Data Processing:

Personas

Customer Journey Maps

All Data

Design Aspects

■ **FIGURE 1**. Schematic overview of data use, from research to design aspects. Interviews were analyzed using affinity diagrams, which, together with the literature research, formed the input for both personas and customer journey maps. All data were used to form the design aspects described in Discussion.

Search engines:	Topics:	Source types:	Result:
Google (general)	Socioeconomic	Academic articles	Target group
Google Scholar (academic)	Sociodemographic	Government reports	data
Focus (academic)	Computer devices	Statistical data	
	Educational preferences	Trend reports	
Languages:	Leisure activities	Online blogs	
English		Books	
Dutch			
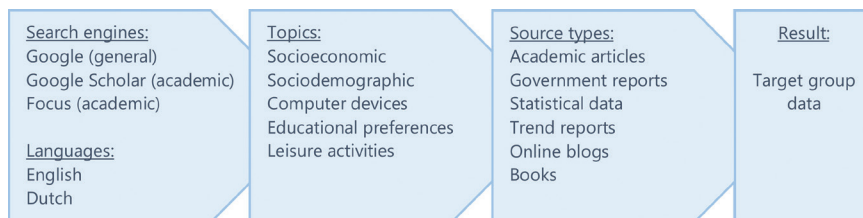
■ **FIGURE 2**. Schematic overview of the literature research.

(8,9). The information and insights gathered through the literature study, interviews, affinity diagrams, personas, and customer journey maps together formed the results of this study, which were then condensed into several design aspects to consider when developing a new diabetes education tool (Figure 1).

Literature Research

The literature research covered data about the target group, including their use of digital devices (desktop and mobile), leisure activities, and education preferences. Academic articles, government reports, statistical data, trend reports, books, and online blogs were reviewed (Figure 2), using the Google, Google Scholar, and Focus search engines. The literature sources were from the Netherlands and the United States, searched with both Dutch and English keywords. Literature sources from the United States were included if Dutch sources were not found. The associative, nonexhaustive search included looking for information about the learning preferences of people with a lower education, seniors' usage of digital devices and spare-time activities, and the digital gaming preferences of young seniors. A thorough review of existing diabetes education was not included to maintain a fresh perspective.

Semi-Structured Interviews and Affinity Diagrams

Parallel to the literature research, 20 patients (8 male, 12 female; aged 45–80 years [mean and median 63])

and 10 HCPs (1 general practitioner, 2 internists, 2 dietitians, and 5 diabetes nurses) were individually interviewed to gain insight in the daily life of diabetes patients and the diabetes education process. Patients were asked during their regular checkup if they wanted to be interviewed afterward. Half of the interviews—including 10 patients and 5 experts—were held with participants from general practices; the other half involved participants from Máxima Medical Center, Eindhoven. Generally, newer patients and those with few complications are treated in general practices, whereas patients with complex therapy regimens or multiple disease complications are treated in hospitals. Both health care settings were included to cover a broad range of patients, from those whose diabetes was managed with just lifestyle intervention (general practices) to those struggling to control their blood glucose despite extensive medicine use (hospitals).

We asked the patients about the beginning of their diabetes; their information needs and education then and now; and their daily life, digital device use, struggles with diabetes, and suggestions for diabetes education improvement. The experts were asked about their role toward patients, therapy processes, patient education, struggles as a practitioner, and ideas for an educational diabetes application (app).

The interviews were analyzed using affinity diagrams. An affinity diagram is an organized, tree-shaped overview of interview notes, sorted by affinity (10). Notes on a similar topic are grouped together into a branch (e.g., walking). Multiple branches form a higher-level branch (e.g., walking, cycling, and swimming branches form a larger branch for physical activities). Typically, an affinity diagram has three levels of branches (e.g., walking would be grouped under physical activities, which in turn would be grouped under daily life). By sorting based on affinity instead of predefined themes, the
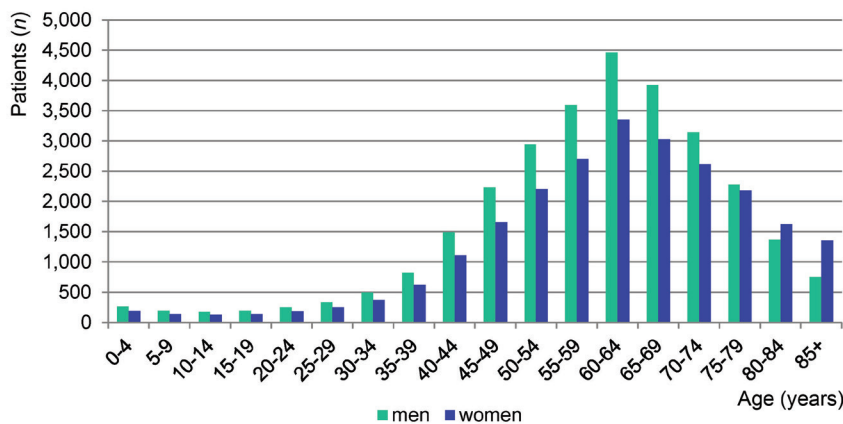
FIGURE 3. Absolute number of new diabetes patients in 2011 in the Netherlands (11).

interview results determine the major themes, giving a more realistic overview of the target group's issues and preferences. The interview notes were sorted into two affinity diagrams: one for the general practice setting and one for the hospital setting, to find out whether these two groups of patients have different needs.

Personas and Customer Journey Maps

The affinity diagrams (with information on daily activities, hobbies, and information preferences, among other things) and literature data (with information on demographics, device use, and game preferences, among other things) together formed the base for two personas and two customer journey maps. Personas are fictional characters based on target group research and defined by distinctive characteristics within that group (7). For each persona, a customer journey map is created. A customer journey map shows the story/timeline of the persona and its emotions and contact points (or information sources) per story segment (8,9). It is a tool to get insight into patients' journeys, or experiences, and to find out the problems they are facing with regard to specific topics (e.g., the first half year of living with diabetes). For example, a story segment can be "visiting a diabetes nurse for the first time," which happens at the

hospital (contact point) and makes the patient feel anxious (emotion). Both the personas and their corresponding journey maps are evaluated with diabetes practitioners to check for realism. They can be used by development teams to evoke empathy toward diabetes patients, to better understand their needs, and to evaluate ideas without constantly needing to ask actual patients.

Results

Literature Research
Approximately 88% of Dutch diabetes patients are >50 years of age, and most new diabetes patients are 60–64 years of age (Figure 3) (11). Therefore, the results shared here focus on the young senior age-group (aged 50–65 years). Figures from Statistics Netherlands show that prevalence of diabetes is inversely correlated with educational level (11). Education studies (12,13) show that teaching people with lower education levels (i.e., without a university diploma) should be done in small steps, allow time for repetition, explain the same information in different contexts, and include tasks and situations from practice. Individuals in this category need to learn by doing and should be supported by a coach or trainer in an interactive setting.

The number of young seniors using personal computers and mobile devices is growing rapidly (14,15). However, typical age-related prob-

lems such as deficits in eyesight and fine motor skills lead young seniors to prefer tablets over smartphones (16,17). Deficits in eyesight, hearing, and agility, as well as increases in processing time and difficulty remembering things, are typical age-related problems that start at ~40 years of age (18). These problems are even more prevalent in patients with diabetes because of macro- and microvascular damage (19,20).

One reason our target group uses computers or tablets is to play online games. People with lower education levels generally are more interested in playing online games than those with higher education levels (21,22). The Entertainment Software Association (23) found in 2014 that 30% of all U.S. citizens who played games played puzzle, board game, game show, trivia, and card games, and 28% played casual or social games. Young senior gamers are often women who play casual online games to relieve stress and to be social. The same study showed that many young senior gamers like to play with people "with the same level of maturity" or with their grandchildren. They prefer adventure games that include problem-solving, exploration, and communication. Other important factors include a game's storyline, characters, types of puzzles included, and visual design (artistic or cartoon-like design is preferred) (24).

Apart from playing online games, young seniors with lower education levels like to spend their spare time watching television, engaging in hobbies, resting, and using the computer and Internet (e.g., for email and online banking) (15). People with lower education levels also use the Internet more for chatting than people with higher education levels (22).

Semi-Structured Interviews and Affinity Diagrams
The 30 interviews resulted in >1,110 interview notes. Part of the affinity diagram from the hospital interviews is shown in Figure 4. We found that

FIGURE 4. Left: a snapshot of the affinity diagram, partly covering two major themes (green blocks): daily life and patient experience. Green stars mark opportunities, and red stars mark challenges. Right: magnified section of the affinity diagram showing the base for the attitude of persona Lisa. The codes below the colored theme cards refer to specific interview notes (e.g., U11-26 refers to user 11, note 26).

family and loved ones play an important role in the daily life of young seniors with diabetes, especially with regard to sharing diabetes experiences and creating understanding among themselves and their loved ones. We also found that our target group likes playing board and card games, both alone and with others. Patients in the general practice setting especially described playing digital games on Facebook or on their computers. Apart from games and family, these young seniors seemed to spend most

of their spare time watching television, crafting, or exercising (walking, cycling, and/or swimming).

The HCPs confirmed that patients today spend more time online. They indicated that the Internet is an important source of information for their patients. The patients, however, mainly referred to what their diabetes practitioner told them and said that, if they found information, they usually checked with their practitioner before changing their routine. Practitioners play a crucial role in diabetes educa-

tion for their patients, serving as a coach that supports them with their self-management. Media such as television and magazines trigger patients to learn more about diabetes.

Personas and Customer Journey Maps
Based on the general similarities and differences between the interviewed patients and the interviewed HCPs, two personas and corresponding customer journey maps were created. The personas and maps show two different ways of coping with diabetes that were identified using the affinity diagrams. The first persona, Lisa, actively manages her diabetes and is eager to learn more about it. However, she struggles to achieve adequate glycemic control. The second persona, Gerard, does not understand much about diabetes, has more of a "wait-and-see" attitude, and thinks the practitioner should "fix" him. Whereas Lisa is more individualized and focused on her well-being, Gerard is more of a family man and focused on the world around him. The characteristics of these personas were based on the literature research and interviews. The customer journey maps show that patients get the most diabetes information soon after diagnosis, but also that the two personas react differently to the learning process. The therapy in the maps is based on Dutch Physician Society guidelines (25). The complete personas and customer journey maps are provided in online Appendix A. Figure 5 shows a visualization of the two personas, including fictional quotes that describe their view of diabetes.

Discussion
Young seniors (50–65 years of age) are a large target group for educational diabetes tools. This group is very diverse, but our research shows that some general factors could be useful in the creation of diabetes educational solutions. To make these factors more explicit and useful for development purposes, they are listed below, along with suggestions for how or when to apply them.

"I just want to go my way and not be ruled by diabetes."

Gerard, 65, forester

"Living with diabetes is quite doable, but you need to keep paying attention."

Lisa, 57, receptionist

■ **FIGURE 5**. A summary of Lisa and Gerard, the two personas created during this study, including quotes that describe their attitude toward diabetes. The personas were based on the literature research and affinity diagrams. The age and job level are taken from the literature research (6). The attitudes represented were based on the affinity diagrams. (Photo source www.freedigitalphotos.net. Artists: stockimages and imagerymajestic.)

Factors to Consider When Educating Young Seniors With Diabetes

- HCPs play a crucial role in the diabetes education of their patients. Although patient self-management is encouraged, diabetes practitioners are needed as coaches or trainers. This could mean informing patients about the existence of an educational solution and asking them to use it at home or leading a group course in which the education tool is incorporated.

- In general, there are two distinct types of patients:
  - Eager-to-learn types, represented by the persona Lisa, who search for information and like to check their knowledge (e.g., with their diabetes nurse or through an app)
  - Wait-and-see types, represented by the persona Gerard, who require a low threshold for learning and who need extra incentives (e.g., a solution that involves loved ones as well as patients)

- Even patients who do not seek out information can be prompted to do so if a diabetes item is presented in the media. Television seems to be the main source of diabetes information, followed by magazines and newspapers, which could be considered for both educational and marketing purposes.

- Solutions for lower-educated young seniors should embrace a learning-by-doing format, through which information is given in small chunks and presented in different contexts. Repetition is key and could be realized through sending reminders or messages, facilitating refresher courses, playing games, or acting out scenarios.

- Young seniors with diabetes seem to have a strong need for sharing experiences with other diabetes patients, family members, and loved ones. Including these individuals in the solution might motivate patients to practice more in their home environment and thus learn more. Learning about diabetes together (e.g., by attending a class, watching a documentary on television, or playing a multiplayer educational game) can foster empathy and understanding.

- The "gamification" of education is likely to lower the threshold for learning because many young seniors already play digital games, both alone and with others. Gamification may include adding a competition element (e.g., improving your time or your score or racing against other players) or transforming theoretical knowledge into interactive visuals. The types of games preferred by this target group are casual or adventure games incorporating puzzles, artistic or cartoonlike visuals, and a social aspect.

- Taking into account their deficits in eyesight and fine motor skills, digital apps for the young senior target group can best be developed for tablet or personal computer. The larger screens on these devices provide more room for larger interface elements such as buttons and texts.

Limitations

What appeals to young seniors in the Netherlands does not necessarily appeal to young seniors in other countries. Cultural differences (e.g., food preferences, attitudes toward medicines, social values, education, and popular sports or physical activities) need to be considered in developing educational tools for people in other regions of the world. However, we believe that most Western cultures are comparable enough that the factors discussed here will translate well to any Western country.

Implications and Recommendations

A large target group was specified for this study. However, applying all the factors identified into one solution will not guarantee that the solution will work well for all patients within the young senior target group. On the contrary, we recommend considering these factors as a starting point for new projects to aid in finding the direction that best fits the specific context of the project. These factors can be used in designing digital apps (e.g., diary apps, games, and e-coaches), but also for other forms of diabetes education such as workshops. Based on the results of this study, the E-DES team chose to develop a tablet game for young seniors. The factors discussed here were incorporated into different possible game concepts, and the personas Lisa and Gerard were crucial in the choice of the final game concept (26).

Duality of Interest

No potential conflicts of interest relevant to this article were reported.

References

1. Norris SL, Lau J, Smith SJ, Schmid CH, Engelgau MM. Self-management education for adults with type 2 diabetes: a meta-analysis of the effect on glycemic control. Diabetes Care 2002;25:1159–1171

2. Loveman E, Frampton GK, Clegg AJ. The clinical effectiveness of diabetes education models for type 2 diabetes: a systematic review. Health Technol Assess 2008;12:1–116, iii

3. DCCT Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. N Engl J Med 1993;329:977–986

4. Stratton IM, Adler AI, Neil HA, et al. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study. BMJ 2000;321:405–412

5. E-DES: The Eindhoven Diabetes Education Simulator [Internet]. Available from https://diabetessimulator.wordpress.com. Accessed 11 July 2015

6. Academia.edu platform. The use of semi-structured interviews in qualitative research: strengths and weaknesses. Available from http://www.academia.edu/1561689/The_use_of_semi-structured_interviews_in_qualitative_research_strengths_and_weaknesses. Accessed 11 July 2015

7. Cooper A. *The Inmates Are Running the Asylum*. Indianapolis, Ind., Sams Publishing, 2004

8. Stickdorn M, Schneider J. *This Is Service Design Thinking*. Amsterdam, The Netherlands, BIS Publishers, 2014

9. Heart of the Customer. Customer journey map: the top 10 requirements. Available from http://www.heartofthecustomer.com/customer-experience-journey-map-the-top-10-requirements. Accessed 11 July 2015

10. Tague NR. *The Quality Toolbox*. 2nd ed. Milwaukee, Wisc., ASQ Quality Press, 2004

11. Baan CA, Poos MJJC, Uiters E, et al. How common is diabetes and how many people die from it? Available from https://www.volksgezondheidenzorg.info/onderwerp/diabetes-mellitus/cijfers-context/trends-en-toekomst#!node-toekomst-prevalentie-diabetes. Accessed 11 July 2015 [in Dutch]

12. Dekkers L, Ketelaar H. *Learning Opportunities for Lower Educated People*. Den Bosch, The Netherlands, Province of Noord-Brabant, 2005. [in Dutch]

13. de Greef M. *Learning in Different Contexts: the Proceeds of Trajectories Language and Basic Skills for Lower Educated People*. Den Bosch, The Netherlands CINOP, 2012 [in Dutch]

14. CBS StatLine. Computer usage by individuals compared to personal characteristics. Available from http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=71098ned&D1=a&D2=a&D3=l&HDR=G1&STB=T,G2&VW=T. Accessed 11 July 2015 [in Dutch]

15. Cloïn M, van den Broek A, van den Dool R, et al. *In View of the Time: a Look at How Time is Spent by Dutch*. The Hague, The Netherlands, The Netherlands Institute for Social Research, 2013 [in Dutch]

16. Deloitte. Global mobile consumer survey 2013: addicted to connectivity: the Dutch mobile consumer perspective. Available from: https://www2.deloitte.com/content/dam/Deloitte/nl/Documents/technology-media-telecommunications/deloitte-nl-global-mobile-consumer-survey%20(1).pdf. Accessed 11 July 2015

17. App Specialisten. Seniors and tablets: an ideal combination? Available from https://www.appspecialisten.nl/kennisbank/ouderen-tablet-apps. Accessed 11 July 2015 [in Dutch]

18. Eger A, Bonnema M, Lutters E, et al. *Product Design*. The Hague, Netherlands, Eleven International publishing, 2012

19. International Diabetes Federation. *IDF Diabetes Atlas*. 6th ed. Brussels, Belgium, International Diabetes Federation, 2013

20. Mayne N. Neuropathy in the diabetic and non diabetic populations. Lancet 1965;2:1313–1316

21. Van Deursen AJAM, Van Dijk JAGM. *Computer and Internet Use Trend Report 2011: a Dutch and European Perspective*. Enschede, The Netherlands, University of Twente, 2011 [in Dutch]

22. GGD (Dutch Community Health Services agency). *Internet Usage: Results of the GGD Health Panel*. Schagen, The Netherlands, GGD Hollands Noorden, 2013 [in Dutch]

23. Entertainment Software Association. *Essential facts About the Computer and Game Industry in 2013*. Washington D.C., Entertainment Software Association, 2014

24. Pearce C. The truth about baby boomer gamers: a study of over-forty computer game players. Games and Culture 2008;3:142–174

25. NHG (Dutch Physician Society). NHG guidelines for diabetes mellitus type 2 (third review). Available from https://www.nhg.org/standaarden/volledig/nhg-standaard-diabetes-mellitus-type-2. Accessed 11 July 2015 [in Dutch]

26. Maas AH, van der Molen P, van de Vijver R, et al. Concept development of the Eindhoven Diabetes Education Simulator Project. Games Health J 2016;5:120–127