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Can Virtual Reality Improve Therapeutic Education in Diabetes?

Managing day-to-day life with diabetes is not limited to taking pills or injecting insulin; it requires constant attention and adaptation. It involves responding appropriately to hypoglycemia that may occur during physical activity, understanding foot care to prevent injuries that could lead to more serious complications, and being able to manage technologies such as continuous glucose monitoring systems, among others. Learning to cope with these situations is essential, and therapeutic education is the foundation that enables people with diabetes to take control of their condition in their daily lives.

According to the Guide to Structured Therapeutic Education Programs of the Spanish Diabetes Society, among the techniques used in educational interventions are those aimed at skill development. To learn how to act in diverse situations, problems are proposed that must be solved, demonstrations are carried out, or the best way to intervene in different circumstances is rehearsed(1).

The purpose of these activities is primarily practical. Therefore, the focus should not be placed on methodologies that are mainly theoretical—such as excessively long, lecture-based training sessions and/or pamphlets that are eventually discarded or left in a desk drawer—but rather on training the knowledge and skills necessary for self-management. In this context, new ways of learning and teaching come into play— »

» more interactive and innovative methodologies that capture attention and encourage participation. One example of this could be virtual reality.

WHY IS INNOVATION IN EDUCATION NECESSARY?

Although traditional methods may have a positive effect on the acquisition of knowledge and skills, one of their limitations is that they are not usually tailored to each individual and are, in most cases, overly theoretical. As patients, even when paying attention to explanations or reading the written information provided, it is sometimes difficult to put what has been learned into practice—especially when discussing techniques such as insulin pump management, sensor insertion, or insulin administration.

Emerging methodologies make it possible to complement more traditional educational tools through the use of technology. In this way, knowledge transmission is reinforced by putting skills into practice using digital resources, which are increasingly present in our daily lives. Among these technologies are:

- **Self-modeling,** an educational methodology that involves recording patients performing specific procedures related to their condition in simulated situations. This makes it possible to rewatch the videos and analyze whether the actions were performed correctly, improving self-care and promoting autonomy. In our setting, we have used this methodology through the European Clinical Modelling Project with Nursing Degree students, with promising results ***(see attached image)***.

- **Augmented reality,** which overlays digital images or information onto the real world. Thus, the use of specialized glasses—or even a smartphone camera—can display instructions on how to use specific injectable devices or the best way to treat a foot ulcer.

- **Virtual reality (VR)** would be equivalent to putting on "special glasses" that allow us to transport ourselves into a virtual environment. One could be inside a nursing consultation room, inside the human body observing the action of insulin, or even viewing a technique from the perspective of a person with diabetes (2). In this regard, there are different types: »

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- **Non-immersive,** in which computer screens are used and VR is clearly distinguished from the surrounding environment.
- **Semi-immersive,** using projectors that surround the users.
- **Immersive,** in which VR headsets are used, sometimes accompanied by controllers that allow interaction with the virtual environment. In this latter type, wearing the headset allows the person to feel transported to a place that does not exist and to perform actions as if they were actually there, with the environment changing according to how they interact with it.

Each type provides a different approach and has utility for the educational process, but the main protagonist for people with diabetes is virtual reality.

VR APPLIED TO DIABETES EDUCATION

Over the years, teaching–learning methodologies have adapted to the needs of the time. In the field of VR, several highly promising projects have emerged:

- Simulators for patients: initiatives have been developed to teach exercise performance, glucose level monitoring, and the adoption of healthy eating habits (2, 3). Evaluation of balance in people with diabetes and its improvement through VR-based rehabilitation programs has also been highlighted (4, 5).
- **Training for professionals:** within the framework of the European DEVICE project, fully interactive and immersive VR scenarios were used to simulate real diabetes-related emergencies. Based on the results obtained, personalized feedback was provided. After completing the study, participants reported increased confidence and felt they had benefited from the knowledge acquired (6).
- **Student training:** VR has also been tested in student education, where students improved their knowledge of hypoglycemia compared with those who had not used this technology for learning (7). Furthermore, immersive VR has been shown to foster more positive attitudes toward the disease and greater empathy (8).
- **DIABERSE:** a pioneering project in Spain (Castile and León) focused on diabetes education for patients in the metaverse—that is, in a virtual world with which users can interact. In this virtual environment, resources prepared by diabetes experts were available, and the use of VR headsets enabled patients to learn how to manage their condition from any location where such devices were available, including hard-to-reach areas such as rural regions (9).

BENEFITS OF LEARNING WITH VR

Without a doubt, VR increases patient engagement, transforming learning from a passive process—as in traditional methodologies—into a more comprehensive experience. Similarly, situations can be repeated as many times as necessary, without risk, and allowing the simulation of scenarios that are difficult to recreate in real-life contexts, such as a medical emergency. Thus, this methodology makes it possible to reach people who live far from hospitals or primary care centers, improving not only their knowledge but also the empathy of professionals and family members toward those living with diabetes.

CHALLENGES AND ETHICAL CONSIDERATIONS

Of course, VR is not perfect and is not accessible to everyone. The main challenges and considerations include:

- The high cost of devices.
- Accessibility issues, as older patients may be reluctant or have difficulty using this technology.
- The appearance of side effects, although generally minor, such as dizziness or visual fatigue.
- Privacy concerns, since platforms providing these services collect usage data, over which users do not have direct control.

» - Although scientific evidence increasingly shows strengths, large-scale studies demonstrating solid long-term benefits are still lacking.

LOOKING TOWARD THE FUTURE

VR opens new possibilities in therapeutic diabetes education by combining the best of both worlds: in-person workshops with educators and immersive VR sessions. If technology costs are reduced and integration into healthcare systems is achieved, VR could transform monotonous sessions into motivating experiences, becoming a powerful ally not only for educating people with diabetes but also for training the health care professionals who care for them. There is still a long road ahead, but the potential of these technologies is enormous. D

CONCLUSIONS

- Therapeutic education is key for people with diabetes to learn how to manage their disease.
- Traditional methodologies may not be attractive and/or effective for learning practical procedures.
- VR offers immersive experiences that increase motivation and active learning.
- Recent research shows that VR can bring therapeutic education to hard-to-reach areas.
- Although economic and accessibility challenges exist, VR has enormous potential for the education of people with diabetes.

SITUATIONS CAN BE REPEATED AS MANY TIMES AS NECESSARY, WITHOUT RISK AND ALLOWING THE SIMULATION OF SCENARIOS THAT ARE DIFFICULT TO RECREATE IN REAL CONTEXTS

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