

Midwives' account of virtual reality childbirth education

Marjaana Siivola¹, Lauri Malmi¹

¹ Department of Computer Science, Aalto University, Espoo

**Marjaana Siivola, Department of Computer Science, Aalto University, PL 11000, 00076 Aalto, FINLAND.
Email: marjaana.siivola@aalto.fi**

Abstract

In Finland, prenatal clinics and birthing hospitals struggle with resources to provide expectant parents with childbirth education (CBE) and a tour of the hospital birthing unit. Not preparing for birth is common, and not knowing how and where to give birth causes parents unnecessary stress during pregnancy. One new possibility to complement CBE is using virtual reality (VR) to deliver content.

The aim of this study is to describe midwives' views of the status of parents' preparation for birth and provide information on the VR CBE program's advantages and challenges from the midwife's perspective. The study consisted of two focus group sessions with seven participants. Participants were midwives with experience from a hospital birthing ward and had provided childbirth education. The data was analysed using a thematic content analysis approach.

According to the midwives, the parents do not prepare for birth well enough. Preparing for birth affects the parents' knowledge about childbirth, their cooperation with the healthcare personnel, and how they trust the birthing process, themselves, and the healthcare personnel. Preparation can also have adverse effects if the birthing person is trying to give birth with a detailed plan or has false expectations. Parents should focus on knowledge, attitude, and mental and physical exercise in preparing for childbirth. By preparing from trusted sources, parents can make informed decisions. They have the skills to stay calm, relaxed, and open-minded during labour and birth. Physical and mental exercise will help them cope with labour and relax their mind and bodies during birth.

Midwives see VR as offering great potential for concrete, realistic, and flexible childbirth education that can address current challenges. They were also worried that VR could replace face-to-face contact. However, since there is minimal such contact in the current CBE, VR could enhance childbirth education and offer a realistic and concrete image of birth and a hospital tour.

Midwives want families to prepare better for birth and work on their knowledge, attitude, and exercise. By preparing, parents understand childbirth, trust themselves, the birthing process, and the midwives; cooperation works better. Midwives see VR as an excellent addition to childbirth education by offering realistic and concrete online childbirth education. VR should not replace face-to-face contact.

Keywords: virtual reality, usability, childbirth education

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Introduction

Childbirth education

Prenatal education in Finland aims to coach families on birth, breastfeeding, baby care, upbringing, and parenting and offer them peer support [1,2]. Childbirth education (CBE) should provide up-to-date, evidence-based information about childbirth, enable a positive childbirth experience for the expectant parents, and support the birthing person's capabilities [1]. Parents have reported that they would have needed more support related to preparing for childbirth, their relationship with the partner, and fear of childbirth (FOC) [3].

The CBE provided to expectant parents varies, with some receiving no education [4]. According to the 2019 study, only 23% participated in the CBE offered by the prenatal clinic, and 77% did not [4]. The most common reason for not receiving CBE was multiparity (37%). For 18%, the prenatal clinic did not organise CBE, and 9% reported that they could not participate due to the way the CBE was organised. For example, they had only one possible time to attend, and they were sick, the location was far away (100km), or the session was in the morning or during the day. Most parents who received CBE must still reach their learning goals [4]. Online learning removes participation barriers. Hence, the potential of online learning should be explored further [1,4].

Virtual reality

VR is a computer-generated three-dimensional graphical representation of the natural or imaginary environment in which users are immersed

through a dedicated headset [5–7]. VR immerses users in another environment and helps them transfer knowledge to the natural world [5,7]. VR enhances learning through experiential learning [7] and improves self-efficacy [5] and emotional response [8].

Previous VR education studies have used ready-made VR material to distract users during labour, reduce pain, or alleviate fear [9–11]. Noben et al. [12] and Chang et al. [13] developed VR material for nursing students. Our VR CBE program explicitly targets the content for pregnant families.

Usability and user-centred design

Usability provides information on a product's effectiveness, efficiency, and satisfaction when used in a specific context by specific users [14]. The usability of VR systems is still developing [7,15]. Usability issues like cybersickness, user interaction problems, struggles with VR hardware, and fatigue are still occurring [7,15,16]. Gaming benefits the education industry, which supports the publication of VR hardware in the consumer market [7].

User-centred design promotes good usability. It considers the users and the context of use early on and iteratively tests the design with relevant user groups [14]. The official CBE guidelines by the Finnish Institute for Health and Welfare request a user-centred design [1]. Our research, therefore, uses the ISO 9241-210 iterative user-centred design process (Figure 1) [14]. Previously, we had user studies with midwives [4], parents [17], and pregnant users [4,18,19]. This article reports the midwives' views on the VR CBE program.

Iterative User-centered Design Cycle

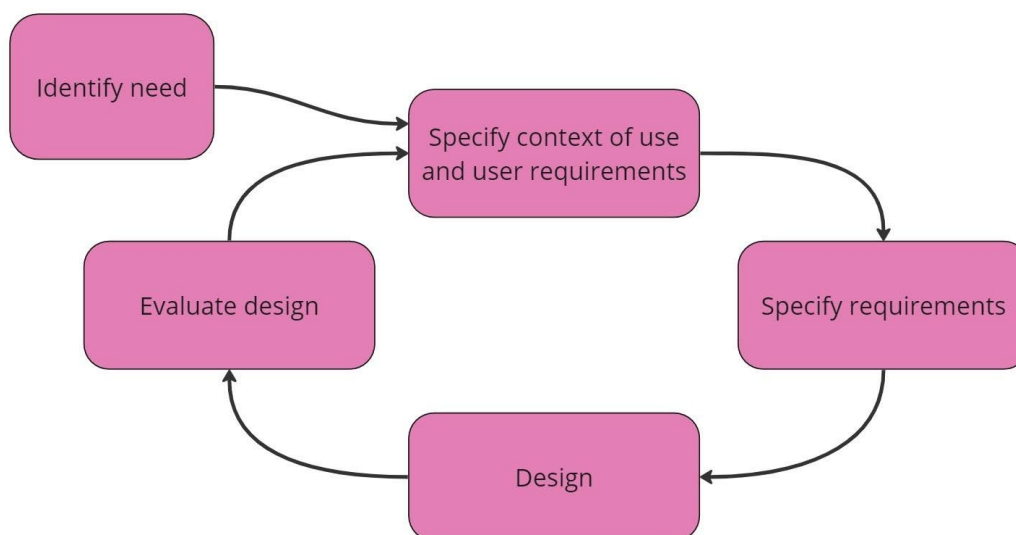


Figure 1. Iterative user-centred design cycle according to the ISO 9241-210 (2019).

Previous studies of the VR CBE

Our aim was to study if online learning methods can improve the outcomes of CBE. Two methods were chosen for the user-centred design process: flipped learning [18] and virtual reality (VR). In the first VR experiment, a VR CBE program was developed and tested with parents [17]. The results suggested that the program provided a feeling of being in the birthing unit. The VR program was usable with multiple devices: a VR headset, a smartphone, a tablet, and a computer. The program had usability issues, such as content distribution. For example, the birth ball was available where the ball was in the 360°

panorama image like in Figure 2. Most users used the content from left to right, so the order of the content did not follow the progression of labour, confusing the users.

The second version of the program was developed and tested with pregnant users [19]. In this one, the content was reorganised according to the progression of labour from left to right, which was perceived as a consistent way to present the content in the VR program (Figure 3). The VR gives the parents a realistic and concrete view of birth and the birthing hospital. The usability of the VR headset was excellent A+, and learning goals were improved [19].

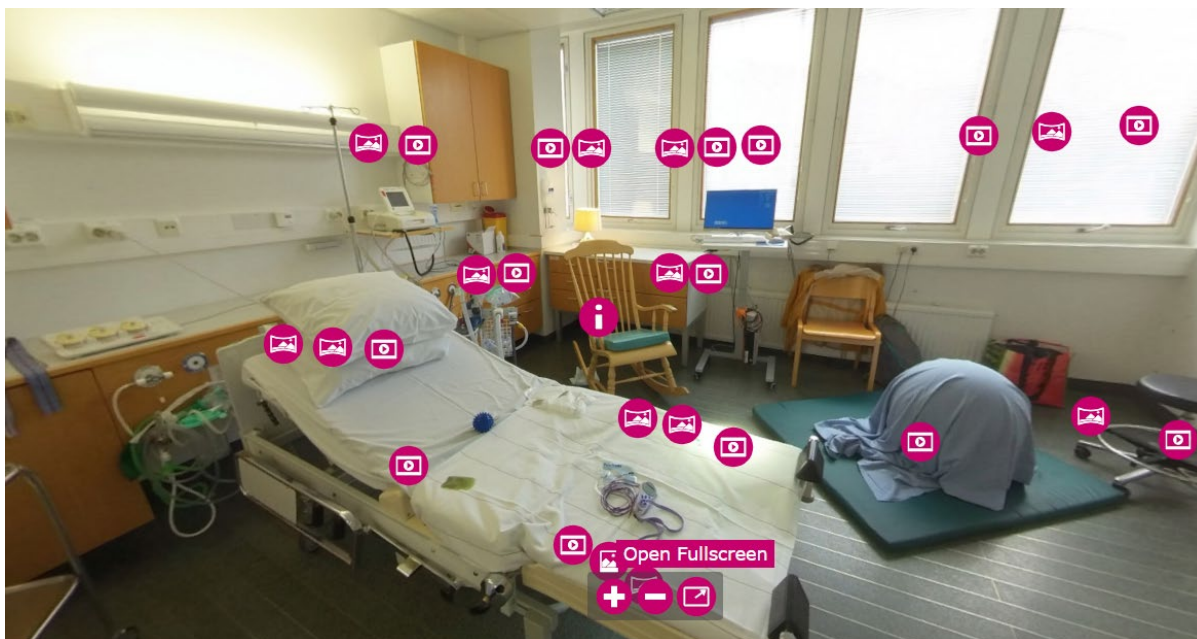


Figure 2. The content in the first version of the VR CBE when used with a computer. The corresponding videos were located next to the location relevant to the content.



Figure 3. For the second version used in this study, the content was reorganised according to the flow of birth from left to right. This image is from the Oculus Quest 2 VR headset.

Research questions

This article aims to describe midwives' views of the status of parents' preparation for birth and provide information on the VR CBE program's advantages and challenges from the midwife's perspective.

The research questions were the following:

1. How do the midwives see the families preparing for birth?
2. What are the benefits of VR CBE from a midwife's perspective?
3. What are the challenges of VR CBE from a midwife's perspective?

Material and methods

The focus group methodology [20] was selected for this study to uncover midwives' perceptions of the VR CBE program. We had seven midwives in two focus groups. They had worked in a hospital birthing ward and had CBE instructing experience. The recruitment was done by a midwife who published a call to participate in the local midwifery online forum. Participation was voluntary, and there was no compensation. The midwives participated in the study as individuals on their own time. No ethical approval was needed. The sessions were held in December 2023 in the local library meeting room. The

number of participants was limited to four per group since the midwives used the VR CBE at the beginning of the test. The researcher was the facilitator and recorded the discussion on a computer and a smartphone recorder.

First, each midwife got familiar with the VR CBE with the Oculus Quest 2 VR headset. Midwives were instructed to watch the videos to view the program overall. After the testing, the researcher facilitated the group discussion with the questions in Appendix A. The two focus groups used the VR CBE program for forty-five and thirty minutes. The first group had one VR headset, and the second group had two VR headsets. The discussion took forty-two and forty-eight minutes, correspondingly.

The recordings were transcribed for the analysis, and a thematic content analysis approach was applied [21]. First, the data was read several times and simplified. Next, the initial codes were formed and marked to the data. The data was reorganised according to the codes and research questions. Similar codes were grouped, and potential themes were formed. The data was reviewed according to the initial themes, and themes were reconsidered and revised where appropriate. Table 1 presents an example of the data analysis.

Table 1. Example of the data analysis.

Original data excerpt	Simplified	Code	Group	Theme
“Not so much on pain relief, but what happens physiologically.” User 1	Concentrate on the physiology of birth.	Physiology of birth	Physiology	Knowledge
“... understanding basic physiology of birth, that they kind of have the idea of the normal physiology of birth...” User 7	A better understanding of the physiology of birth	Physiology of birth		
“I wonder why no one has told them about the latent phase.” User 3	No information on the latent phase.	Knowledge of the stages of labour	Stages of labour	

Results

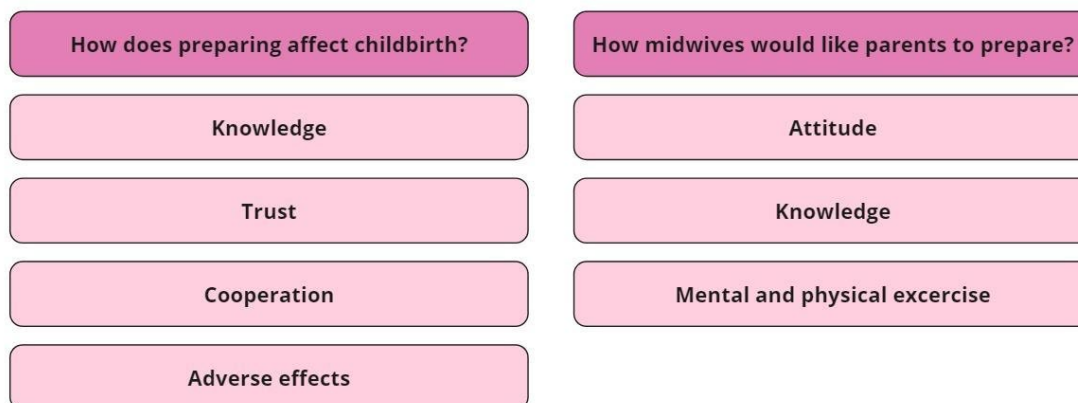
The first focus group had three midwives, and the second had four. Table 2 presents the users and collected data on their background and responses to Likert scale questions 4 and 5 in the interview concerning preparation for childbirth. All midwives had provided CBE, and most provided CBE for families

with an FOC in the hospital. The midwives had been practising midwifery for an average of twenty years. They used the VR CBE program for an average of 16 minutes before the focus group discussion. They all agreed that parents should prepare better for childbirth and that preparing is helpful for them. The thematic analysis results of open-question responses are presented below and themes in Figure 4.

Table 2. Users and their thoughts about current preparation for childbirth. Likert scale used in the study: 1. Strongly disagree, 2. Disagree 3. Neither agree nor disagree, 4. Agree, 5. Strongly agree.

Midwife	1	2	3	4	5	6	7	Average
Session	A	A	A	B	B	B	B	
How many years have you practised midwifery?	6	30	5	39	18	26	16	20
What kind of CBE have you taught?	Private, doula CBE, FOC	Haikaranpesä, relaxation, a tour of the hospital	A tour of the hospital, hospital CBE, FOC, Online, pilot group CBE at a hospital, Helsinki pilot	A tour of the hospital	A tour of the hospital, FOC	A tour of the hospital, FOC	A tour of the hospital, FOC, Digital pathway, Prenatal Clinic, co-op pilot	
How long did she use the program? (minutes)	17	15	14	23	17	12	15	16
Parents prepare enough for childbirth (1-5)	1	2	2	3	3	3	2	2,3
Preparing for childbirth affects childbirth. (1-5)	5	5	5	4	5	5	5	4,9
Do you wish parents would prepare better for childbirth? Yes/No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100% yes

Themes for the current childbirth preparation



Benefits and challenges of the VR CBE

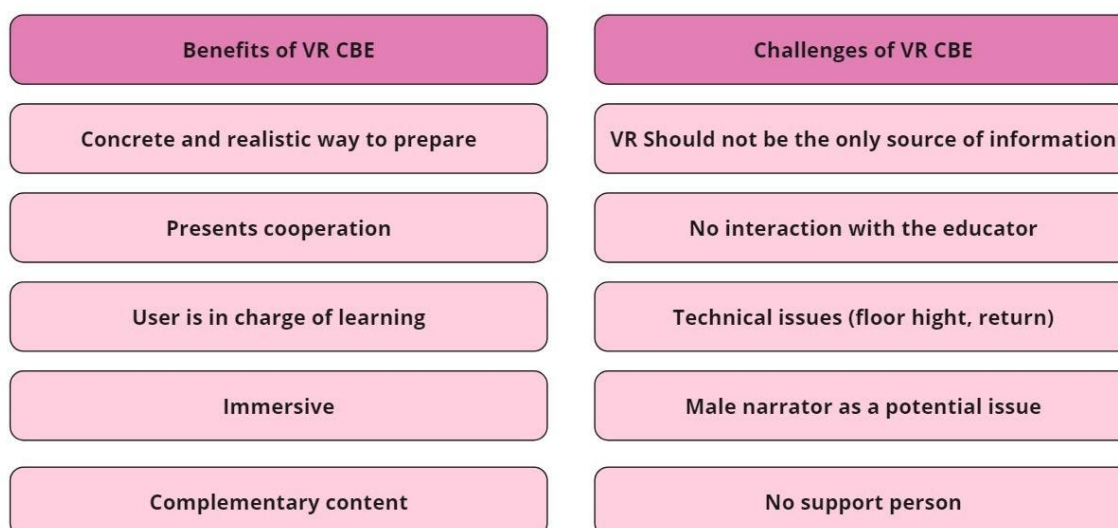


Figure 4. The themes for childbirth preparation and its effects on birth, and for the benefits and challenges of the VR CBE

Midwives' views on current childbirth education

As indicated in Table 2, the midwives would like the parents to prepare better, and they agree that preparing for birth affects childbirth. When inquiring about how preparation affects childbirth, four themes emerged: *knowledge, trust, cooperation, and adverse effects* (Figure 4).

When parents have prepared for birth, they have *knowledge* on the birthing process and realistic expectations, and they better understand themselves and what they need. They are flexible, can change plans according to the situation, and stay calmer than the ones who have yet to prepare. Midwife 1 mentioned: "When they know what can happen and their choices, they can adapt to the situation." By preparing, the parents have information on

which they can base informed decisions and cope better with pain. Midwife 4 continued, “They can participate in the decision-making process.”

Preparing helps parents *trust* their birthing body, the birthing process, and the midwife. Midwife 1 stated, “When prepared, one can trust their body. That the body knows what it is doing.”

Midwives feel they can communicate and *cooperate* better with prepared parents, and it is easier to help and support the parents. Midwife 4 stated, “In the best scenario, parents have prepared well, know their options, and have open minds about what is coming. Then we can communicate what to do in each situation and what is needed, for example, for the pain.”

The midwives raised the concern that some CBEs have *adverse effects*, especially when they tend to offer a fixed solution to any birth, and especially first-time mothers think they can give birth in a certain way. Sometimes, the birth plan is too detailed without room for change, and parents come to deliver the baby with a detailed list of what they want to use for pain relief. Midwife 4 mentioned: “Preparing affects birth positively. However, sometimes, in a negative way, if one comes up with a detailed plan of how their birth should go.”

When inquiring about how the parents should prepare for birth, three topics were highlighted: *attitude, knowledge, and mental and physical exercise*. The midwives would like parents to look for information from trusted sources, be interested and active in preparing for childbirth, and exercise physically and mentally for birth.

Parents should have the *attitude* to actively search for information and prepare so they know what they want. Midwives wish everybody the opportunity to find out their preferences. Midwife 3

wants “parents to trust themselves and listen to their bodies and what the body needs.”

Midwives would like parents to have better *knowledge* on childbirth. Parents should know the physiology of childbirth, stages of labour, hormones during birth, where the pain comes from, and non-medical and medical pain relief. Midwife 7 stated: “They should focus on basic physiology as well, not only on the medical pain relief.” From stages of labour, all midwives agreed on the lack of knowledge of the latent phase and what to do at home during the early labour. Also, parents should be better informed about the transition and pushing phases. Midwife 2 explained: “It consumes our resources when people who have not had CBE call us when they do not know what to do at home when the contractions start.” CBE should offer information on hospital policies and guide parents on practical issues, like registering and parking. In addition, seeing the birthing room and its equipment can help reduce stress about the unknown, fears, or trauma.

The parents should *exercise mentally and physically* for birth. Exercise will help them be patient and persistent during birth and find ways to calm and relax their bodies and minds. They can better endure the birthing process. Midwife 6 stated, “I hope they would prepare for birth holistically from mid-pregnancy. Knowledge-wise, but also think of mental and physical endurance. Giving birth is physical, so information only is not enough.” Midwife 7 explained, “Relaxation is necessary, and you don’t learn it unless you practise it and work for it.”

Benefits of VR CBE

The midwives see that VR can help when the live training possibilities have been removed, and the families cannot tour the hospital. Midwives commented that VR CBE could complement current CBE and should be part of their new integrated digital

care plan. Midwife 6 mentioned: "This can add a sense of security when you see what you need to do and know what the place looks like." It provides experience on what happens in the birthing room, what it looks like, and what equipment the room has. If one has trauma from previous experience with healthcare staff or they are afraid of hospitals, VR provides a safe way to learn what happens during childbirth and how midwives interact. Figure 4 presents the five themes on the benefits of the VR CBE.

The midwives see that VR CBE offers a *concrete and realistic way to prepare* for birth and has excellent potential for CBE. The program provided a peaceful, non-frightening way to see the birthing room. Midwife 7 commented: "Clearly, there is a need for this kind of program. It feels very concrete." Midwife 1 stated, "This provides a possibility to be there." They described the program as a good, positive, compassionate, and safe way to learn.

Midwives were pleased that the program provided information about *collaboration with the midwives*. There was time to discuss the options, and the birthing person made the choices. Midwife 6 stated, "This can be a substitute to see how the midwife and the birthing person communicate. How the midwife touches or calmly discusses with you."

It was positive that the *user is in charge of what they want to learn*. Midwife 1 stated: "You can define what interests you and you are not forced to follow a particular order of information." She continued: "You can return to the content as you want. It is based on the needs of the person using this."

The VR CBE is *immersive*. Midwife 3 explained: "You are in a bubble, and you concentrate on looking around and the things you see." The program follows one's movements; you can look around and

feel like you are in the birthing room. Compared to watching an online video when many users multi-task, immersion makes the user concentrate on learning.

The study produced many *complementary content* ideas: videos from home during the latent, transition, and pushing phase, induction of labour, the effect of induction of labour, transfer to the hospital, parking, registering, use of contraction apps (or are they needed), and the use of music during labour and birth.

The challenges of VR CBE

Figure 4 presents the five themes related to the challenges of VR CBE. All midwives agree that *the program should have interaction with the educator, and VR should not be the only source of information*. Midwives worried VR could reduce the current live contact. At the beginning of the focus group discussion, midwife 6 asked, "Does this replace live sessions or meetings with the midwife?" Since very few live CBEs or meetings with the midwife at the birth ward are currently offered for parents, the VR CBE could be a great addition. Midwife 7 commented that live contact is not provided for multiparas, but "They would like to see the ward as well, and how to get there, so this could serve them." Adding connection with the educator will benefit all the users. Families should always have a way to ask a childbirth educator or midwife questions.

The midwives had some *technical issues*. From the presented content, the midwives commented that the VR world was bigger, and the floor height differed from the natural world. Midwife 6 said, "I felt I sat higher, and I was worried I would fall if I moved too much." A few had difficulties finding the return button on the 360° videos. The midwives requested that the length of the videos be visible.

The *male narrator* was raised as a potential issue. The narration had a male voice; some midwives did not like that, and some did not notice it. However, they all got used to it. The midwives discussed that in some cultures, males are not welcome in the birthing room, so the male narration may worry these parents. Midwife 7 wondered: “For some women from different cultures, it can be horrifying to think that there are men [in the birth ward].”

Midwives wanted the program to *have a support person* in the videos so that the support persons could learn their role during birth and what they could do. They discussed whether the support person would be a male partner, like most have, or female support or several. After the gender equality discussion, they concluded it would be most inclusive to have different support for different videos.

Discussion

This paper presented the VR CBE program from the perspective of midwives. Our focus groups had experienced midwives with extensive birth ward and CBE backgrounds. They consistently said that the families do not prepare enough for birth, and preparing does affect the birth, as in the previous study [4]. Midwives see that the VR program can improve CBE by offering realistic and concrete information about childbirth and the hospital environment, as in previous studies [17,19].

Positive childbirth experience is the first goal for the CBE in the official guidelines [1], and it was also highlighted in our results. A study by Sutton et al. [22] found that women's mismatch between expectations and the experience can cause them birth dissonance, leaving them having negative feelings or even traumatised after birth. They suggested four steps to reduce birth dissonance, of which three were related to CBE: teaching realistically about labour pain, participating in decision-making,

and including medical and non-medical pain relief. VR CBE can provide these goals by offering concrete and realistic images of birth, an example of how to participate in the decision-making, and using pain relief in different stages of labour. The program would benefit from adding material from medical pain relief.

Midwives highlighted physical and mental exercises to help parents use the methodologies during birth. Many CBE programs offer methods for psychological or physical coping strategies, like prenatal yoga [23] and hypnobirthing [24]. Still, these often need more information on medical pain relief and interventions. Hospital-based programs concentrate on medical pain relief and lack information on non-medical pain relief and what to do at home when labour starts. These are often leaving the parents with an unrealistic image of birth. Our program would benefit from adding physical and mental exercises.

Content from home in early labour, the latent phase of labour, was strongly advised by the midwives and requested by the users [17,19]. The VR CBE should have content from the latent phase and the home environment. For example, using a birth ball at home during the latent phase can postpone admission to the hospital [25].

The midwives worried that VR would replace face-to-face interaction in CBE. The current VR CBE program does not have user interaction but contact with the educator could be incorporated into the program. A new study [26] provides insight into how one can feel being present and part of a group in an asynchronous VR environment. The researchers created a social VR environment where one can join later and still feel socially present and welcomed. This setup would be interesting to study in the VR CBE context.

According to Vekved [27], the childbirth educator should be a mentor who provides a space that helps parents discover the information, supports their transformation into parenthood and bridges the gap between families and healthcare professionals. VR can provide a way to discover by giving the natural context for self-discovery. VR can help bridge the gap between professionals and families when families see how the interaction can work in a realistic setting.

The usability issues and development ideas were similar to the ones found with the expecting parents' user test [19]. The floor level difference was uncomfortable. The midwives were present in the videos most of the time, which was considered non-realistic. Midwives also wanted a support person present in the videos. Pregnant users [19] did not comment on the male narrator nor had any problems finding the return button as the midwives did. The midwives did not raise any issues about the actor's spatial distance to the camera, which has been a development suggestion from previous user studies [17,19].

Lack of access to the VR headset will make it harder to scale the program's use. Most users do not have a VR headset, and the prenatal clinic cannot afford to offer them. Our program is usable with different devices. However, VR offers the most immersive experience, so we should consider ways to provide the VR experience to our families. The prenatal clinic or the public library could have VR headsets for the expecting parents, or the birthing hospitals could offer VR headsets. A less expensive option is the cardboard VR headset, which provides a relatively good VR experience.

Strengths and limitations

This research is part of a project to develop a user-centred interactive online CBE with an iterative

user-centred design process. This user study is only one part of the iterative process and supplements the previous results from parents and pregnant users with healthcare professionals' views.

The main limitation of this research is the small number of participants. The midwives eager to develop CBE most likely attended. The innovative midwives helped the research to get out-of-the-box discussion and thinking in the early stages of development. Midwives who do not have CBE in their tasks could come up with different results and ideas. This group of users should be studied in the future.

The results are limited only to using the program with the VR headset. This research did not consider using the program with a computer, a tablet, or a smartphone. More research must be conducted to study the usability of the other devices.

The first author, a Lamaze-certified childbirth educator, a birth doula, a birth doula trainer, a certified professional adult teacher, and an elearning specialist, conducted the thematic analysis alone. The second author gave feedback on them.

Conclusions

The two focus groups were consistent with each other and with the previous user studies that parents do not prepare for birth enough and it has an effect on the birth. Midwives see that the VR CBE has excellent potential and could be a great addition to the current CBE. VR offers a realistic image of birth, a hospital tour, and CBE information in an immersive way. Midwives were worried VR might replace face-to-face contact, which they considered essential. There should be some possibility for contacting a professional and asking questions. However, there is very little interaction now, so they see

VR improving the parents' preparation for child-birth.

Conflict of interest statement

Marjaana Siivola works for Doules, which provides CBE, but the company did not participate in the research funding or the research. The research was not done during working hours.

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Appendix A. Focus group discussion outline

1. What did you think of the VR CBE?
2. In what circumstances would this be useful?
3. What was good in the program?
4. How well do the expecting parents prepare for their childbirth? Likert Scale from one to five.
5. Does preparing affect childbirth? Likert Scale from one to five.
6. If so, how does it affect childbirth?
7. Would you want expecting parents to prepare better for birth? Yes/No
8. If so, how?
9. How could the VR CBE help expecting parents?