6 Driving Simulators in Teaching and Learning: A Qualitative Study

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Abstract: Different learning styles require different teaching methods, and using simulators as learning tools can be an important contribution to driver instruction. Road traffic is a highly complex and high-risk environment. For this reason, driver training is an important factor in providing road safety. Educating professional driving instructors is an important contribution to increased road safety and fewer dead and injured in road traffic. This study explored how simulator training in driver education could be beneficial by investigating authorized driver instructors as well as driving students' perceptions after testing the simulator. The research question was: Which factors influence perception and use of driving simulators in teaching and learning driving skills? For this study, 28 individual semi-structured interviews were conducted with driving instructors and students in three rounds over a period of one year. Thematic analysis was used for analyzing the data. Perceived transferability (main category) is important when teaching and learning driving skills through the use of a simulator. The transferability depends on two underlying factors (categories) that influence the perception and use of the simulator: a technological focus or a pedagogical focus. While holding a mainly technological focus, the simulator is viewed as a tool or pedagogical multimedium that provides learning by itself. On the other hand, a pedagogical focus sees the simulator as a tool that should be used in a larger pedagogical context. The authors found that increased experience using the simulator made the instructors and students shift from a technological focus to a more pedagogical focus. A driving simulator can be beneficial for learning and teaching the complexity of driving, from technical maneuvering to strategic decision making, but for the instructor to effectively use a simulator for teaching, there needs to be a sense of perceived transferability for the instructor. As increased use of the simulator seems to shift the instructor focus from a more technological to a pedagogical focus, experience with and use of the simulator as a pedagogical tool should be implemented in the educational program for driving instructors.

Introduction

Simulation-based education can provide safe and effective learning environments (Ziv et al., 2003). However, simulators are seldomly used in driving instructor and driver training education in Norway (Sætren et al., 2018). Road traffic is a complex system in a potentially hazardous environment where human error can cause injury and death. The risks of this environment include elements such as drivers' risk perception, technical maneuvering of the car, other drivers' behaviors, weather conditions, lighting, and road structure. Driving, therefore, requires a specific set of technical and non-technical skills, optimal decision making, and precise behavior, all of which are important factors in driver training. It is essential for driving instructors to use optimal learning tools to provide optimal learning outcomes.

Even though Norway's driver training is extensive, it could significantly benefit from studying the training experiences of other high-risk industries. For the past decade, driver training has been rather stable in how it is conducted and in the technology that is used for training purposes in Norway. In other high-risk industries, simulator for training is extensive, such as in aviation (Salas et al., 1998), nuclear (Bye et al., 2011), and medicine, including nursing (McGaghie et al., 2010; Verkuyl et al., 2020). In the surgical field, for example, a typical stress intervention training consists of didactic learning, simulation-based exercises, and individualized and specific feedback on technical and non-technical aspects of performance (Sonal et al., 2016). In Norwegian driver training, however, the use of simulators is rare, and it is estimated that between five and ten driving schools out of Norway's existing 1,056 (NPRA, 2020) have a simulator (Sætren et al., 2018).

Research from the past ten years focuses on learning driving skills using a simulator has included a health perspective for conditions such as stroke, sleep deprivation, motoric challenges, and age (McKay et al., 2011; Sawula et al., 2018), transferability to real-life driving (Gemou, 2013), or training related to dark or eco-driving (Jamson et al., 2015; Sætren et al., 2019b). However, there have been few studies about using driving simulators for standard learner driving (Sætren et al., 2019b), and there is a conspicuous gap from pedagogical, driving instructor, and student perspectives. Moreover, there is limited knowledge about which factors influence the perception and use of such simulators.

Thus, the research question is: Which factors influence perceptions and use of driving simulators in teaching and learning driving skills?

The chapter focuses on teaching and learning driving skills with a driving simulator, as viewed by experienced instructors and students learning to become driver instructors. First, the authors present simulation-based education in driver training and experiential learning theory, and then they present the technology acceptance model. After that, they introduce the pedagogical theoretical framework of driver training, driver instructor education, and pedagogy in Norway. They then present the methods, results, discussion, and conclusion.

This study is a part of a four-year project exploring if and how driving simulators can improve driving instructor education and driver training, which is called the SitT-project (Simulation in Driver Education; Sætren et al., 2018, 2019a, 2019b, 2020a).

Simulation-Based Education in Driver Training

Driver training has traditionally relied on the apprenticeship model, which is when practitioners train with a learning driver in real-life traffic. Although this hands-on learning provides valuable experience, simulation-based learning allows for a safe learning context and an opportunity to gain basic knowledge prior to entering a high-risk context. Simulation-based education is not easy or intuitive, and the educational context is of great importance. As medicine has a long tradition of using simulators in an educational setting, this chapter provides a critical review of twelve general features and best practices (McGaghie et al., 2010) that are most likely to be generally applicable to simulation-based education. These twelve factors are feedback on performance, deliberate practice, curriculum integration, outcome measurement, simulation fidelity, skills acquisition and maintenance, mastery learning, transfer to practice, team training, high-stakes testing, instructor training, and educational and professional contexts.

There are benefits and challenges regarding the use of simulators in driver training (Sætren et al., 2018). The advantages of simulator driver training include repeatability, reproducibility, and standardization of training programs. This includes access to different scenarios that would be unethical to train in or difficult to encounter during training, such as accident scenarios and dangerous contexts, darkness and difficult weather conditions, and extreme traffic density. The ability to make errors in a safe environment makes simulator training a much different learning context than real-life traffic. More general advantages include cost-effectiveness and environmentally friendly training (de Winter et al., 2012; Hirsch & Bellavance, 2016; Sætren et al., 2018).

However, challenges are important to consider as well; these can include a variety of driving simulators with varying degrees of fidelity in curricula-based training programs and simulator sickness, which is increasingly common for people over the age of 30. Nausea and discomfort will negatively affect training outcomes (de Winter et al., 2012).

Experiential Learning and Simulation as a Pedagogical Method

Simulation as a pedagogical methodology is based on the premise that hands-on experience plays a central role in learning; its use in different sectors, such as the healthcare sector (Jeffries, 2005), draws on theories of experiential learning (Kolb, 1984, 2014), situated learning (Lave & Wenger, 1991), and social learning theory (Bandura & Walters, 1977).

Kolb (1984, 2014) has stated that knowledge is created by grasping and transforming experience. Experiential learning theory is based on the idea that learning is a process in which knowledge is created through the interaction between a person and the environment. In Kolb's learning cycle, knowledge is created and re-created through concrete experience, reflective observation, abstract conceptualization, and active experimentation. When using a driving simulator, the learner is given a chance to participate in a new experience (concrete experience), during which the learner can reflect on these experiences (reflective observation), develop a new conceptual understanding of the importance of specific behaviors and skills (abstract conceptualization), and actively experiment with what was learned in future practice (active experimentation). With the use of a driving simulator, the process of active experimentation may result in the desire to test different behaviors and skills, generating a new cycle of learning while acting in a safe environment.

Technology Acceptance Model

To explore common perceptions regarding new technology and actual use, the technology acceptance model (TAM) is valid and robust (Davies, 1989; King & He, 2006; Venkatesh et al., 2003). This psychological model is based on the theory of reasoned action (Fishbein & Ajzen, 1975) and was designed to explain a user's intention to actually use new technological equipment. The assumption of the model is that an individual's reaction to technological use will affect the intention and, thus, the actual use of the technology. In other words, the user experience will influence the user's perception of the technology. The TAM consists of two primary predictors: ease of use and perceived usefulness. In addition, behavioral intention is the dependent variable. The idea is that if a technology is perceived as useful, it probably will be used, even though the user must spend time learning how to operate the technology. On the other hand, a system that is easy to use and easy to learn might not be used if the end-user does not perceive it as useful (Davies, 1989; Venkatesh et al., 2003).

The Pedagogical Theoretical Framework of Driver Training in Norway

In the 1980s and 1990s, the main focus of driver training in Norway was completing a sufficient number of training hours, primarily in technical maneuvering. One of the most comprehensive revisions of the Norwegian driver trainer model was undertaken by the NPRS in 1998; they recommended creating training in terms of the actual behavioral and learning objectives from the curricula rather than simply number of hours trained. Curricula were revised to focus on reflections and understanding concepts such as risk and development of the learners' risk perceptions. This was a turning point from a more objectivistic view of training, in which elements such as the numbers of hours and technical handling of the vehicle were essential to a more ments are that the person learning to drive has completed the theoretical introductory course and that the experienced driver has held a driver's license continuously for a minimum of five years without penalties or endorsements (FOR, 2017).

Norwegian Driver Instructor Education and Pedagogy

Norway has the only driving instructor education program that includes a two-year university education to be authorized as a driver instructor in the world. During those two years, traffic pedagogy, road traffic law, and traffic psychology are taught in addition to physics and technology (Nord University, 2020). Two universities offer this education; however, because Nord University educates approximately 100 instructors each year and OsloMet only about 10–15, the chapter focuses on Nord University's education. This university is home to Norway's largest driving school, with approximately 100 student drivers at any given time. At Nord University, driving pedagogy is largely affected by practice, which is an integrated part of future instructors' education. The students function as the instructors of the driving school and are guided by praxis lecturers. The students are organized in groups of six to seven students, with a praxis lecturer who has overall responsibility for both the students' and their driving students' progress. This system, called guided praxis, is implemented during a student's first month and persists throughout the two-year education (Nord University, 2020). The guided praxis is integrated with the theoretical approach, and the education includes theory praxis, which emphasizes learning and teaching operational, tactical, and strategic driving skills (Michon, 1985; Peräaho et al., 2003). Until 2019, the student instructors at Nord university only used real-life cars as tools to teach their regular student drivers.

Driving instructor education consists of different approaches, including lectures for up to 100 students, seminars for smaller groups, guided praxis groups, problem-based learning for smaller groups, and individual reflection. Supplemental instruction is offered for physics and road traffic law. Thus, the pedagogy consists of varied methods for individual and group learning (Nord University, 2020).

Methodology

A qualitative approach using semi-structured interviews was used to collect data (Kvale, 1997). Interviews were conducted with driving instructor students and with driving instructors who had experience using simulators in driver training in Norway. This study is part of a four-year project about using driving simulators in driver training in Norway. This study was the first initiative for exploring the potential use of driving simulators in driver training with a driving instructor present. The methodology was chosen to explore a theme that was not widespread.

Participants and Procedures

Three rounds of interviews were conducted with 28 participants. The first round was with five driving instructors in Norway who had used simulators in driver training for some time (Sætren et al., 2019a). The interviews were conducted face-to-face at driving instructors' workplaces and were situated in different parts of Norway (Kvale, 1997). The second round was with driving instructor students who had tried the simulator on their own and in groups prior to their praxis. All first-year students received a lecture in advance with guided instructions on how to use it and which programs they were expected to test. After this round, six interviews were conducted. The third round was after the students used the simulator in their teaching (approximately six months after the second round). Here, two students from each praxis group received lectures about how to use and what lesson to teach in the simulator. The groups selected which two students were to participate in this. The lesson and instruction resembled how this would be conducted prior to lessons in cars. The interviews in this round were conducted immediately following the lesson to ensure participants were providing their private opinions without discussing the experience of teaching, as both the student pedagogical observer and the student who had the role as the instructor for each group were interviewed. In all, 38 students completed the simulator instruction, and seventeen instructor students were interviewed in the third round, fourteen males and three females. All interviews lasted about one hour, and they were recorded and transcribed. Participation was voluntary and based on informed consent.

Tab. 1: Overview of the groups of informants and number of interviews.

	Informants		
Round 1	5 experienced instructors		
Round 2		6 students trying on their own	
Round 3			17 students using simulator to teach

Equipment

The simulators were basic driving simulators with a driver's seat, steering wheel, pedals, and three screens. The instructor sat in a chair beside the learner, and the pedagogical observer sat in a chair behind them. The software was designed for Norwegian driver curricula, mainly based on level two but also formatted in some respects for level three. All interviews were conducted with people who had prior experience with the same type of software and the same type of simulator.

Fig. 1: An example of a simulator used in this study.

Analysis

Thematic analysis (Braun & Clarke, 2006) was used for this dataset, and Nvivo12 (NVivo12, 2020) was used to categorize the data. Thematic analysis is a theoretically flexible approach to analyzing qualitative data. The six steps developed by Braun and Clarke (2006) are familiarizing the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. The authors wanted to explore factors related to learning and teaching when using simulators for driver training. Thus, each interview was conducted by the researchers, transcribed, and read through prior to being coded in as many themes as found relevant to the issue. Then, the themes within and between interviews were compared and coded. Even though there was an interview guide, the codes were not necessarily the same as the topics in the guide. The main focus for analysis was to explore how the informants viewed the simulator as a tool for teaching and how they perceived their learners' learning outcomes. Additionally, the instructor students' perspectives were of particular importance, as they allowed insight into their views while in a learning process themselves as they learned how to use the simulator as a tool. Thus, the analysis was data-driven rather than theory-driven and had an inductive perspective.

After the first round of analysis, there were many coded categories and sub-categories. However, for the second round of analysis, it became clear which categories would be developed into broader and more abstract themes. One example was that it became evident that the informants held different views concerning whether the simulator was regarded as useful. Thus, perceived transferability emerged. It became clear that some informants saw this as a useful tool, and some did not, and the main difference between the informants was interpreted to be in this theme regarding teaching and learning with a driving simulator. From there, the themes of pedagogical and technological focus emerged from the data as the analysis progressed. A thorough explanation of the themes is in the results section.

Validity

Validity is assessing the quality of research. There are many different approaches for establishing the validity of qualitative research (e.g., Elliott et al., 1999; Kvale, 1997; Yardley, 2000). Yardley's (2000) four principles for assessing validity together with Elliot et al.'s (1999) seven guidelines for qualitative research form the basic methods for assessing the quality of the current research. Yardley's (2000) four principles are sensitivity to context, commitment and rigor, transparency and coherence, and impact and importance. Elliot et al. (1999) refer to seven guidelines shared by both qualitative and quantitative research as well as an additional seven guidelines pertinent to qualitative research. The seven guidelines directly related to qualitative research are owning one's perspective, situating the sample, grounding in examples, providing credibility checks, coherence, accomplishing general versus specific research tasks, and resonating with readers.

Yardley's first principle is sensitivity to context, which is similar to owning one's perspective and situating the sample guidelines from Elliot et al. As an example, this relates to specifying the theoretical orientation, social context of the participants, as well as personal anticipations, values, and interest of the authors, which helps the reader interpret the data. Thus, a theoretical background of the research is provided for the reader. Additionally, a sociocultural explanation of the program and pedagogical context of the education being explored is provided.

Yardley's second principle, rigor and commitment, involves explaining the authors' engagement in the research context, their methodological skills, how the data collection was conducted, and the process of the analysis. In terms of data collection, analysis, reporting in accordance to rigor and coherence (Yardley, 2000), grounding in examples, and providing coherence according to Elliot et al. (1999), the authors explained how the data collection was conducted and in what settings, as well as how the analysis was conducted. In addition, they also have quotations explaining the categories to ensure the categories are grounded in the data as a credibility check.

Yardley's third principle, transparency and coherence, relates to clarity in the explanations, which is similar to resonating with the reader and coherence by Elliot et al. (1999) and involves having a fit between theory and method. Based on the above validity elements, this research has transparency and consistency regarding the research question, literature, and methods. Further, findings are presented in a coherent way using the structures of the findings to map the interactions between the categories, which Elliott et al. (1999) stress as important. The discussion was based on the research question and related to the findings of the study as well as the literature presented in the theory section and introduction for coherence. The fourth and last principle of Yardley, impact and importance, is presented later in this chapter.

Ethics

This project was approved by the Norwegian Centre for Research Data (NSD) prior to collecting data. This was to ensure that the research was in accordance with privacy guidelines and regulations. Identification and confidentiality were ensured through various methods, including restricting access to the recordings and de-identifying the transcriptions. The transcripts were not available to anyone but the researchers. Furthermore, all participation was voluntary and based on informed consent.

Results

The main data category found was *perceived transferability*, which reflected whether the participants found the simulator useful for the purposes of teaching and learning driving skills. This category was affected by whether the informants held a *technical focus* or a *pedagogy focus*, which were the two subcategories. Regarding perceived transferability, this category reflects whether the instructors and instructor students perceived the simulator as a tool that would be useful for effectively transferring knowledge from the simulator to real-life driving.

Technology Focus

Those who held more negative perceptions toward using the simulator related their answers to technical aspects, arguing that the simulator experience was not realistic enough, that the software was underdeveloped, or that the graphics were not up to expected standards. The main issue for this group was whether the simulator would replace real cars for instruction. It was interpreted that, for this group, teaching and learning using a real-life car was perceived as optimal and that a simulator could never replace this optimal way of teaching and learning how to drive a car.

> We discussed the simulator experience in the praxis group. Most said it was unrealistic. That it would not replace cars. (Student 1)

Further, another view was related to whether the simulator was to be used with a driver instructor present. An example of this was the differences between the instructor students and the established instructors' perceptions of usefulness regarding vocal instructions in the software. This seems to be based on perceived usefulness in regard to expected use. Instructors with a more technological focus seemed to think that the simulator would be optimal if it could be used without an instructor present and with a voice and text present for the learner. However, many of the instructor students commented that the voice was distracting and hindered their teaching. They did not perceive the usefulness of the simulator to be related to student drivers using the simulator to teach themselves, but rather as a tool where they were present and plan the session for the simulator the same way they would for a car lesson.

> Like in the simulator we use, there is a voice and text that enters the screen. I think that is a little misleading because when we are prepared to teach one thing, and the screen and voice start commenting on something else (this is regarding the same practice on level 2). This can be confusing for the learner… I think it is easier if you do not have software that interferes so much so that you can use your role as an instructor instead. (Student 2)

Pedagogy Focus

Pursuant to previous results, those who had a more positive experience seemed to have a more pedagogical view of the situation, in the sense that they took a more abstract look at the simulator as a tool. They planned what to do, why, and investigated how the use of the simulator could provide a probable learning process according to the curricula.

> I prepared for the lesson the same way I have done when I teach in a car. Which goals I had for the lesson and the learner's premise and so forth. I wrote down how I thought it would be conducted and tried it out in the simulator on my own prior to the lesson to see how the exercise was built so I could plan it. So, planning the lesson in advance is quite like how I would have done it using a car. (Student 3)

In addition, efficiency and learning environment was mentioned in this regard, as the simulator would make it easier to find specific learning locations, and the learning context was inherently calmer than real-world driving. By gaining easy access to these areas, the instructor would not have to spend time driving around to find a suitable teaching environment, and one could be certain that the exact planned training goal would be one that they could train for. As a learning tool, the simulator allows access to exactly what an instructor has aimed for and prevents any other interruptions.

> It is easier for some training. You have more space. It is easier to find a place to train. Here you have all opportunities. (Student 4)

> One thing that is good is that the learner is much more relaxed in a simulator and can, to a larger degree, focus on things that we might not be able to focus so much on in a real-life car because we have to watch out for so many other things. To focus on one thing in a simulator without it being at the sacrifice of other things is a huge benefit. (Student 3)

The *perceived transferability* changed based on experience, as represented by the arrow from technological focus to pedagogical focus in Figure 2. Even though all informants mentioned that the simulator was easy to use at all stages, the perceived benefit of using it to instruct others depended on how much experience the informant had with the device. From the first round, when the students tried it themselves, more students were preoccupied with the idea that it would not teach learners much. They believed that the simulator could be used for beginners or learner riders who had never experienced sitting in a car. A typical comment was something like:

> If you have a very novice student driver who never drove a car before, it could be okay. You get gearing and clutching and steering. (Student 1)

> The goal is probably to have a start-up of learning. I think it could work with gearing and clutching. (Student 5)

During the second round, more informants saw that it was beneficial, but many still seemed to think it would not be very beneficial for levels above the one they were in now. Thus, it seems that by using the simulator, students' focus may shift from a technological focus to a more pedagogical focus.

> I had low expectations. I did not think it would be useful after I had tried it out myself because I found it unrealistic. But when I experienced my student driver try it, I saw that it was useful for her. I think she got a lot from it. (Student 6)

> If I had a simulator, I would probably use it at the very beginning, like we are now, on level 2. I do not think it is useful for level 3 and 4. (Student 5)

However, instructors who had more experience reflected on how the simulator could be used for levels three and four as well.

> Perhaps even more in level 3 with the tactical driving. Things you cannot create in real-life training, you can show the student driver in a simulator. How you react in different situations. (Driver instructor 1)

The shift in perceived transferability for the students is interpreted as closely connected to the students' experience, and thus their learning process on how to use the simulator as a tool.

Discussion

Simulators are not commonly used in Norwegian driver training, although simulation-based education has several benefits in other industries. In this study, the research question was: Which factors influence perception and use of driving simulators in teaching and learning driving skills? For instructors and instructor students, the perception and use of a simulator depend on the perceived transferability from the simulator to a real-life setting, and that this depends on whether the focus is more

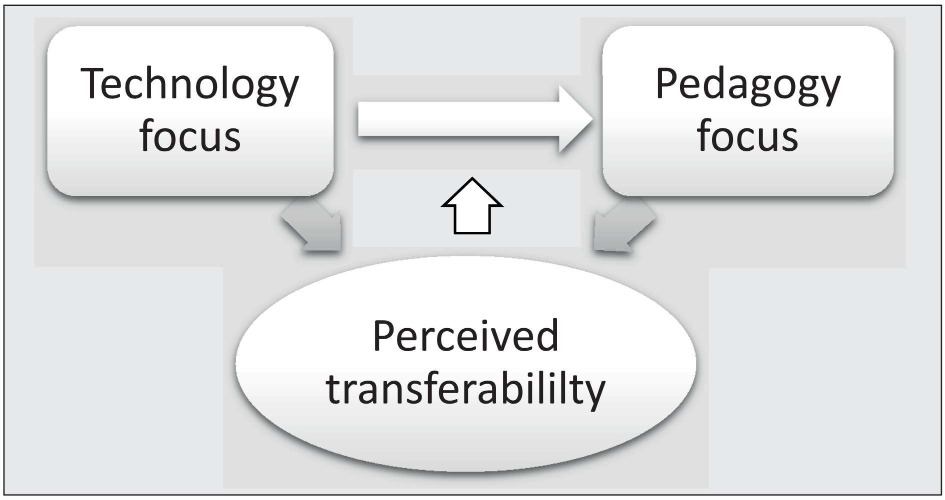

Fig. 2: Categories of the perception of usefulness of a driving simulator.

technological or more pedagogical. Another important point is that experience shifts the focus from a more technological to a more pedagogical perspective. These results, based on the previously presented literature and a model created from the findings, are discussed (see Figure 2).

Use of Driving Simulator for Teaching

The main category, perceived transferability, is conceptually closely connected to the category of perceived usability in the technology acceptance model and depends on whether the perceived transferability is more of a pedagogical or technological nature. This is related to what kind of usability the instructor expects. On the one hand, if the usefulness is closely connected to replacing a car directly, it is more likely that the simulator is not regarded as useful. On the other hand, if usefulness is linked to a broader pedagogical view of the technology, it is regarded as useful, and the informants are more positive toward using it in the future. This is according to the theory of technology acceptance, which states that if a person sees the technology as useful, actually using it would be more probable than if a person does not see the technology as useful for solving the tasks the person expects (Davies, 1983; Venkatesh et al., 2003).

In addition, how much experience they have with a simulator plays an important role. As the students experienced the simulator, their positive attitude toward using it as a pedagogical tool increased. However, it seems that they need to experience it to understand the benefits. For instance, while they are teaching at level two, they do not see how it can be beneficial for level 3, and their perception of the simulator's usefulness stops at the level they are at themselves. Further, how to use it includes factors such as whether the instructor should be present and whether to plan for the lesson in advance.

The simulator further provides a calmer teaching environment. As stress level lowers, the learning context becomes more optimal. For learning the skills required in a highly complex, high-risk context, a safe and calm environment would be beneficial for avoiding issues such as cognitive overload. Then, when entering a high-risk road traffic setting, the instructor and the learner will have more capacity to focus on the other elements that are included in a real-life traffic context. This goes for every part of the curricula and every level. For instance, on level two, the simulator could be used to train with gearing and clutching before entering roads with traffic. On level three, a practice such as merging onto high-speed roads could be beneficial to practice on a simulator before entering a real-life scenario for the first time at 80 km/h. The simulator provides the opportunity to focus solely on the selected learning goal prior to entering a complex context. This would be less stressful for the instructor as well as for the learner. Additionally, it is less stressful for the student in an instructor role, who is also in a learning process.

The degree of fidelity is a feature that has a gap in understanding (McGaghie et al. 2010). There is still a question of how much fidelity is enough or too much. According to the results, how the user views the simulator (from a technological or a pedagogical perspective) and their experience with it are factors in this question. If the user, as with the instructor, views this from a technological perspective, the simulator has a lesser chance to be used, as the perceived usefulness will be low (Venkatesh et al., 2003). From this perspective, the simulator industry could benefit from making higher fidelity simulators to reach a broader client segment. However, a higher fidelity simulator would probably further increase the costs of acquiring a simulator as well as taking up more room, and the balance of learning outcome and costs would be important.

For a new tool to be used by educational institutions, educators need to demonstrate results such as improved learning outcomes and road safety. However, these elements are difficult to measure (Kardamanidis et al., 2010). Regarding improved learning outcomes, what is tested in, for instance, dark driving with a multiple-choice test, resembles the lower levels of learning according to Bloom's taxonomy. The basic theoretical foundation of dark driving is found to be learned as well or even slightly better in a simulator than outdoors on a track (Sætren et al., 2019b). This is important learning, but for a simulator to be of extensional use, it should also be important also for higher levels of learning.

Simulators and the Learning Process

Experiences are catalysts for learning, and actual learning occurs in the debrief and reflection during and after the experience. Thus, educators and learners can reflect together and analyze their performances. A preferred factor in using a simulator for such learning is that it makes standardization possible. Learning to handle complexity while performing tasks is a complicated learning process. To ensure that the learner has the necessary experience, some degree of standardized learning is preferred.

engaging content in the simulator, could, in the context of the experiential learning theory (Kolb, 1984, 2014), breach the learning cycle for those who do not view simulation as a pedagogical process.

This breach in immersiveness could also be due to previous experiences of using media content, where the difference in age group and experience could come into play. Young people are used to technology and videogames, including games involving car driving. In this study, it was the experienced instructors who had gotten rid of the driving simulator that was not positive in this regard. It was not due to safety aspects so much as the practical issues they had experienced. Furthermore, instructor students showed more enthusiasm about using a simulator, which shows a difference in experience. Additionally, guided simulator praxis for students provided an experience that made a shift to a more pedagogical and positive attitude. Thus, experience alone might not be sufficient. Yet, the experience should be based on guided instructions in accordance with the twelve features of McGaghie et al. (2010).

Will the simulator be beneficial for learning? It seems that the perception of whether it will depends on whether one views the world through a technological or pedagogical focus. In addition, experience seems to play a part. When assignments are given to students that include a simulator and reflection, the view seems to change over time. Thus, learning by experiencing is important. The use of a simulator is not intuitive, which coincides with the finding that the self-taught experienced driver instructors were less successful; those educating future driving instructors need to guide students in how to use it and give them an opportunity to practice with it. It is also possible that the ones with a pedagogical focus may have a more self-driven learning process, while the ones with a technological focus could benefit from being facilitated into the sequential parts of the learning cycle.

Implications and Further Research

The authors argue that using a simulator as a learning tool and for learning to teach others is beneficial. They do not argue that the entire learning process should be conducted in a simulator, but rather for practice, including at higher learning levels, prior to entering a real-life context, to learn during these levels in a safe environment. Including simulators in driver training can provide a calm, safe learning context that is environmentally friendly and without the complexity that would be a distraction for the learner and instructor.

Further, this paper was written during the COVID-19 crisis in 2020. Driving schools are also facing major challenges since they are not allowed to teach in cars because the learner and the instructor would be in too-close proximity to each other. The schools have been closed for weeks and months at this point, as well as the university. A simulator would allow the distance between the instructor and the learner to increase to the mandatory two meters, as the chair for the instructor can be moved further from the learner in the same room. Thus, the use of a simulator has the possibility to benefit the industry for safety regarding infection control in the future. It would also allow the university to continue educating students. Because alternative training methods are beneficial for several reasons, more in-depth research on the use of simulators in driver training is needed.

Examples of topics for further research might be exploring how personality affects learning and teaching using simulators. This research has shown that different perspectives affect perceptions of usefulness, and this might be linked to personality and abstract thinking ability. Further, it would be of interest to explore the views of student drivers. The current research takes on the perspective of the instructor role, but what about the learner's role? Additionally, there is a knowledge gap regarding simulator instructor training to educate, evaluate, and perhaps certify professional simulator educators. For the training to be optimal, the simulator instructor must also be properly skilled. Finally, conducting experiments with quantifiable measures to see if the learning outcome is as good in a simulator as it is in a car, for instance, at level three, would help understand more about the actual learning outcomes for the student driver.

Conclusion

Simulation-based training allows educators to create experiences that encourage learning in a safe environment. A driving simulator can be beneficial for learning and teaching the complexity of driving on all levels, from technical maneuvering to strategic decision making. The entire learning process should not be conducted in a simulator, but some parts could, for instance, be taught in a simulator prior to entering real-life traffic. To increase the chance of instructors using a simulator for teaching, there needs to be a sense of perceived transferability to real-life settings. This depends on if one sees the pedagogical potential in the use of a simulator in the learning process. Simulation-instructor education and experience using the simulator should be implemented in the educational program for driving instructors.

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