TACIT KNOWING: IMPLICATIONS FOR THE DESIGN OF COMPUTER SIMULATION TRAINING IN POLICE EDUCATION

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Abstract

This paper focuses on the practical knowing that is central in police education. Drawing on perspectives about tacit knowledge and embodied learning (e.g., Argyris & Schön, 1974; Merleau-Ponty, 1945/1997; Polanyi, 1966) as well as empirical examples, this paper will discuss the design of and what can be expected from computer simulation training for the development of police students' professional knowing. Based on the the lessons learned from working with computer simulations in police education we argue that computer simulations can be a useful aid for practical training, but they cannot replace exercises in scenario training or drill exercises.

Keywords: adult learning, tacit knowledge, reflection, professional knowledge, vocational education

Introduction

This paper concerns the development of professional knowing in police education and computer simulation training. More specifically, the focus of this paper is on the practical knowing that is central in police education and essential in many professions. This knowing consists of "quiet,"experience-based knowledge and skills – an embodied practical knowing (cf. Polanyi, 1966). In this sense, knowing is about more than just isolated technical skills and procedures; rather, it involves both specific practical techniques and the thinking and decision-making required to use these techniques effectively (cf. Söderström, Åström, Anderson, & Bowles, 2014a). Extensive resources are spent during police education on a variety of practical exercises, such as drill exercises and scenario training, to teach students how to deal with complex and risky situations where collaboration, decision making and assessment are crucial for a safe and professional practice (e.g., Gonczi, 2013; Reader, Flin, Lauche, & Cuthbertson, 2006). Exercises include, for example, handling weapons (firearm, baton, pepper spray, etc.) and shooting, but also more complex skills where the performance may vary depending on the environment and the set of circumstances. Police education like many other vocational educations has limited opportunities and resources for students to practice sufficiently for developing professional knowing. Thus, computer simulation training is used to support the development of professional knowing (e.g., Dorn & Baker, 2005; Mooney et al., 2012). However, the primary focus of computer training appears to be largely on specific skill acquisition (e.g., shooting, driving).

Despite their increased use, there are many questions surrounding whether computer simulation training can support professional knowing. In this paper, we examine the link between computer-based training and the development of professional knowing. Drawing on perspectives about tacit knowledge and embodied learning (e.g., Argyris & Schön, 1974; Merleau-Ponty, 1945/1997; Polanyi, 1966) as well as empirical examples, this paper will discuss the design of, and what can be expected from computer simulation training for the development of police students' professional knowing. The field of computer simulation training consists of many different types of computer-based training methodologies (e.g., desktop simulation, motion-based video gaming, and high-fidelity simulation). This paper and the empirical examples used will focus on desktop computer simulation, but since the argumentation presented does not specifically build upon any one type of technology the reasoning should be relevant for any computer simulation training designed to develop professional knowing.

Research on Professional Knowing and Computer Simulation Training

Professional knowing has been investigated in a wide variety of contexts, such as medical education (Dieckmann, 2009: Hopwood, Rooney, Boud, & Kelly, 2016), crisis management (Berlin & Carlström, 2013; Moats, Chermack, & Dooley, 2008), firefighting education (Blondin, 2014, Holmgren, 2015), and in police education (Alison & Crego, 2008; Sjöberg, 2016; Stokoe, 2013). There is a general agreement among researchers in the field that developing professional knowing requires extensive training within a particular domain (Ericsson, Krampe, & Tesch-Römer, 1993) and acquiring the professional skills necessary for effective performance normally takes many years of training. Although extensive research on scenario training and other physical training situations has been conducted, there is still limited knowledge on how professional knowing is developed and learned. Additionally, knowledge on how different situations with varying degrees of complexity can be handled is limited (see Sjöberg, 2016). From a theoretical point of view, the development of professional knowing is to learn to acquire the embodied knowledge (know how) to handle the different practical situations an individual can face in real life (knowing-in-action) (Argyris & Schön, 1974, Schön, 1983). This knowing incorporates tacit, experiential knowledge and skills that are gradually acquired by practice (cf. Kinsella, 2009; Polanyi, 1966). How the body feels and perceives the environment is central to the understanding of practical knowledge (Merleau-Ponty, 1945/1997; Polanyi, 1966). Although scenario training does involve embodiment, an observation one can make from previous research is that this theoretical stance, embodiment and body techniques acquired through training and teaching and how it is learned (see Crossley, 2006), has largely not been specifically addressed.

One possible reason for why research on professional knowing has neglected embodiment may be due to its complexity. For example, when a building is being searched in order to locate a suspect, a threatening situation may arise where the police student has to adapt his or her actions and weapons to solve the situation in both legal and effective terms – a situation that often creates physiological stress reactions (Armstrong, Clare, & Plecas, 2014).

In conjunction with an intervention an officer must integrate sensory, motor, emotional and cognitive factors in order to deal with and solve the situation. This example illustrates a complexity that can occur in embodiment that is difficult to capture for researchers in typical laboratory or scenario test. In addition, the theoretical frameworks used in the research have not to any major extent taken into account embodiment. Without a theoretical framework that can provide interpretations in relation to tacit embodied knowledge, it is even more complex to pay attention to aspects of embodiment when applying it to professional knowing.

This lack of attention to embodiment is also true for research on desktop computer simulation training and the development on professional knowing in general, including police education. Typically, research has mostly focused on cognitive aspects of the situation being trained such as complex and integrative reasoning (Huppert, Lomask, & Lazarowitz, 2002; Ingerman, Linder, & Marshall, 2009; Silén Wirell, Kvist, Nylander, & Smedby, 2008) and for police education specific skills training such as shooting) (Li, 2009) or tactical decision making (Hartley & Varley, 2001) has been the focus. Clearly, there is a gap in the knowledge that is relevant to the design of desktop computer simulation training that we elaborate on in the next section.

Embodied Professional Knowing And The Design Of Computer Simulation Training

Evident from the review of research concerning scenario training, one complication that might hinder the designing of effective computer training modules for professional knowing is the fact that little is known about learning professional knowing. We cannot inform the design process with empirical data since no such data appears to exist. Instead, we have to rely on theoretical research that can provide a basis for understanding what factors interact and in particular which factors contribute most to the development of professional knowing. Theories on how practical knowing is acquired put forth that knowing is a consequence of bodily experiences and sensations (Merleu-Ponty, 1945/1997). Thus, desktop simulations have had to focus on cognitive aspects because, as defined by In Merleu-Ponty and Polanyi terms, they cannot accommodate embodied action. Desktop simulations, irrespective of how interactive they are or how much advanced technology is used, involve primarily the training of the cognitive strategy the user employs and even that is constrained by the design limitations of the simulation. In practical scenario training, we rely, in Polanyi's terms (1966), on our awareness of the body's contacts with external things, and we learn to pay attention to these things. For example, in many situations in the field police officers' actions will be dependent on their situational awareness, which smells, tastes, touch, and hearing can influence (cf. Damasio, 1994), and which includes embodiment in terms of selective attention, movement and action in relation to the situation to be solved. Such complexity is very difficult to pack into a simulation.

This is not to say, however, that desktop computer simulation training does not have a role in the development of professional knowing in police education. Drawing on Dewey's view, "Every experience affects for better or worse the attitudes which help decide the quality of further experiences"

(1938, p. 37), computer simulations need to be anchored to the complex and risky situations that are to be trained in a practical scenario exercise. In other words, the simulation must be relevant for scenario training in order to support the development of professional knowing. The computer simulation training examples in this paper were designed to facilitate the understanding of complex situations, as they should be handled in the physical training situation. However, the effect of computer simulation training is not only a result of the design of the simulation tool, what it allows or limits. The link from practical scenario training to the design and performance of computer-based training is of crucial importance (e.g., Chang, Chen, & Sung, 2008; Söderström, Häll, Nilsson, & Alhqvist, 2014b; Windschitl & Andre, 1998). In the next section, we illustrate the lessons learned from working with computer simulations in police education with help from two different projects.

Lessons Learned From Working With Simulation Training in Police Education

In this section we describe lessons learned from working with computer simulations in police education

The Computer Simulation Training Sessions

The first project was a desktop gaming simulation designed to train peaceful resolution of conflict during local entry clearance search and to prepare the students for a physical search (see Söderström et al., 2014a). Conducting a search involves moving from areas under the control of the police into adjacent areas. Officers must assess the level of risk and evaluate whether or not they will have control before moving into subsequent areas. The simulation was developed using the game engine "Unreal" which provides a 3-D first person game user interface (see Figure 1). The students (n=12) worked about 1 hour with a desktop gaming simulation that trained local entry search. The task was to search through a building using the search tactics and to locate risk areas. The students worked in groups of three. As one student undertook the simulated task, the other two commented and discussed the search strategies. The computer simulation training was followed two weeks later with a practical training situation.

Figure 1. Local entry clearance search simulation.

The other example we use is a virtual case (see Figure 2) where 35 students worked to prepare for a large scenario exercise (see Söderström et al., 2015). The students were presented with a task that required interpretation of the situation and developing strategies for how to solve the situation as well as identify possible actions. The students worked 1.5 hour in their base groups (5-6 students). The computerized material consisted of images, videos, texts and discussion questions. A practical scenario training two weeks later followed the computer simulation training.

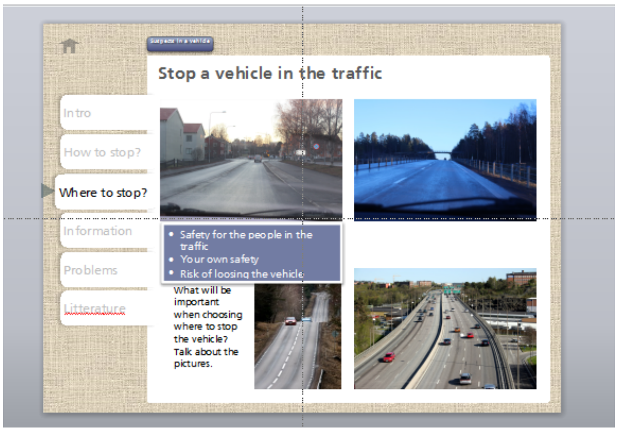

Figure 2. Online virtual case.

Students' Perceptions of Computer Simulation Training

The students' experiences of the computer simulation training were evaluated with questionnaires with items focusing on their experiences of working with the computer simulations as a support for the practical training. Answers were given by grading statements on a five-point scale. The results from the two groups of student were quite different. On one hand, the students that carried out the local entry clearance search simulation (n=12) were only moderately convinced that the simulation training contributed to being prepared for the practical search, discovering risk areas, giving guidance on how to act or contributed to feeling confident about the various possible means of action. The mean value of the students' responses on the items varied from 2.57 – 3.00. On the other hand, the students that worked with the virtual case (n=35) believed that the work with the virtual case clearly helped them to develop their knowledge of police work, contributed to and understanding of different ways to solve a problem, gave guidance of how to act and that they were theoretically prepared for the scenario training (mean value on the items varied from 4.11- 4.54)

Clearly, the students participating in the local entry search did not experience the same amount of support as the students from the virtual case when moving to the practical training. The students in the virtual case thought that to a high degree everyone in the group took responsibility, worked well together, that the group performed well and that the various solutions for the tasks were well discussed (mean values from 4.09 to 4.37). Responses about how well the group functioned from the students who worked with the local entry search were lower (mean values from 3.58 to 3.92). The items concerned their perceptions of how the group assisted their strategies and actions while performing the simulation, how different strategies for solving the task were discussed and how the group performed.

Reflections on the Training Sessions

Although both simulations were influenced by theories on reflection (Dewey, 1938; Schön, 1983,1987) and addressed senses as guides for action in design process (Söderström et al., 2014a), only the virtual case could be said to be of any help in preparing the students for the practical training. The explanations to these differences can be analyzed on several different levels, but here we want to emphasize its link to practical scenario training as well as to how the training is designed and performed. One interpretation of the missing relevance for the local entry search simulation for the practical test is that the different characteristics of the simulations mediated how the training session was performed. The local entry search simulation was built on a gaming platform in a first person perspective. Like a game that is played just to perform the tasks, there is a risk that a gaming simulation for education is performed in the same way. It is possible that the simulation sessions were performed at a pace where the detecting and marking of risk areas turned out to be an unplanned trial and error that, in Schön's (1987) terms, contributed to an "exploratory action undertaken only to see what follows" (p. 70). In this sense how the training was performed is one clue to how we can understand the little relevance the students believed the local entry search had for their practical training. On the other hand, the virtual case is a simulation that did not support or motivate students to perform it in the same way. Therefore, it was easier for the students in the group to remain focused and attentive to the situation that was to be resolved, which contributed to a more concentrated and conscious training.

Another explanation to the differences in students' experiences of the training might be found in the group work. It appears as the simulation sessions mediated the group work differently. In the simulation, the focus should not simply be on performing the task, but also on how the task is performed (e.g., thoughtfully). This will particularly affect and facilitate the discussions within the groups. As the results show, the virtual case students were more positive to the discussions about how to act and appropriate actions in relation to the situation to be solved in the simulation. In one sense, consistent with Argyris and Schön's (1974) perspective, they applied an inquiry process of identifying how a situation may be managed –" the action appropriate in order to achieve an intended consequence" (p. 7), which the local entry search students did not do. The virtual case sessions can be interpreted as the students' collective efforts to testing the theories-in-use, e.g., ways of doing in situations to achieve an intended consequence (Argyris & Schön, 1974; Schön, 1987). Similarly, as Sellberg's (2017) study of a full mission ship simulator showed that bodily conduct and talk by the instructor filled in missing aspects of the real world, it is possible that the students collective work filled in missing aspects of the practical training in the simulation session.

The discussion we have presented demonstrates that action never takes place in a vacuum. The teaching situation and how a situation is understood affects an individual's actions and what goals they are directed against (cf. Goffman, 1974). Although both examples discussed here were designed to challenge the students' theories-in-use in order to avoid the experiences of their actions in the simulation sessions being processed superficially, we have learned that a computer simulation's relevance for practical scenario training is a complex endeavor that needs, in various degrees, to be supported by pedagogical steering. In other words, the need for pedagogical steering differs between computer simulations.

Concluding Thoughts

Learning practical skills is about acquiring skills that can be used both in simple and in complex situations within an ever-changing environment. Computer simulations can be a useful aid in offering many and varying experiences about typical cases and in discovering the prevailing situation in the practical training which is similar (cf. Johnson's [2010] view on transfer). However, computer simulation training cannot replace exercises in scenario training or drill exercises. To fully learn practical knowing in Merleu-Ponty´s (1945/1997) terms is dependent on the body's sensations and perceptions in the development of knowing. By acknowledging this, it becomes clearer what and how computer-based training could contribute to the development of practical skills in training with extensive elements of practical-oriented training such as police education. However, since we cannot fully rely on research on physical scenario training in the design of computer simulation, a user centered design based on students' experiences of practical training may be a more feasible way to carve out aspects that can inform the design process. Scenario training is resource intensive, and it is essential that students be well prepared for the training. Sjöberg's (2016) study demonstrated, for example, that preparation is important for how training is performed and what lessons are learned. He showed that it is both about managing equipment and weapons (wanting to avoid focusing on a radio that does not work or a baton that is stuck) and to quickly read the situation and act expediently (wanting to avoid focusing on peripheral things in the situation).

Simulations offer opportunities to recreate and simulate situations and scenarios that are considered relevant to the profession and the content that the student should learn. However, the design of computer simulation training (both the simulation and how the training is designed and performed) needs to consider the specific aspects that surround tacit knowledge and embodied learning in the "real sense." Through an alternation between simulation and practical training, theories in use can be altered and new theories of action can be tested in the scenario training directed by a process of reflection rather than blindly using a trial and error approach (cf. Argyris & Schön, 1974; Schön, 1987). Students working together can discuss possible solutions to the task and strategies can be tested in a simulated environment before being tested in scenario training. This interplay between discussion and testing in practical scenario training gives the student the possibility to develop theories which in line with Argyris and Schön's (1974) thinking can facilitate knowing what to do in a given situation in order to achieve an intended consequence.

Although, computer simulation training has the potential support the students' development of theories-in-use, it cannot put the theory of action into practice, which is the proof of whether it is learned in the most important sense (Argyris & Schön, 1974, p. 12; cf. Polanyi, 1966).

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