Transferring Tacit Knowledge in Safety-Critical Systems
Examples from maritime pilot training

Rikard Eklund & Anna-Lisa Osvalder

Division Design & Human Factors
Chalmers University of Technology, Gothenburg, SWEDEN

Purpose and aim

Purpose

- Identify ways to improve maritime pilot training to mitigate increasing requirements for safe, economical and environmentally sustainable shipping in Swedish territorial waters

Aim

- Describe prevailing methods of tacit knowledge transfer during different elements in the Pilot Training Programme
- Provide suggestions on improvements of tacit knowledge transfer

Maritime piloting – A safety critical operation

- Maritime pilots use their expertise to guide vessels in specific waterways
- In safety-critical systems the complexity and the required skills to manage these systems are challenging
- The consequences of errors can be disastrous
- Accurate knowledge management is vital for a safety-critical organization to reach set goals

Explicit and implicit knowledge transfer

- Managing explicit knowledge is relatively easy but managing tacit (implicit) knowledge is more difficult
- Expert tacit knowledge can be problematic to manage in terms of elicitation, documentation, and transfer, on individual as well as on group level
- An effective transfer process of tacit knowledge between experts and novices is essential
- Different didactical methods need to be identified and applied
- Tacit knowledge transfer is dependent on situated learning, such as community of practice, apprenticeship, or hands-on learning in social settings

Maritime piloting – training

- Pilot students are already expert mariners – but as a pilot they need to train to provide guidance to other vessel crews
- Basic pilot training for 1-2 years
- Conducted in classrooms, simulators, and in various real-life maritime environments, often in social settings
- Learning a new skill is to reproduce the expert's existing knowledge into the mind of the novice pilot
- Much of the student's specific skills are acquired when the student interacts with a supervisor during actual pilotage on a specific waterway

Methodology to identify tacit knowledge transfer

Mixed-methods

- Observations
- Interviews
- Questionnaires
- Document analyses

- Eye-tracking technology
- Live-stream and recordings, data collected for analyses

Results – tacit knowledge transfer

- Briefings before, during, and after simulator sessions are important nodes of transferring tacit knowledge
- During briefings - individually between instructor and student, or in group settings - tacit knowledge can more easily be adopted due to interaction effects when focusing on solving the same task
- The simulator provide means for the instructor to show, and for the students to try, different approaches to achieve effective pilotage
- The simulator cannot solely comprise an effective didactical instrument - needs to be operated according to a set syllabus

Results – tacit knowledge transfer

- It is difficult to adequately document in didactical or pedagogical terms
- Documenting and storing tacit knowledge is not sufficient in terms of knowledge transfer but requires an effective transfer process
- Tacit knowledge transfer is largely dependent on the personal didactical technique or style of the individual instructor
- Further studies are needed to deepen the understanding on how knowledge transfer and learning outcome are linked

Conclusion

- Improved understanding of *where, when, and how* tacit knowledge is transferred provide opportunities to improve the transfer in terms of efficiency, pedagogics, and didactics

- Maritime pilot training is dependent on situated learning – with focus on the social situation containing in the specific piloting environments (e.g. pilot station, piloted ship, simulator)

- Competence (applied knowledge) is constructed in cooperation with fellow students and experienced pilots

Conclusion

- Domain specific procedures, techniques, tactics, norms, and problem solving are constructed during all phases of the maritime pilot training

- Eye-tracking technology can be used as a didactical tool to improve maritime pilot training and to evaluate tacit knowledge transfer

Transferring Tacit Knowledge in Safety-Critical Systems
Examples from maritime pilot training

Rikard Eklund & Anna-Lisa Osvalder
rikard.eklund@chalmers.se

CHALMERS