Reference	*BP37*
Project Title	Future Driver Training: towards an open research platform for immersive simulation gaming for improving safe driving behavior and interaction
Coordinator	*University of Skövde*
Project Manager	Paul Hemeren (paul.hemeren@his.se)
Project Duration	2024-09-01 – 2025-08-31
Author(s)	Paul Hemeren
Confidentiality	no

Contents

Summary

Understanding drivers' theory material is a key component of education leading up to driver's license acquisition in Sweden. Sweden's novel immersive approach to driver risk training can be extended to driver's theory training as well by use of game-based learning as a complement to traditional driver's education and driver ADAS interaction.

The partners in this project can provide to the development of the gamification factor to help the young potential drivers understand the traffic situations and how to react to them. Swedish National Association of Traffic Instructors, STR is the key partner that provides the trade organization that represents a large proportion of the country's traffic instructors. Every year, STR member companies train over 200,000 people in all different qualifications and modes of transport – drivers that you then meet in traffic. Gamification can be used to develop this according to STR.

This pre-study project has used two gamification education developments that can be used to create better traffic knowledge for people learning to drive. The first gamification development had our partners create games to understand traffic situations. The second gamification development used gamified solutions to make traffic theory accessible and practical where students at the University of Skövde developed gamifications.

The outcomes of this pre-study design charrette series used lo-fi prototype traffic game, to be further refined via user testing and evaluation in driver training and driver interaction with ADAS. This lo-fi prototype may be physical or digital, or a mixed reality blend of physical and digital components and be included in a larger funding application.

TITLE

Future Driver Training: towards an open research platform for immersive simulation gaming for improving safe driving behavior and interaction

1. Background

The project was initiated by a gamification partner to potentially develop driver education.

Here is an article that provides a basis for the project:
Sharma, D., Sharma, J., & Mehta, N. (2025, January). **Empowering education through augmented reality and gamification: Fostering social change in the learning experience.** In AIP Conference Proceedings (Vol. 3253, No. 1, p. 030012). AIP Publishing LLC.

The present study aims to investigate the combined effect of an immersion technique such as gamification and AR (Augmented Reality) technology on learner engagement and societal behavior change. The empirical purpose is to discern the effectiveness of gamified AR applications as interventions on learning outcomes, as well as the role of these stimulations in maintaining persistent lifestyle modulations.

2. Project set up

2.3 Purpose

This research aims to determine if there is value in using game design to improve the driver education experience and outcomes, and ultimately to make our roads safer.

The workshops we used were participating in part of a research pre-study project funded by SAFER (Vehicle and Traffic Safety Centre at Chalmers) to study the value of game design in improving driver education and training. Taking part in this study was entirely voluntary. This consent form gave researchers permission to use data from their workshop experience in our study. Game design prototype materials and answers to the questions in the provided workbooks were collected as a basis.

The goals of a team created a game that helps teach driver theory to younger people studying for their driver's license in Sweden. This can be done in many ways, and there were many different aspects of driver theory education that they could focus on. The first game teams used unique perspectives, and the game prototype was unique too. And the students presented gamifications that STR watched and so them as very good.

2.4 Objectives

Collaboration for this pre-study has brought together representatives from academic research into road safety, human machine interaction, game design, and pedagogy with stakeholders from industrial research and relevant national associations. This core group have run a series of participatory design charrettes with representative end users and stakeholders to develop a lo-fi prototype.

Objectives for this SAFER pre-study project:
- An initial rough prototype of a future driver training tool that can also be used as a research platform.
- Evaluation of prototype in light of the research applications of interest to the members of the grant group.
- Further external funding applications.

2.5 Project period
Start date – September 1, 2024
End date – August 31, 2025

2.6 Partners
University of Skövde (Paul Hemeren, Maurice Lamb, Jana Rambusch)
Linköping University (Birgitta Thorslund)
Smart Eye (Henrik Lind)
Folksam (Maria Klingegård)
AutoLiv (Tejas Chandran)
External SAFER Partner: STR (Sveriges Trafikutbildares Riksförbund) (Christer Rosén Wickman, Marie Stenman)

3. Method and activities
The goals of a first workshop were two-fold in relation to the developed games: 1., knowledge exchange, and 2., idea generation.

The structure can look like this:

- PART 1: KNOWLEDGE EXCHANGE
  Workshop hosts open the session
  Introduction round

- PART 2: IDEA GENERATION
  Start with guided individual or paired concept brainstorming
  Card sorting of all ideas

Choose 1-3 to develop in first prototype working in small groups of 3-5 participants.
Give out game design kits with guided process questions/instructions.
Give plenty of making time
Groups have time to share their prototypes and reflect together in the whole group at the end
End with reflection time all together

There was a first task of learning driver theory. The members of the project were to develop the key components of the driver theory education. There was a feedback loop of experiential learning presented in the appendix, and where the affordances of games contributed to a learning process. Here are some of the areas that were developed by the project people:

- Name of the Game. – Right of way
- What are players trying to accomplish? Try to get home and need to get thru intersections.

- What is the "Core Mechanic" of the Game; How does a player win? The play card and right of way – who develops for each played card.
- How many players are there? 2-10 players. One can have like 10 cars, a player uses one-to-five cars.
- How are players and their attributes represented? It has to do with weather, the traffic places (urban, city or country side), and the time of day.
- What resources exist, and how are they represented? Action cards with answers, and points of the way judges are available.
- What other information will you need to keep track of, and how? At least three levels of basic, medium, and advance.

In this area of the project, the purpose was to create the gamified solutions in the driving license app to provide the gamification that can be used by young driving education people. This was developed by the students in Skövde, and STR was a key partner to determine the usefulness of the driving license apps.

The different student areas that we brought forward were:

- **Students in a rush**: One day available for them, no study, do theory test and a driving test. Usually don't pass.
- **Moped students**: eight hours theory lessons, 4-hour lections on the moped, and then the theory test, and then driving test where only 40% pass.
- **Special need students**: ASB-Autism, theory time, driving lessons and they have difficulty judging situations of other drivers and road users. This takes looker time to learn to drive, which is an important area for the project.
- **Migrant students**: Difficulty learning the language of instruction hinders subject comprehension and social integration, as seen with needs for specific language support. Gamifications could be used to further develop these students for traffic situations.
- **Economic problems for students**: Buying lessons are difficult and the driving tests are more on the failure level.

According to STR, the gamifications for the special need students (ASB-Autism) will provide a much better understanding for the traffic situations. This area will also be more specific in a gamification area.

The student groups:
Five education student groups within the gamification area at University of Skövde used the scientific methods and game-based tools to create prerequisites for education and safe driving. It was a prototype project (7.5 credits); 10 weeks (50%). This includes also an important collaboration between SAFER partners and a non-partner STR where driver education is a key area.

Game Design Workshop Workbook
Assignment: Make theory accessible and practical

STR representatives who came to oral presentations:

- Lotta Persson (lotta.persson@str.se)

- Paulina Rosenqvist (paulina.rosenqvist@str.se)

What STR provided us for the student projects:
- Access to körkortsboken website for both students and teachers
- Maria Prole acted as contact for the students in case of questions during the project
- Students got a smaller gift bag as a "thank you" for their work with the projects (handed out after the oral presentations).

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Gamification Factors:
- **Points and Rewards System**: Drivers can earn points for safe driving behaviors, such as adhering to speed limits, maintaining safe following distances, and successfully using ADAS features. Looking in mirrors.
- **Feedback Mechanisms**: Providing real-time feedback through visual or auditory cues
- **Scenario-Based Training**: Use gamified scenarios within the ADAS interface to educate drivers about new features

18-25 ages

Group 1: Körkortsappen, 3 students
Group 2: Kontaktuppgifter, 3 students
Group 3: Körkortsboken, 4 students
Group 4: STR presentation, 4 students
Group 5: Kontaktuppgifter, 3 students

The five different gamification driving license apps are available to see the scenario-based trainings: https://his.drive.sunet.se/s/pwP26CFDiiJ8Fdc

4. Results and Deliverables

The goals of a workshop are two-fold: 1., knowledge exchange, and 2., idea generation.

How closely do the game components match the real world: *Abstract or Real*?

Are the players. roles more: *Symmetric* ***or Asymmetric***?

Does information tend to be: *Hidden or Visible*?

Are player interactions with each other more: *Cooperative or* *Competitive*?

Future Driver Training workshop

Special need students: Neuropsychological disorders Anti-social behavior (ASB) + Autism and Attention Deficit Hyperactivity Disorder (ADHD)

Here is the complete workshop workbook that was used to provide the gamification factors that can be used to improve traffic areas for young potential drivers (students).

Here are the five student areas that we put forward as different trainings for the young traffic drivers. The students have different factors to be provided in their driver trainings.

Student in a Rush

About the project

Funding:
- SAFER
- 200,000 SEK
  100,000 for HS.
  100,000 divided between various organizations.

Project period:
- September 1, 2024 – August 31, 2025

Future Driver Training

Towards an open research platform for immersive simulation gaming for improving safe driving behavior and interaction

Project members

Paul Hemeren (project leader), HS
Maurice Lamb, HS
Jana Rambusch, HS
Rebecca Rouse, HS

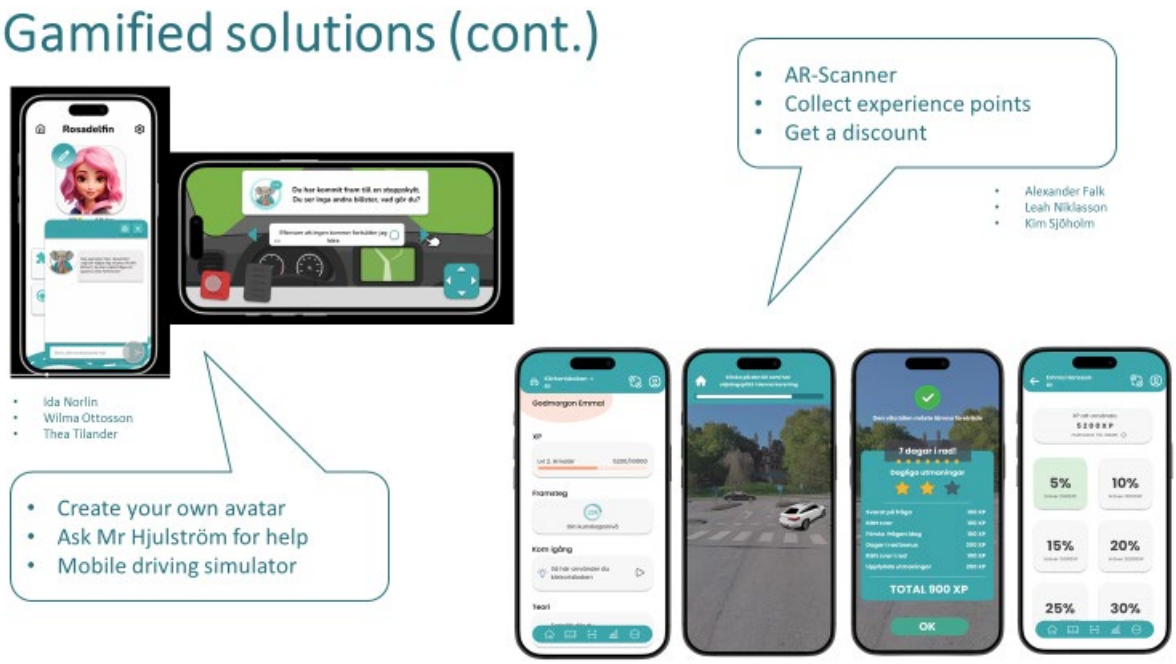
Linköping University
SmartEye
AutoLiv
Folksam
STR Sveriges Trafikutbildares Riksförbund

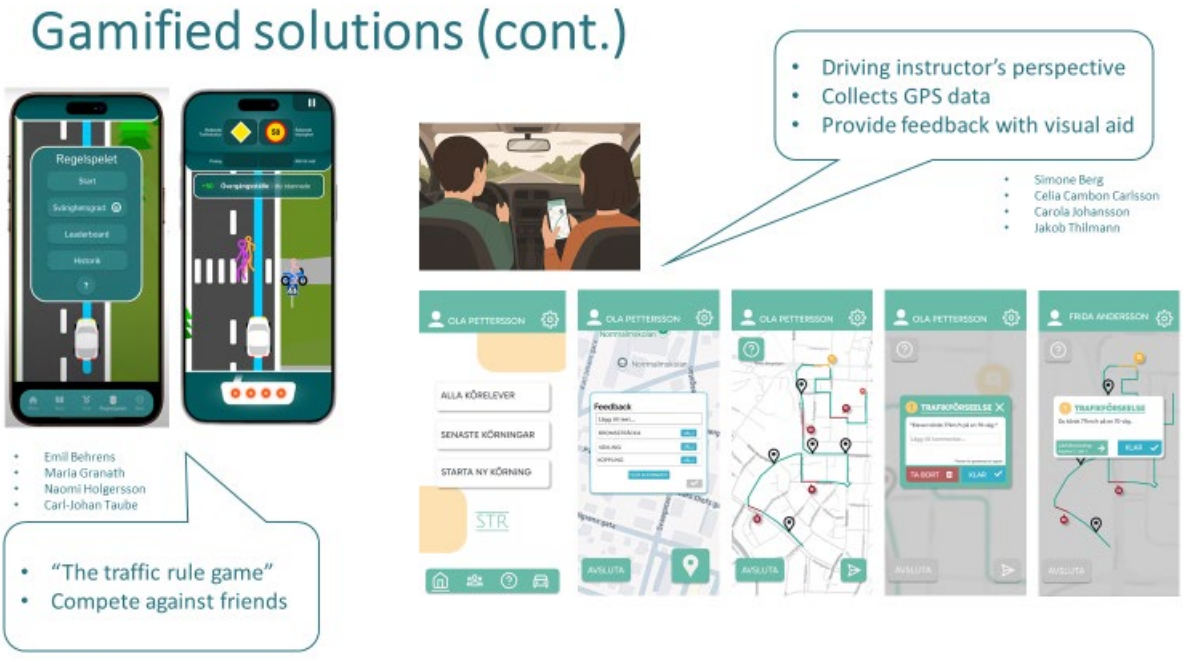
Assignment: Make theory accessible and practical

A UXD-student project

- Prototype project (7.5 credits); 10 weeks (50%)
- First-year students
  - 5 groups
- Teachers involved:
  - Jana Rambusch (course coordinator)
  - Maurice Lamb (examiner)
  - Ulrica Bohné
- Client: STR SVERIGES TRAFIKUTBILDARES RIKSFÖRBUND

Gamified solutions





5. Conclusions, Lessons Learnt and Next Steps

Gamification factors:

- **Points and Rewards System**: Drivers can earn points for safe driving behaviors, such as adhering to speed limits, maintaining safe following distances, and successfully using ADAS features. Looking in mirrors.

- **Feedback Mechanisms**: Providing real-time feedback through visual or auditory cues
- **Scenario-Based Training**: Use gamified scenarios within the ADAS interface to educate drivers about new features

Gamification cognitive factors

- **Feedback Loops**: Provide immediate feedback on driving performance, such as alerts for unsafe behaviors or confirmations of safe practices.
- **Cognitive Load Management**: Present information in a clear and digestible way to avoid cognitive overload while driving.
- **Adaptive Learning**: Implement adaptive gamification that adjusts challenges and rewards based on the driver's performance and learning pace, creating a personalized experience that keeps them engaged.

These conclusions have provided the factors for a much more specific project. We are still in relation to the companies that have developed in the project.

6. Dissemination and Publications

The results have been spread to the gamification area and the other project partners. The next areas are still being used in the relations with the other partners. The next factor is to further develop the potentials with the "current" partners. We have also created further student projects in gamification as well.

We have not published in combination with this project yet. BUT there are some clear resent publications where we can show our further development of the current publications.

7. Acknowledgement

SAFER has provided us this opportunity to further develop the factors that can help young driver potentials to understand driving that is needed. The project partners have developed this with us here in Skövde. STR is a key partner in this area.