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Driven to drive: Designing gamification for a learner logbook smartphone application

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ABSTRACT

Driving can be dangerous, especially for young and inexperienced drivers. To help address the issue of inexperience a gamified logbook application was developed for Learner drivers. The application aims to encourage learners to undertake a wider range of practice, while also making it easier to record their mandatory practice sessions. This paper reports on the design of this application, focusing on the effect that adding gamification can have on the usability and user experience of the application and the importance of playability testing for gamified systems. Two versions of the application were developed, one with game elements and one without game elements. This paper presents findings from a study that compares the user experience of these two versions of the application with twelve recent Learner drivers. Overall, participants reported that the gamified version was more engaging and motivating than the non-gamified version, however neither versions were preferred over the other. We theorise that this may have occurred due to a number of usability issues that arose, including an increased difficulty in learnability due to the added game elements. These design issues are important to address in future gamified system designs.

Author Keywords

Learner drivers; smartphones; gamification; gameful design, user experience, player experience

ACM Classification Keywords

H.5.2. [Information interfaces and presentation]: User Interfaces; K.8.0 [Personal Computing]: Games.

INTRODUCTION

Younger drivers are at a greater risk of death and injury from road crashes than older, more experienced drivers. In Australia in 2011, 17-25 year olds comprised 12.9% of the nation's population, but contributed 21.9% of the road crash fatalities [15]. Governments across Australia are employing a range of strategies aimed at addressing this issue. In Queensland, Australia, Learner drivers are required to

undertake 100 hours of supervised driving practice before they can attain a driver's licence. Although this mandatory requirement encourages driving experience, it doesn't necessarily encourage a greater variety of practice [17]. Given that a breadth experience is an important part of driver safety it is imperative that Learner drivers undertake a wide range of practice while learning to drive.

This paper reports on the design of a gamified application that encourages young people to maximise the breadth of supervised driving experience as Learners so a more experienced driver will emerge in the next, independent, driving stage. Our research goal is to investigate the extent to which a gamified smartphone application can increase engagement in the learning to drive process. The design and development stage of the research is reported in this paper. This stage involved interviews with experts in the field of Learner drivers and a study with twelve recent Learners to investigate the potential impact of the gamification. Results compare participants' preferences and examine the feedback they provided in terms of learnability, satisfaction, enjoyment, motivation, and playability. The results of the study provide important guidelines for future gamified system design. The results also highlight the usefulness of conducting playability studies when designing gamification.

LEARNING TO DRIVE

As of July 2007 all Learners in the state of Queensland, Australia, must achieve a minimum of 100 hours of supervised driving experience (including 10 hours of driving at night) before applying for a Provisional (intermediate) licence [13]. Similar programs are used in other Australian states, in New Zealand, and in some jurisdictions in the United States. In Queensland, practice hours are logged manually in a large (16cm x 22.5cm) logbook. The information required to be logged for each driving session includes the date, the time at the start and end of the session, the driving duration (minutes), the car's odometer at the start and end of the session (kilometres), the licence number of the supervising driver, the State in which the supervising driver is licensed, the car number plate, and if the person is a registered driving instructor. Once complete, the logbook is submitted to the state licensing authority, the Department of Transport and Main Roads, and audited for accuracy prior to permitting the young novice driver to undertake their practical driving

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assessment. Given that the driving log is recorded in a physical book, the current method of tracking supervised driving practice has a number of usability issues. It takes time to fill out, requires a black or blue pen, and needs to be carried with the Learner as they move about from car to car and supervisor to supervisor. There is a possibility that the logbook can be lost and replacing it not only incurs a cost, but also the hours previously recorded need to be accurately remembered, and reliably transferred. A smartphone, logbook application could alleviate the majority of these problems and may be more appropriate for the technologically oriented youth of today. Moreover, an application could streamline the logging process by using sensors on the device (e.g., location, time and date) and can backup data to a server in case the phone is broken, lost, or stolen.

While novice drivers represent those facing the greatest risk of death and injury on the road, the learning-to-drive stage is one the safest periods of any driving career. This is because Learner drivers are required to be supervised when driving during this period. In the local context recent research suggests that Learner drivers should aim to *spread the practice over the learning period*, be encouraged to continue to practice *beyond the mandated one hundred hours have been logged*, and look to *drive in a variety of different circumstances* that become progressively more challenging in nature [17]. To encourage these behaviours, and motivate good practice habits in Learner drivers, gamification was explored as a potential solution

GAMES AND DRIVING BEHAVIOUR

Gamification is defined as the “use of game design elements in non-game contexts” [4]. Previous research suggests positive results when using gamification to encourage behaviour change, for example taking medication at prescheduled times [3], and drinking healthy amounts of water during the day [2]. However there has been little research that has investigated the use of gamification in the driving context, and in particular to encourage a variety of practice during the Learner phase.

The use of game elements and mobile devices has previously been explored as a means to influence driver behaviours in other contexts. McKall & Koenig [9] presented research that discussed how traffic congestion could be reduced by using gaming concepts and incentives. The Speed Camera Lottery [18] encouraged drivers to slow down by entering drivers who didn't speed into a lottery where they could receive cash prizes funded by drivers fined for speeding. Game elements have also been integrated into cars to encourage environmentally friendly driving, such as the Nissan Leaf, which uses game elements to reward users who drive economically [12]. In Australia a number of government-funded interventions have used online games to educate Learners regarding on-road risks and safe driving behaviour, such as *Keys 2 Drive* [8] and *Road Trip to your Licence* [14]. Driving simulators have

also been explored for their potential to train learner drivers, principally for their ability to provide a safe environment in which to encounter hazards [1].

Gamification research has grown in popularity over the last few years in a range of different fields. However few publications explain how the researched gamified systems were designed. Of those that have proposed guidelines and frameworks for gamification design, these are typically specific to a particular context [6, 11]. To address this, the design of our gamified logbook system will be explained, providing an exemplar for future game development in this particular context, as well as guidelines for other contexts.

LEARNER DRIVER LOGBOOK DESIGN

An iterative, user-centered design approach was used to develop the gamified smartphone logbook application, which also drew upon game design techniques and processes [7, 16]. Development involved gathering design requirements through interviews with experts, iterating through different prototypes (using paper wireframe and digital mockups), building working prototypes and receiving feedback through usability and playability testing. Prototypes were built for the iOS platform (iPhone, iPod Touch and iPad) due to its popularity in the Australian smartphone market [10].

Design Requirements

Requirements for the design were primarily gathered through interviews with five experts who were consulted for their extensive knowledge of learner drivers and on-road driving risks. The experts are widely recognised as leaders in academia, research, government and industry, having studied learner drivers extensively and/or contributed to state licensing processes. Experts were consulted for their extensive knowledge of Learner drivers.

Interviews with experts

Interviews discussed key issues for Learner drivers. Interviews were semi-structured, with questions focusing on (a) Learners in general and some of the challenges they face, (b) the Queensland licensing program, and (c) the current logbook process and opportunities for a gamified mobile logbook application. The interviews were coded using a grounded-theory approach.

Results supported the literature findings, that young driver safety is indeed a considerable public health issue. Inexperience of young drivers in particular was identified as a prominent contributing factor by all interviewees. The feedback regarding the recent changes to the state licensing program were favourable, however it was also mentioned that the 100 hours is “*a crude measure*” of driving experience as it focuses on a number to achieve, rather than the breadth of experience achieved by the Learner driver. Interviewees recommended that this breadth of experience include basic traffic negotiation skills (e.g., merging or changing lanes, turning right across traffic, reversing) and

driving in various contexts (e.g., single lane roads, multilane roads, heavy traffic, unsealed roads).

Issues with the current logbook were raised, revolving around the difficulty of the process and current drawbacks of using a physical book. Experts stated that the logbook process could be laborious and tedious, requiring extensive details to be entered for each trip. The book also needs to be transported when practicing in different cars. Furthermore, logbooks can be lost and replacing it costs money and requires the hours previously recorded to be accurately remembered and transferred to the new book – a highly risky venture when the minimum Learner licence duration is 12 months. Interviewees responded positively to the idea of a gamified mobile logbook and its potential to address both the logbook and experience issues. However they were wary of game elements that encouraged competition or challenged drivers to complete tasks that may be beyond their skill level. This was because the pace at which each driver learns is different, and competition or excessive guidance could potentially encourage dangerous driving habits.

Design requirements

Based on the results of these interviews, the literature review, and the informal discussion with Learners and supervisors, a number of design requirements emerged for the gamified logbook application. These included:

- DR1) Provide all the functionality the *current physical logbook* provides
- DR2) *Streamline* the process of logging practice
- DR3) Have a focus on the *experience of practice* undertaken, rather than hours attained
- DR4) Encourage Learners to *spread the practice over the learning period*
- DR5) Encourage Learners to practice *beyond the mandated one hundred hours*
- DR6) Encourage Learners to *drive in a variety of different circumstances* that become progressively more challenging in nature
- DR7) Don't encourage excessive *competition* between learners or provide *challenging tasks* beyond their skill level as it could lead to dangerous driving
- DR8) Be careful to adhere to laws regarding the use of mobile phones while driving, as there is a *ban on all mobile phone use* (including any hands-free or loudspeaker functionality) for learners.

Using these requirements as a basis, a logbook prototype was then designed.

Logbook functionality

The logbook application provided five primary functions. The first was the ability to *record practice* (addressing DR1 above). For this the user simply pressed the record button, entered the odometer reading of the car and the application

would begin to record the practice (see Figure 1). At the end of the practice session the user simply pressed the 'stop recording' button and the data was filled in automatically (including start time, end time, day or night, date, end location, total distance, total time and weather) making the input process easier (DR2). Crucially, the recording interaction took place before and after driving occurred and didn't require use during the trip (DR8). Users could record any skills or the types of practice they undertook during the trip (e.g., U-Turns or reverse parallel parking). They could also note skills or behaviours that needed further work (DR3).

Other functions included an *overview* screen where Learners could see the total hours they had driven, along with other information such as total number of trips recorded, average time, and distance for each trip (DR3). The *logbook* view (see Figure 1) provided a list of all the practice sessions recorded using the application (DR1). The *resources* view provided a list of links to information about obtaining a licence (DR1) and the *settings* view provided a number of options for configuring the application and exporting logbook data to email (DR2).

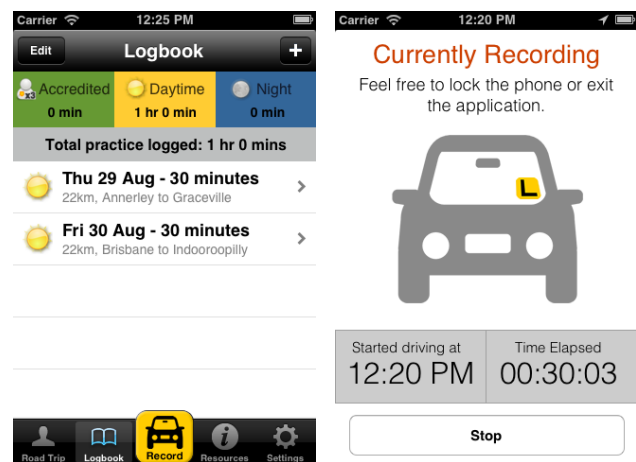


Figure 1 –The recording screen (left) with driving times, and the logbook screen (right) with totals and individual sessions

Gamification Design

The gamification was designed using an evolved version of a framework from a previous study [5]. This framework included four steps:

1. Identify gamification goals and metrics
 - a. Identify the goals and sub goals of the context that are lacking in engagement/motivation
 - b. Translate these goals into metrics
 - c. Work out how to measure and enforce the metrics
2. Understand the player
3. Design the gamification experience
 - a. Aesthetics, Story, Technology, Mechanics
4. Obtain feedback and iterate the design

Identify gamification goals and metrics

The goals of the gamification design were based on design requirements DR4, DR5, and DR6. These requirements were turned into metrics that could be used as the basis of the design:

- DR4: Practice at least two hours each week
- DR5: Complete 105 hours, 110 hours, 120 hours, 130 hours and so on.
- DR6: Undertake and master various driving skills (e.g., Merging Lanes, Changing Lanes, Turning right across traffic, Entering/Exiting Highways) and undertake and master various driving contexts (e.g., Multilane roads, Heavy traffic, Moderate traffic, Light traffic, Sealed road, Unsealed road)

Sensors on the smartphone could then be used to measure and enforce some of the driving contexts (e.g., time of day and weather), as well as practice spread and amount. To measure and enforce the other metrics the learner's supervisor could be used.

Understand the player

Age and gender are some of the most significant demographic variables on gameplay as these help determine play patterns and interests in terms of games [16]. Also player types may be considered [7]. The players of this application are primarily *16-24 year olds* and both *males* and *females*. As the audience is quite large there could be any number of each type of player therefore the design of the gamification will need to cater for a range of different players.

Design the gamification experience

The story behind the gamification design was kept simple and based around the players choosing some friends and undertaking a virtual road trip around Australia. The road trip challenged Learners to complete a trip around all of Australia before they upgraded to the next licence stage. The entire trip would take approximately 200 hours of practice to complete, therefore encouraging practice beyond the mandated 100 hours (DR5). The mechanics of the game revolved around players picking a car, choosing a nearby destination, and then each time they undertook practice they were rewarded with virtual coins (see Figure 2).

Coins were rewarded based on frequency of practice (DR4), the total trip time (DR5), and the choice of skills and contexts completed during the trip (DR6), such as U-turns and reverse parallel parks. These coins could then be used to purchase different amounts of fuel, as well as other items (e.g., repair kits and spare tires), to help advance the player around Australia. Fuel directly translated into kilometers based on the type of car the player had chosen. As players completed the virtual road trip they would visit new towns and cities in Australia and unlocked interesting information about these locations such as local tourist attractions.

Players also had a choice of which destination they would visit next. Some of the destinations were quicker to reach, however they were more dangerous to travel, whilst other destinations took longer to reach but the journeys were considered to be less risky. A player's car might break down and if this happened players had to pay for repairs. Players could also choose from different cars with different characteristics, for example *The Van* was less reliable and broke down often, but could travel further on less fuel. Changing cars regularly was an integral strategy when travelling different routes around the virtual road trip.



Figure 2 –The single trip score (left) with rewarded coins for a single practice session, and the game screen (right), with next city, progress and game options

Colorful and playful cars were used that were non-gender specific in their design. Feedback and interactive elements such as buttons were based on real road signage. The design also included actual photos from each location visited around Australia. These began as blurry images and as the player got closer and closer to the destination they became clearer (see Figure 2).

USER STUDY

Twelve drivers were recruited to participate in individual usability and playability studies to trial two versions of the mobile logbook prototype. Both prototypes provided the same underlying logbook functionality but only one included the game elements. The aim of the study was to:

- *Compare* preference and user experience of the gamified version to the non-gamified version in terms of learnability, satisfaction, enjoyment, and motivation.
- *Evaluate* subjective playability and potential motivation of the gamified version.

Study Method

A 45-minute laboratory session was held during which participants tried both versions of the application. Participants completed a questionnaire recording demographic information (age, gender), technology experience (technology videogame usage), and driving experience (experience of learning to drive and with the

physical logbook). Participants were then presented with one of the two versions of the application, chosen in a randomised counterbalanced order. Participants were asked to perform tasks that used all the functions of the application. For the non-gamified version participants recorded a practice session, edited the practice session, and manually entered practice. The same tasks were used for the gamified version, except the manual practice entry task (a less important task) was replaced by a task that required participants to purchase fuel for the road trip. Screen interactions were recorded, observations made by the researcher, and the audio from interview questions and comments during application use were recorded.

A questionnaire was administered after the participant tried each version of the application. Questions asked the participant to report on whether they if they *enjoyed using the application*, if *using the application was fun*, if *using the application was frustrating*, if they had to *think hard to use the application*, if they feel the application is *useful overall*, and if they could *easily work out how to use the application*. They were also asked if the *record a drive*, *logbook*, and *resources* functions were useful and if they feel the application would be *useful for a Learner driver*. Responses to these questions were given on a 5-point Likert-scale (1: *Strongly Disagree* - 5: *Strongly Agree*). Wilcoxin ranked tests were used to compare the results.

This process was then repeated with the other version of the application. After participants tried both prototypes a third questionnaire was administered that asked the participant to compare each prototype version in terms of preference, enjoyment and motivation (choice of: *non-gamified version*, *gamified version*, or *neither*). The user then was free to try the gamified version for another five minutes. Following this a playability questionnaire was administered, which asked if they found the game elements enjoyable, what they liked and didn't like about the gamified application, and if they had any improvements they'd like to see or further comments. A brief unstructured interview was then undertaken that probed for any further playability feedback, or suggestions for improvement. A statistical analysis was undertaken on the quantitative data using Wilcoxon Signed Ranks Tests to compare Likert-scale questions and chi-squared goodness-of-fit tests for version comparisons. Qualitative data, including short answer questionnaire responses and recorded audio, was coded using a grounded-theory approach.

Participant Overview

Participants (10 males, 2 females, 17-23 years, average 19 years) were recruited from the local university community via advertisements in lectures and received two movie tickets for participating. Participants had recently completed the logbook and therefore were ideally positioned to compare and contrast their experiences of the traditional paper-based approach with the alternative mobile application-based approach. Ten of the twelve participants

reported that they had found learning to drive to be an enjoyable experience overall. However, when asked about their experience of using the physical logbook, nine participants detailed a number of negative aspects of it. They identified the logbook as being a tedious process to fill out (six responses), that it could be easily forgotten (three responses), and also it could be easy to lose and damage (two responses). All participants reported that they used a smartphone on a daily basis and had been using a smart phone on average for the last 4 years. All participants reported that they play videogames for at least an hour a week, with eight participants playing between 1 to 6 hours a week, two participants playing 10 hours a week and two participants playing 20+ hours a week.

STUDY RESULTS

Usability and preference comparison

Only one usability result proved to be significantly different between the applications, and that was that participants reported that they found the gamified application harder to *learn how to use* than the non-gamified version ($p < 0.05$). Apart from this result no other significant differences were found between the two versions. This may indicate that participants found both versions to be equal in terms of usability (apart from learnability). However, it is noteworthy that the majority of the mean scores for each version were relatively high (above 4, or *agree*) for 14 of the 20 results. These high means may suggest a *ceiling effect* occurred (i.e., bunching of scores at the upper level reported by the instrument), which could be due to the novelty of both versions of the application when compared to the physical logbook.

Learnability

The learnability result indicates that the gamified version of the application was harder to learn to use than the non-gamified version. It is interesting to note that although an introductory screen provided an overview of how the gamification worked, a number of participants ignored it. Five participants skipped it completely and four participants spent only 7 to 10 seconds reading and synthesizing the information on it (unfortunately data wasn't recorded for the remaining three participants due to an error with the screen recording tool). It was observed that participants generally opted to take a more exploratory approach to understanding the game elements, with the majority of participants attempting to try and tap on different parts of the game screen (see Figure 2) to learn what was, and wasn't, part of the game. Participants reported that the gamification was difficult to understand initially. However once they had completed tasks involving recording practice, receiving coins and buying petrol, then their understanding of the game elements became much clearer.

Preference to Physical Logbook

After using each version of the application participants were asked if they preferred that version to the physical logbook currently being used by Learner drivers.

Participants reported that they would prefer both the gamified logbook and the non-gamified logbook to the physical logbook ($p < 0.05$). Short answer feedback asking why participants preferred the *non-gamified* version to the physical logbook was unanimous in agreeing that it improved the process of logging practice. In particular short answers reported on the application's ease of use compared to the physical logbook (seven responses), the way that it automated the process of recording and calculating math (five responses), and the fact that less physical tools were required, such as pens, paper and the logbook itself (three responses). Short answer feedback asking why participants preferred the *gamified* version to the physical logbook said that it improved the logging process (eight responses) and also because it included game elements (six responses).

Comparing preference, enjoyment, and motivation

Participants were asked which of the two versions they would *prefer* to use if they were learning to drive. Eight of the twelve participants preferred the non-gamified version, however a chi-squared goodness of fit test revealed the result was *not significant* ($p > 0.05$). Participants were asked which of the two applications would be more *enjoyable* to use if they were learning to drive. Ten of twelve participants reported the game version would be more enjoyable to use. A chi-squared goodness of fit test revealed this was *significant* ($p < 0.05$). Participants were asked which of the two applications would be more *motivating* to use if they were learning to drive. Nine of twelve participants reported the game version would be more motivating. A chi-squared goodness of fit test revealed this was *significant* ($p < 0.05$).

Qualitative feedback on playability

A number of short answer and interview questions asked participants to report on the playability of the gamification design. The qualitative results from these were transcribed and analysed to reveal three main themes:

- 1) There were both positive and negative reactions to the gamification added
- 2) A number of playability issues with the gamification design existed
- 3) A number of gameplay improvements could be made to the gamification design

These themes are discussed in detail below, highlighted using relevant quotes from interviewees as well as observations made by the researcher.

Positive and negative reactions to the gamification

There were a number of reactions, both positive and negative, to the addition of the game elements to the logbook application. Positive reactions were more common than negative reactions and addressed general aspects of the gamification. Participants reported that the game elements added fun to a somewhat serious task: *"I didn't feel like I was just inputting data. I was receiving something for the work that I was putting in."*, *"adds a side of gaming to a*

more or less serious task", and *"I like that it adds a little fun to driving when it can become boring and tedious"*.

Participants also discussed the potential for the gamification to motivate, supporting the earlier findings of the application motivation comparison: *"I think it's exceptionally well to add into the application and actually keep the user motivated to do it [practice driving]"*, *"it would encourage more frequent drives"*, *"It does encourage you to try different aspects of driving (...) and this would push me to seek out the scenarios in which to get more coins."*

Two participants had negative reactions to the game, stating primarily that they thought the gamification was underwhelming; *"The road trip game was a bit of a letdown"*, *"The actual game seems a little underwhelming"*, and *"I like the rest of the application, but the actual road trip thingy makes me think 'why, why does this thing need to exist?'"*. The same participants also mentioned that they would personally prefer to have an application without the game elements: *"I'd just get the app for the logbook feature. I wouldn't really want to play the game"*, *"It's a nice addition but I, myself would just use the logbook feature only"*, and *"I just want to record my experience, I don't want to play games"*.

Playability Issues

A number of playability issues were identified in the gamification design. Some users had trouble grasping how the game elements worked without first recording a practice session. During the tasks some participants indicated a sense of confusion; *"So I'm not sure what I'm meant to do now"* and *"at this point, I'm not sure what to do. I'm here and I don't know what to do"*. Some participants had difficulty discerning between the game and the logbook functions *"Are we actually going to the Gold Coast, or is it a game?"* Some participants also felt the gamification experience was too short; it *"doesn't engage the user for more than a few seconds"* and *"overall it was an enjoyable application, the game element was rather short"*.

A number of participants thought the addition of game elements might encourage more cheating due to their game-like nature; *"I can see people putting, you know, they've done every hill start, U-turn, three point turn in every drive so they can get more points"*, *"so there might be an incentive to cheat instead of using it for your own advantage"*, and *"it may lead to more forging of trips"*.

Suggested improvements

A number of participants provided ideas for improvements and additional game elements including the addition of a more in-depth tutorial, an achievement system, and competitive elements. A few participants suggested the gamification experience should take less precedence over other functions; *"Focus a little less on the virtual side of the app, since learning to drive is a practical experience - I wouldn't want to be spending time doing virtual activities."*

DISCUSSION

The research findings provide important guidelines for future gamified system design. Importantly, whilst the findings suggest that the gamified application could be more enjoyable and motivating than the non-gamified version of the application, this doesn't necessarily translate into user preference. The gamification design added a level of complexity to the application that had the potential to cause confusion for some users. It was also noted that adding gamification may create some unwanted interactions, such as cheating. The research findings also support the usefulness of conducting playability studies when designing gamification.

More enjoyable and motivating, but less preferred?

It was interesting to note that although participants reported the gamified version as being more enjoyable and motivating, eight of the twelve participants indicated that they preferred the non-gamified version to the gamified version. This may have been due to the learnability issues experienced by some participants, or it could have been because the game experience was lacking in terms of playability. However, results indicate it may have been the case that the game elements simply got in the way of streamlined practice recording process. This suggests that gamification shouldn't come at the cost of utility and usability.

Addressing the learnability issues

Results indicate that learnability proved to be an issue for some users. Understanding how the fictional game elements linked to real actions proved difficult at times. Unfortunately the introductory screen wasn't enough, particularly as many users skipped reading it altogether. It is essential that better guidance be provided to users to instruct them on how the gamification works, otherwise it may just confuse the user. A number of video games provide in-game tutorials to teach the player the basics of gameplay. If the gamification isn't simple enough to grasp, then an interactive tutorial could be included in more complex gamification designs to guide the user.

Addressing the game experience

The added game elements aim to create a game-like experience, therefore the gamification design should consider the users as *players* as well. All the participants had some previous experience playing games, with some users reporting more experience than others. Although results indicated that a number of participants found the game elements to be a positive addition, two participants found the gamification to be underwhelming and not that engaging. Participants also suggested additional game elements that they would have liked to see added to the design. These included achievements, rewards, and competitive elements. Because the intended audience was quite large, the game experience was designed to be broadly appealing. However it may be more suited for a smaller subset of the original intended audience and a tailored game experience designed to address their particular needs. The

original design requirements still need to be kept in mind though. This presents a challenge, particularly as participants felt there should have been more competitive elements, however competition was identified as one potentially problematic aspect that could lead to dangerous driving habits.

Gamification may get in the way of the function

On the other hand, the application also isn't just a game and needs to provide underlying functionality that is both easy to use and useful for the user. Results indicate that at times it became difficult for some participants to discern between game elements and logbook functionality. One participant thought they had to drive to the location specified by the game elements! Therefore the metaphors used in the gamification design, such as the use of virtual fuel, destinations, and passengers, need to be clearly separated from the logbook functionality.

Two participants mentioned that they would prefer to use an application without the game elements as they got in the way of the logbook functionality. To address this issue gamified systems could provide a way to opt-out of interacting with the game elements. Less emphasis could also be placed on the gamification.

Potential for the game elements to encourage cheating

A number of participants also reported that the addition of game elements might encourage cheating due to their game-like nature. It can be difficult to handle cheating in gamified designs, as video games in general encourage players to explore the boundaries of what is possible, and if a flaw is found it may be exploited. Cheating may not only ruin the experience for some players but also poses an issue if it affects the underlying utility and goals of the application – in this context, encouraging people to log false practice. Potential for cheating in gamified systems needs to be identified early and addressed. Further enforcement could be built into the gamified application, or particular game elements with exploits could be removed.

Feeding the results back into the gamification design

Based on the results of this study a number of design adjustments and recommendations can be made. Improvements to the gamification mechanics and user interface will be made that include: providing better guidance to introduce players to the gameplay; focusing on particular players by adding achievements as well as exploring minor competitive and sharing features; reconsidering the emphasis on the gamification; and addressing potential issues of cheating. As well, the function and gamification will be tied together more strongly, which will include: rethinking the mechanics and metaphors used in the gamification design; and focusing on functionality of the application first and gamification second by moving it to a secondary screen. These insights would not have been gained without conducting both a usability study *and* a playability study. A usability study revealed some issues, but without getting the users to 'play'

through the gamified experience, then the suitability of the game elements would not have been realised. Also problematic aspects such as cheating may not have been found and therefore not addressed prior to widespread release of the application.

Limitations and Future Work

There were some limitations of this study that need to be addressed. Firstly the sample size was relatively small and also made up of primarily males. This means that statistical significance is less likely to be achieved and also gamification feedback may be skewed to favor male preferences in video game, such as achievement and competition [16]. Interestingly these were both found to be a requested addition to the design. Secondly the application was tested in a controlled laboratory setting, rather than in the field. As such, future work involves making a number of design changes based on feedback, and then undertaking a month-long field study with Learner drivers to further gauge the impact of game elements on user experience and motivation in a more realistic setting.

CONCLUSION

This paper provides an overview of the design and feedback of a gamified mobile application that aims to encourage more diverse learning experiences for Learner drivers. Results from a study with 12 recent Learners indicate that the basic functions of the mobile application are useful, in particular when compared to the current physical logbook. Results also suggest that the addition of gamification to the logbook provides a more enjoyable and motivating experience for users. The added gamification design did cause some learnability issues that need to be addressed and it was also found that participants didn't necessarily prefer the gamified version to the non-gamified version. This suggests that adding gamification shouldn't come at the cost of utility and usability. These results provide important guidelines not only for the development and refinement of this application but for future gamified system designs as well. The results also support the usefulness of conducting playability studies when designing gamification.

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