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The Danish Simulator - Exploring the Cost-cutting Potential of Computer Games in Language Learning

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Abstract

The Hunt for Harald, *also known by its project name the Danish Simulator (DS), is an online, interactive language and culture training system for Danish in the serious games category. It combines speech recognition with a virtual world and elements of game play for learning purposes. It allows the learner to navigate the virtual world and talk to the local population, who respond if they understand what the learner is saying. The ultimate goal of the game is for the learner to locate Denmark's birth place, the Jelling Mounds and talk to the King who erected it, Harald Bluetooth.The platform is developed in cooperation with Alelo Inc. (www.alelo.com) and modeled on their Tactical Language and Culture Training Systems (TLCTS) (Johnson, 2006), which have hitherto primarily been used to provide military and civilian personnel with language courses for Arabic and Afghani, although other sectors and languages are quickly joining. The aim of the platform is to teach Danish language and culture, especially pronunciation and conversation, to the 45.000 immigrants taking Danish lessons every year, with the explicit purpose of reducing the annual cost of approximately 150 million euro.*
The platform has been tested on roughly 250 students at three language centers around Denmark from October 1st 2011 through March 31st 2012.The main aim *of the current article is to describe the* reasoning for developing it and the results of *the study which was conducted*.N*ot only* was it shown that *the platform* could *take* over up to 20% of *in-class hours, students and*, some, *teachers also enjoyed working with it.* For an online video presentation please visit www.dansksimulatoren.dk

Introduction

The main interest in using (computer-)games in learning environments, seemingly revolves around discovering and utilizing the underlying motivational strategies that prompt people of all ages and sexes to spend hours, days and even years playing the same game. How do we motivate our learners to learn while also having fun? Embattled are the days of rote memorization and boring books. David Shaffer [1], promotes the idea of using games to alter the way we learn and think, in order to increase our competitive edge. In the medical, military and aviation sectors, simulations are becoming increasingly common due their ability to allow learners to experience situations that are difficult or impossible due to reasons of *time, cost or safety* [2]. For the pilot trainee and the soldier, it is much cheaper, and safer, to crash a flight simulator or fire a digital bullet.
The financial crisis and statistics showing that for every 5 people who leave the Danish work force, only 4 re-enter, led to the establishment of the Foundation for Welfare Technology (FWT) in 2009, under the Ministry of Finance. The FWT was created to fund projects that could realistically demonstrate cost-lowering benefits, by introducing technology, or methodology in certain areas of the public sector without lowering the quality of the provided service. An often cited example is the introduction of robot vacuum cleaners in the elder care sector, saving perhaps 3 minutes of time for each caretaker on each visit. In 2010 the Danish Simulator was approved for funding. The aim was to develop a computer game with the explicit purpose of taking over up to 20% of in-class hours, without a drop in the passing rate and without lowering the quality of the learning experience.

Danish education in Denmark

Denmark has en integration policy which focuses on teaching immigrants social studies and culture, but especially language, within a 3 year period. The aim is to enable the learners to participate in and contribute to society on equal footing with a native.
Classes are provided for free. Ensuring access to classes is a municipal responsibility and is usually managed by public, or in some cases, private language teaching centers which specialize in this particular activity. There are approximately 60 language teaching centers in Denmark, employing around 1200 teachers all in all [3].
Language learning is offered in one of 3 separate tracks, designated DU1, DU2 and DU3. As a learner, you are assigned to a track, depending on a preliminary interview assessing your current skills

and also your educational background [4]. Each track is further into 6 modules, which are each concluded with a test to determine whether the learner is ready for the next module/ track. The designation DU3.1 would signify Danish Education, track 3, module 1.

Table 1, shows the distribution of learners on the various tracks, based on 2009 figures [5].

Table 1: Overview of Danish Educational System		
Background of learner	Track	Placement of entire group in % (2009 figures) [5]
Illiterates with no reading or writing skills, including in own language, or latin illiterates.	DU1	7%
Short(er) educational bacground from home country	DU2	40%
Medium- or long educational background from home country	DU3	53%

Table 1: Distribution of learners depending on background, 2009.

Although the distributional figures, percentage-wise, show no significant changes in the years immediately before and after 2009, the past 5-6 years has seen a significant increase in the number of learners actually attending or signing up for Danish classes, as shown in table 2.

Table 2: Number of learners in total taking Danish classes [3], [4], [5], [6]	
Year	**Number of overall participants** (rounded numbers)
2005	37.000
2006	36.500
2007	37.000
2008	39.000
2009	45.000
2010	49.500

Table 2: Annual number of learners taking Danish lessons

What becomes evident when examining Table 2 is the fact that there has been an increase of almost 13.000 learners from 2007 to 2010. The number of language centers and teachers has remained fairly stagnant within the same period, although the number of teacher based in-class hours, per module, have been reduced.

Trials, Evaluation and Conclusion

Learner trials began on October 1st 2011 and involved 3 language centers in different parts of Denmark: Aarhus, Odense and Sønderborg. The trial period was 6 months, divided into 2 x 3 months. 3 months is approximately the time it takes for a class to complete one module. The second trial round was set up both in order to prolong the data acquisition period and the data variability, but also to ensure that any technical or other difficulties not previously discovered would be found in phase 1 and be remedied. Phase one lasted October, November and December, 2011, while phase 2 took place in January, February and March, 2012. Evaluation of the trials was done in April, May and June. Several classes from both tracks DU3.1 and DU3.2 as well as DU2.1 and DU2.2 were enrolled as experimental groups in the trials. Approximately 250 students and 9 teachers participated. In addition control groups where found for all experimental groups. In regards to the control groups, some had to be acquired from other language centers as not all of the participating centers had classes that could function both as experiment and control groups.

The experiment called for 20% of all classes on the DU3 track to be taken over by the Danish Simulator, although still in a class setting, so as to ensure that the platform was used and used correctly. 10% of all classes were substituted on the DU2 track, within the same framework as the DU3 classes. The DU3 group was chosen for testing given the instructional language of DS, which is English. Originally it was the intention to have multiple instructional languages, but given the short time frame for development and the lack of knowledge about potential technical difficulties it was decided to initially settle for the largest common denominator, English, which most of the learners on DU3 speak.

Both teachers and students received instruction in how to use the platform. In addition, Instructional videos and a written *how-to and FAQ* were also created and were made available for viewing in the LMS which was chosen for delivery.

Hypothesis and evaluation criteria

The FWT criteria for success were two-fold:

1) *increase efficiency by saving time, thereby cutting costs, 2) without lowering the quality of the service provided.*

The requirements called for a quantitative and qualitative evaluation, done respectively through comparisons of passing rates/test-scores between the experimental and control groups, and questionnaires. The actual evaluation was done by UNI-C, a governmental agency under the Ministry of Children and Education. Our hypothesis was that 20% and 10% of classes on DU3 and DU2 respectively, could be substituted by DS without affecting the passing rate/test scores of learners in a negative fashion. If this hypothesis could be verified, then we would claim that a teacher could be freed from those hours in general. The qualitative part of the evaluation is based on feedback, gathered by administering questionnaires to both teachers and students who used the DS. Separate questionnaires were made for teachers and students respectively. Here we asked them for their opinions on the platform as well as to whether they believed that it could actually substitute the given amount of actual in-class teaching. Our hypothesis was that most would enjoy working with the platform and feel they had been able to learn from it. If this proved to be the case, we believed that the *quality of service* criteria was also fulfilled.

Results of the study

The results referred to below are primarily a translated summary of the main conclusions in the actuall report, which is currently only available in Danish. It should be noted, which is also reflected in the formulations below, that not all experimental classes managed to finish the trials due to either technical problems or language problems, the latter specifically for the DU2 groups.

Quantitative Results

Based on statistical comparisons between the test scores / passing grades of the experimental and control groups, it can be concluded that:

…in the classes where the Danish Simulator was used as intended, the results not only met expectations, but exceeded them. Both on the DU3 and DU2 tracks the Danish Simulator was able to substitute teacher based instruction without a decline in the observed results.

Our initial calculations indicated theoretical savings of 5.26 man-years at the 3 participating language centers and 42.92 man-years on a national basis. Post-trial calculations showed the numbers to be 7.97 man-years at the 3 centers and 65.03 man-years nationally. This would translate to saving of approximately *3.532.183* million Euros annually.
Part of the questionnaires required the teachers and students to rate various aspects of the Danish Simulator on a scale from 1 (worst) to 5 (best). Overall the students gave the Danish Simulator a score of 4,0 and the teachers a 4,2.

Qualitative Results

"…close cooperation between the developers and the teaching institutions is necessary, especially in the beginning, to avoid technical problems and negative perceptions of the platform as a whole."

Especially in the beginning of the trials we experienced problems getting the platform to run properly. Language centers, and many institutions in general, have very restrictive IT-systems. Although DS only works with standard software, some plug-ins and settings were constantly reset and firewalls prevented access.

"… thorough introduction courses and workshops need to be held to familiarize the relevant teachers with the in-depth functionality and structure of the platform before actual in-class demonstrations."

Overall, both teachers and students were thrilled about the focus on pronunciation and dialog and the use of speech recognition. The prospect of working on these subjects *anytime, anywhere* was seen as a great advantage. It should be noted here, that although the DU3 track is comprised of the most students, it is also the track with the greatest truancy. The PT part of the Danish Simulator received a lot of positive feedback, especially from the DU2 users. In-class observations showed that DU2 users felt very comfortable with the very simple user interface and functionality of the PT even though their lack of comprehension of English at times made them hesitant to explore the other areas.

"…It can be concluded that more instructional languages are required in order to accommodate learners."

Although the questionnaires also refer to the SB and GE, there is much less mention of these areas. This leads us to believe that the trial periods were perhaps too short to fully utilize all aspects of the platform, but also, based on some of the feedback from the teachers, in particular, there was a lack of knowledge about and comfort with the overall workings of the platform and how to properly integrate it in the teaching methodology. Some teachers seemed to immediately grasp how they could best utilize the Danish Simulator and some struggled with both learning the functionality (the majority of the teachers were non-gamers/IT) and seeing how to best use it.

"…It can be concluded that both teachers and students believe the Danish Simulator to be a strong supplement to regular classes."

The students in particular felt that they were using a new, modern and interesting tool for learning, as opposed to many other programs they had available.

"…*it can be concluded that both teachers and students have difficulty seeing the Danish Simulator as a direct substitute for teacher based classes."*

Despite the conclusion that DS can substitute part of in-class hours, and the positive attitude toward it as a supplement, both teachers and students were skeptical of it actually replacing a real teacher.

Conclusion

This article has given a description of the language and culture learning platform, the Danish Simulator, which has been tested on its ability to substitute up to 20% of teacher based instruction at 3 language centers in Denmark on the DU3 and DU2 track. The results from the trials show that this could be done without a decrease in the learner passing rate / test scores. It also showed that despite the fact that both teachers and students enjoyed using it and found it a helpful supplement, both groups had trouble seeing it as a direct substitute for teacher based training.

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