How to evaluate student motivation & engagement in e-learning

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ABSTRACT

In last year's I/ITSEC paper, we provided specific insights into practical applications of motivational design principles from John Keller's ARCS-V model, by showing how this is done in several Norwegian Defense Forces e-learning courses. This paper continues the work on motivation in e-learning, and asks whether the effects of motivational design may be measured. We answer the question by way of a trial, where a small segment of the target group of an ammunition safety e-learning course is asked to self-report on their perceived level of motivation. Using the Experience Application Programming Interface (xAPI) the trial tracks and uncovers variations in the participants' motivational levels. We discuss and show how the results can be used by instructional designers when optimizing e-learning courses, provide experience and suggestions from early-stage usage of xAPI.

ABOUT THE AUTHORS

Commander (CDR) Geir Isaksen has more than fourteen years in the field of ADL and are responsible for more than thirty e-learning- and R&D projects in the field of e-learning, m-learning, online learning and emerging technologies. So far, he has published more than 10 papers covering different fields like mobile learning, student motivation and cognitive overload in e learning. He has a master's degree in information computer technology (ICT) & learning from the University of Aalborg (2014) and a bachelor's degree in electrical engineering, from Vestfold University College (1998). CDR Isaksen holds the position as an ADL Staff Officer at the Norwegian Defense University College /ADL section, where he is responsible for leading and coordinating procurement, development and implementation of ADL projects. His military background is from the Navy, serving on submarines for six years as an electro engineer. He is a member of the NATO Training Group Task Group IT/ED since 2005, where he served as the ADL subgroup chairperson from 2007 to 2011. As the Norwegian ADL Partnership executive director and a member of the NORDEFCO ADL forum of experts, he works closely with international cooperation.

Siren Elise Frøytlog Hole has years of experience in design and development of online learning/courses and a background in digital marketing. She holds a BA in Culture and society, an MA in English literature and an MA in Science and technology studies. Hole is now a project manager and scriptwriter at Transform AS, where she works in close collaboration with NoDUC/ADL office, engaging in the production of e-learning courses from the beginning of the process until completion.

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BACKGROUND

This paper presents results from a collaboration between the Norwegian Defense University College (NoDUC) and Transform AS demonstrating how instructional designers can obtain authentic feedback from their learners regarding motivational design within an e-learning course. The first phase was covered in last year's I/ITSEC paper (Isaksen & Hole, 2015), titled "Hey, remember to add motivational design to your e-learning". Using the ARCS-V motivational model, developed by John Keller, as a theoretical starting point, the paper identified and showed how motivational design techniques are implemented in Norwegian defense e-learning courses. This paper is a continuation of this work, describing the design, analysis, and results of a pilot conducted in the Norwegian Army during the Spring of 2016 as the second phase of the project. Using the Experience Application Programming Interface (xAPI) as a method for retrieving information about learners' experiences, the trial focused on how to measure changes in student motivation during interaction with an e-learning course and how to use those results to evaluate the instructional and motivational design in the courses.

Transmedia learning

In 2013 NoDUC established a framework agreement for development of e-learning courses and digital learning assets with Transform AS. Since then, a main concern has included how to innovate our e-learning, by, for instance, making the courses more engaging and interactive using means such as motivational design and storytelling. The notion of transmedia learning provides a succinct overview of some of the aspects involved in our development. According to Raybourn, one part of transmedia learning is when multimedia are used *"to tell different stories but explore a core experience (common theme), which can be experienced through multiple narrative perspectives"* (Raybourn, 2012, page 6) and that *"Transmedia Storytelling is the system of messages that reveal a narrative or engender an experience through multiple media platforms, emotionally connecting with learners by involving them personally"* (Raybourn, 2012, page 9).

As documented in last year's I/ITSEC paper (Isaksen & Hole, 2015), the Norwegian Defense (NoD) e-learning courses produced in the last 2-3 years apply different techniques and several types of multimedia to engage and involve the learners. Actors are used to tell (or rather show) stories related to the work place or subject matter. Such stories underscore the relevance of the learning content, allowing the learner to recognize different situations and experience familiarity when going through a course. Furthermore, immersive technology lets learners explore and discover environments on their own, and high quality animations are used to explain advanced systems or complex ideas or concepts. Figure 1 shows two examples of transmedia learning elements from NoD courses. The screenshot on the left is from the Basic Introduction to Demolition (BID). Here, storytelling is used to give the learner a narrative experience in order to show how the subject matter is relevant for operation in planning. On the right, there is a screenshot from the Basic Submarine Safety course (BSS), showing advanced animations, used to explain compartments and levels in the submarine.
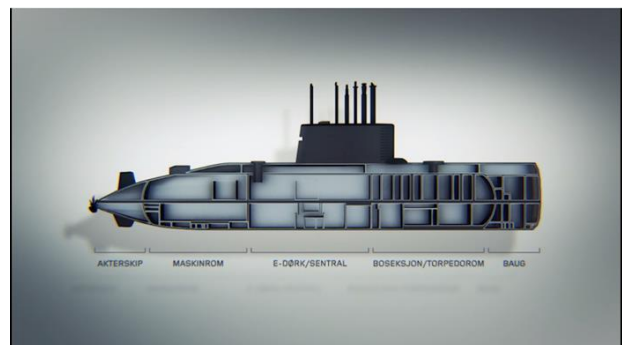

FIGURE 1. Example of transmedia e-learning from Norwegian Defense

Although the appropriate application of transmedia learning will engage, involve and motivate the learners, by using storytelling and emotions, it is important to use caution and not stun or overload the learner with too many digital instruments. Keller emphasizes this when he underlines the importance of *"aiming at keeping learner motivation at an acceptable level, were he/she is focused, energized, dedicated and persistent, maximizing their performance, all the way through an e-learning course"* (Keller, 2015, p. 18). Accordingly, transmedia learning should be used in combination with features that will emphasize learning content, while simultaneously affecting learner's motivation in a positive manner.

Motivational design

Learner motivation is a complex issue and a very important constituent of all types learning activities. Motivation influences engagement, cognitive efforts and thereby affects the ability to process information and construct knowledge (Garrison, 2011, p.89). While there are a number of studies on motivation, and the question of learner motivation presents a field on its own, an instrumental way to approach motivation in e-learning is to focus on certain factors and categories. This is due largely to the nature of the e-learning situation previously described by Isaksen et al. (2014, p.2): in basic e-learning the learner is usually left alone to interact with a PC, tablet or smartphone when going through a course.

Instructional designers have little to no control over factors external to the program that may influence motivation, like personal health and family issues, and must therefore focus on factors within the program with the capacity to influence the learner's motivation. Such factors include the amount of learning content, the way content is structured and presented, and the pace and paths of the learning experience. Thus, when instructors or Instructional Designers (IDs) are focusing on learner motivation, their time and efforts are better spent when concentrating on factors and aspects of the program which are controllable. The aim should be to develop content that capture the audience, nurtures his/her curiosity and are able to maintain a high level of motivation throughout the learning experience. Studies show that persistence in e-learning courses is higher if students are satisfied with the e-learning course itself and if they are happy with their academic achievements along the way (Gortan & Ereb, 2007).

Such findings emphasize the importance of making e-learning that has the right combination of multimedia, intuitive design, appropriate challenges and relevant feedback, factors that directly or indirectly affect learner motivation. A systematic way of doing this is found in Keller's macro model. With this model, relevant motivational elements are divided into five different categories: **Attention. Relevance, Confidence, Satisfaction and Volition** (Keller, 2015). These categories entail a number of questions that successfully aid the development of e-learning courses (Isaksen & Hole, 2015). Consequently, the ARCS-V model has been used by NoD during planning and development of e-learning courses since 2015, and is now an important part if the NoD course development methodology. The ARCS-V model consists of several key elements and examples the ID can use to structure his/her planning and (motivational) design.

Evaluation of motivational design in e-learning

Until now, there has been no real method, satisfying technical solution or incentive to collect real-time feedback about learner motivation in NoD. However, the introduction of the xAPI presents a technical solution and method for collecting such data. Since there now is an available method for collecting various real-time data about learner activities, questions arise as to what kind of information should be retrieved and with what purpose. When IDs use specific multimedia elements, stories, interactions and technique, to foster motivation, it is important and of great value to know whether such devices or techniques actually work. If the result is that students are dropping out before completing an e-learning course, or worse not retaining the information they are supposed to use to construct new knowledge, the people behind the course design need to understand how and why this happens. In cases where elements of an e-learning course do not work as intended, they need to be adjusted, changed or replaced. Otherwise, the consequence may be an e-learning course that costs a lot of time and money, but does not add value or help reach the overall effect and benefits for the organization. The point in question is how such cases can be uncovered. Can motivation and motivational design be measured or evaluated with the aim of improving learning content and tailor it to maintain learner motivation?

THESIS

The question "How can instructional designers obtain authentic feedback from the learners on how instructionally effective and motivating their design of an e-learning course is?" is a large one, and finding a procedure to approach it is a work in progress and a larger collaboration project between NoDUC and Transform AS. As a preliminary but practical phase in this work, we wanted to find whether xAPI can be applied and used as an instrumental method for retrieving information about learner motivation. This research was constructed as a proof of concept with two aims: 1) to validate whether xAPI can be used to collect data about learning motivation in real time; 2) to find whether such data can be used to identify how specific parts of

a course influence learner motivation, and by extension aid the IDs in their work with tailoring courses according to motivation and 3) to gather insight as to how the trial may be elaborated to collect more advanced and specific information about learning experiences.. The thesis was:

"By using xAPI to allow learners to self-report on their perceived motivation during an e-learning course, IDs can retrieve feedback on how multimedia elements, interactions and instructional techniques influence student motivation and thereby enable the ID to adjust or replace content."

E-LEARNING COURSE & TARGET GROUP

In 2014 NoD Logistic Training Center (NoDLTC) developed a training needs analysis (TNA) for ammunition safety training (Sandmo, 2014). The TNA documented that, prior to 2014, there was no common education, addressing ammunition safety in the armed forces (Sandmo, 2014, page 3). It was up to the local platoon leader and company commander to make sure that all personnel got the appropriate safety training. The TNA for the Basic Ammunition Safety (BAS) course was approved in October 2014, and the effect goal was to:

"Develop a course that will contribute to increase the general knowledge of ammunition safety in the NoAF, in order to avoid deviation from safety regulations and accidents". (Sandmo, 2014. Page 4).

Limiting the amount and planning the effect of learning content is a necessary process both for developing a motivational design and to reach an effect goal. When the development of the BAS e-learning course started early in 2015, the learning goals were further specified and optimized more specifically towards reaching the effect goal. In this process, Defense Subject Matter Experts (SMEs) worked closely with Transform AS in order to identify, select and concentrate the content and learning goals.

Target group
The BAS e-learning course is mandatory for all personnel in the NoD, including conscripts. The BAS course must be completed before participating in live firing at a firing range or a duplex field exercise with blank ammunition. For this project, conscripts between the age of 19-25 were chosen as participants. All young adults in Norway go through an evaluation and selection process, before about 25% of them are selected for a 12-month service in the Armed forces. The conscripts participating in this trial were all from the Norwegian Army, serving at the NoD Logistic Training Center (LTC) at Sessvollmoen Military Base outside Oslo. In May 2016, about 100 conscripts received an e-mail from their platoon leader, requesting them to take the online BAS course. They were informed that the course is mandatory, about the purpose of the evaluation and how it was to be conducted. By focusing on a small segment of the target group, the aim was to gather a manageable amount of data about this selection of participants and their perceived motivation for this specific course. Accordingly, the results of the trial could be used as proof of concept and as decisive information about the way ahead.

Basic ammunition safety course
The content of the course is ammunition safety and is structured by way of an introduction, four modules and a final test (Table 2, page 5). The learning path in the program is preset, and it has to be undergone sequentially. The test has to be passed with an 80% accuracy, in order to complete the course. The overall learning goals and expected learning outcome are:

FIGURE 2. Course film introduction

- To know about the different types of ammunition used in NoD.
- To understand how to identify different types of ammunition.
- To understand the basic safety rules when handling and using ammunition.
- To know about the basic routines and management regulations for ammunition.

Transmedia instruments and pedagogical principles in BAS course
The course was planned and structured with the aid of the ARCS-V model. The intent was to use a variety of interactive elements in order to influence learner motivation along the categories: attention, relevance, confidence, satisfaction and volition. Storytelling, real cases, animations and tasks were tailored to the topics in each module. Keller's categories were

TABLE 1. Key elements summarized

Module	Key elements summarized for each module
Intro	Real example from an unwanted dangerous event during an exercise; aim of the course and expected learning outcome.
1	Text to identify different types of ammunition; color coding of different types of ammunition and grenades.
2	The construction of hand weapon ammunition; when to use different types of ammunition; safety regulations for blank ammunition and safety procedures in general
3	Different types of hand grenades; safety regulations when using blank hand grenades and Unidentified Explosive Object (UXO) procedures.
4	Types of signal/smoke ammunition; when to stop an exercise; appropriate actions after accidental shot and return of ammunition.
Test	Final course exam

instrumental during development and gave the considerations seen in table 2, about how to activate and support the learning process and the learner's interaction with the content. The course features were planned according to an intended level of motivational impact. This scale is divided in three levels, High, Good and Low. High represents 4 or 5 stars and indicates a very high motivation. Good represents 3 stars and indicates an acceptable level of motivation, wilts Low represents 1-2 stars, indicating an unacceptable motivational level.

TABLE 2. Motivational elements and techniques summarized

Module	Motivational elements and techniques summarized	Intended motivational impact
Intro & 1	A "move trailer" showing a real example of how a squad of soldiers fired a live anti-personnel mine during an actual exercise. "What's in it for me" (Figure 2). Storytelling to show the correct way of retrieving ammunition. (Figure 3D) Interactive tasks used to explore different types of ammunition and color codes. (Figure 3A)	High on Attention High on Relevance Good on Confidence Good on Satisfaction Good on Volition
2	Animations used to explain the construction of handgun ammunition. Storytelling and questions, allowing the student to explore the safety regulations for blank ammo use and safety procedures Tasks and questions in combination with film examples, explaining considerations made and regulations for the use different ammunition types.	High on Attention High on Relevance Good on Confidence Good on Satisfaction Good on Volition
3	Animation combined with tasks, used to explain grenade types. (Figure 3C) Tasks and film used to explain safety and procedures when training with hand grenades. Storytelling to explain procedures related to UXO.	High on Attention High on Relevance Good on Confidence Good on Satisfaction Low on Volition
4	Animation used to explain about signal and smoke ammunition, combined with tasks. An interactive exercise task, challenge the learner to stop the film when a procedural error or dangerous situation is detected. (Figure 3D) Storytelling about accidental firing during an exercise. Film and questions used to display how to return ammunition.	High on Attention High on Relevance High on Confidence High on Satisfaction Good on Volition
Exam	A regular multiple choice based exam with 15 questions, including images, drag and drop and choose the right spot/picture	High on Attention High on Relevance Good on Confidence Good on Satisfaction Low on Volition
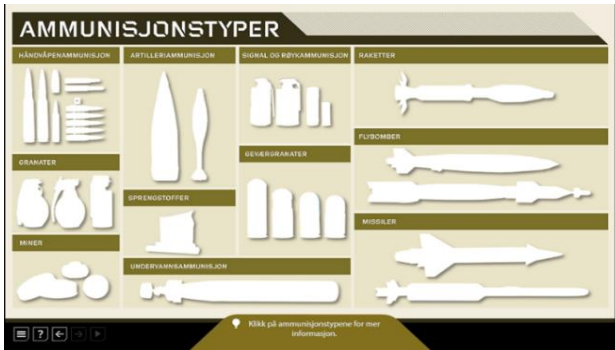
3A (Interactive poster explaining about types off ammo)

3B (Movie based task in Module 4, described in table 2)

3C (Types of grenades eplained with animations)

3D (Storytelling used to show correct procedures)

FIGURE 3A-D. Examples of transmedia elements in the BAS course. Interactive tasks, storytelling and animations

EVALUATION METHOD

Evaluation is an ambiguous term, denoting different practices and intentions depending on the field in question, context or even the individual practitioner (Phillips, McNaught & Kennedy, 2012, p.7). Finding an applicable method and technical solution for evaluation allowing us to conduct the proof of concept within the scope of the trial, was one of the initial considerations. The purpose of the trial was threefold: 1) to collect information about the learners' perceived motivation during their engagement with the e-learning course, 2) to find whether such data can aid IDs when considering improving a course, 3) to gather further experience for more specified and advanced evaluations in the future. Thus, our evaluation method had to be simple, easy to conduct, yet also flexible and possible to combine with other methods at a later stage.

Kirkpatrick's four-level evaluation model (Galloway, 2005, p. 21) is commonly used when planning evaluation. Kirkpatrick divides his model into four levels: (1) Reaction, (2) Learning outcome, (3) Change in behavior and (4) Results. The first level covers the learner's immediate reaction to the course, including satisfaction with motivational elements and instructional design. The second level is used to ascertain whether a course has led to an increase in knowledge, and is often done by testing learners on the course content. The third level conveys whether there has been a change in job-related behavior, and the fourth level documents whether the intended effect goals have been reached. It has been criticized for its simplicity (Galloway, 2005, p. 22-24), but this simplicity and the clear division between different levels can also be used purposefully when deciding the scope of the evaluation and delineating the data a small scale trial can aim at collecting.

The purpose of this project was to validate a proof of concept. Due to the timeframe and intended use of the findings, we have limited our use of Kirkpatrick's model to levels 1 and 2. Because poorly developed content in an e-learning course can both decrease learner motivation and reduce the learning outcome, the current phase in this project aims at capturing level 1: the learner's reaction. Additionally, the collected data can be linked to level 2: learning outcome. That is, level 1 is the primary focus, but since level 2 data is easy to retrieve from the exam, it is a valuable feedback on the course in general and can be used as an indication as to how well the learning content is communicated and transferred. Further, information about parts (if any) that reduce learner motivation and thereby influence the learning outcome negatively can be identified. The first level of Kirkpatrick's model is often regarded as a "smile sheet" that say nothing about the learning outcome (Galloway, 2005, p. 22). Nevertheless, through immediate feedback, course designers can gather information about learners' reception and about how valuable learners find the course. This information can be used to simply make changes in the course, but also to conduct

further explorations and data collection in order to specify what, how and why these elements need changing. In this case, the aim was to use immediate feedback from the learners about their perceived motivation, and then map out possible hypotheses based on the collected data. Furthermore, because the course in question has a final test, immediate feedback and test results can be compared in order to assess learning outcome. The conscripts participating in the trial had no prior knowledge of the subject matter, and they were not tested before taking the course.

Self-reporting solution

Through a self-reporting solution enabled by the xAPI specification, the learners taking the e-learning course in "Basic Ammunition Safety" are given the opportunity to rate their own perceived motivation. After each module, they are asked to subjectively rate their own motivational level, by choosing a number of stars between 1 and 5. If the learner rates his or her motivation to be 3 stars or more, the level of motivation is interpreted as being satisfactory or good. A learner with a good or satisfactory level of motivation will then be asked to specify why he or she experienced the module as satisfactory. The subsequent questions are asked in accordance with the ARCS-V categories as shown in figure 4A. When answering, students will indicate the extent to which they agree with each statement by choosing stars from 1-5. By contrast, if the learner rates his or her motivation to be 2 or 1 stars, the level of agreement is deemed poor, and the learner is asked to indicate why the module was not able to maintain their motivation (figure 4B).

FIGURE 4A. Example of the selecting 4 stars (high) and the follow-up questions.

FIGURE 4B. Example of the selecting 2 stars (low) and the follow-up questions.

Before the conscripts participating in the study get to continue to the next module, they have to evaluate their motivation. This is also the case after the test.

Data collection

Generally defined, "xAPI is a learning technologies interoperability specification that describes communication about learner activity and experiences between technologies" (Tin Can API, 2016). and enables more detailed and varied tracking than other specifications (e.g. SCORM specifications). The core of the xAPI specification is so-called "Statements", specific learning events that are translatable to the sentence "I did this". Broadly speaking, and simplified for the sake of brevity and the purposes of this paper, each statement needs an actor, a verb and an object. The actor refers to the agent who performed a task ("I" in "I did this"), the verb refers to the action ("did" in "I did this") and the object refers to the activity (or other) performed by the agent ("this" in "I did this"). While the xAPI specification can be added to collect data about any learning event, and potentially let instructors or others collect big data, the specification can also be used more purposefully.

For our proof of concept, we wanted specific data about participants' perceived level of motivation at specific places in the learning experience. The question concerning the participant's overall motivation was asked after each module and recorded according to the answers ("User X answered 'Evaluation 1: How is your motivation right now' with response '3/5'"), and the subsequent five questions appropriate for the number of stars selected, were asked and recorded accordingly ("Relevance" […] "The course content is relevant for me (4/5)"). This made it possible for us to collect data about the learners' immediate response about perceived motivation. Although the ADL has developed an excellent dashboard for creating reports, we had trouble using it for our purpose, and when getting our results, we made the reports manually. By extension and in the next phase of this project, information about specific interactive tasks (i.e. time used to complete each task, specific questions about a task, or follow-up questions to the questions concerning the five categories in the ARCS-V model etc.), can be tracked, and by using the dashboard, the data collection may be more advanced. Due to the scope and timeframe of the present trial, however, it was important to have a manageable amount of and a general set of data to work with.

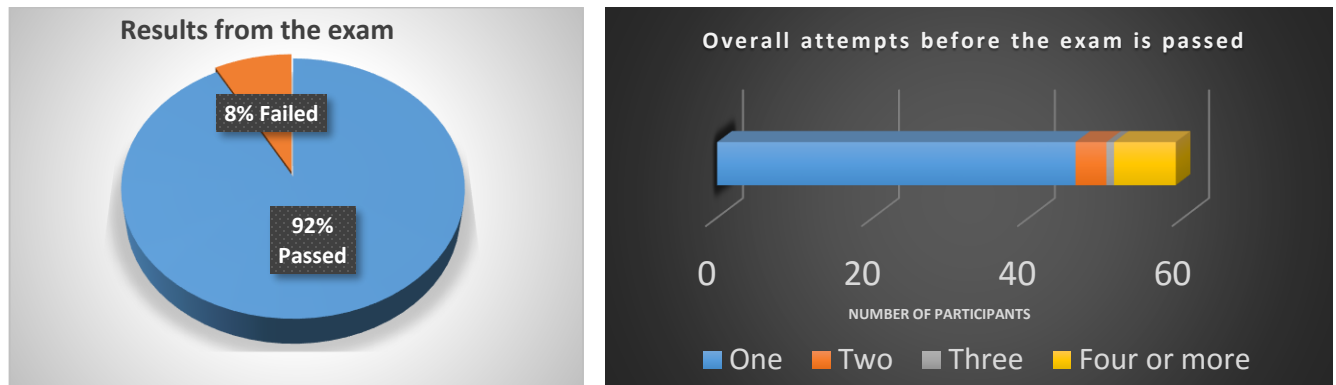## RESULTS, ANALYSIS AND DISCUSSION

FIGURE 5. Overall exam results

From the 100 potential participants receiving the e-mail instructing them to go through the course, we received 60 responses. The overall results from the trial indicate that the course in question, BAS, is able to capture and maintain learner motivation throughout the course. This is supported by the results from the average level of motivation (Figure 6), and by a high score on motivation for all the ARCS-V categories in each module (Figure 7). Despite the high level of motivation, however, the general shape of the curves in question, do show a slight decrease. These results thus correspond with earlier research on motivation and with theoretical assumptions made on the matter. According to scholars such as Keller, Garrison, and Clark, one of the most important and general questions regarding learner motivation is how to maintain it throughout a course (Keller 2010, Garrison 2011, Clark 1998). As discussed earlier, this is also one of the crucial challenges for instructors and IDs, and our entry point when conducting this proof of concept. The findings from the collected data thus verify the relevance of uncovering which elements in a course that work or do not, both for this specific course and in general.

Before looking at the results from the participants reporting a good level of motivation and discussing them in detail, some general points need to be made about the final exam in the program (Figure 5) and the participants that reported a low level of motivation. These results help substantiate and elaborate on how the learners' motivation change and vary through the e-learning course. As the results show, the vast majority of the participants in the trial were able to pass the final exam on their first attempt. This indicates that the instructional design supports the transfer of knowledge.

Overall motivational design analysis

The answers from 87% of the respondents show that their motivational level never was below 3 stars. None of the participants reported a low motivation throughout the entire course. 13% of the participants, however, perceived their motivational level as low, and answered with 2 stars or less after one, two or three modules in isolation. While the number of respondents reporting a low level of motivation is too few to make conclusive remarks about the reasons for the poor motivation, the answers give indications as to which modules that can be singled out as potentially having a lower motivational impact for some users. As shown in Table 3 these are module 3 and 4 (red numbers). The overall results retrieved from the responders answering with 3-5 stars, indicate a high level of motivation for the participants taking the course.

TABLE 3. Number of entries from respondents

Module	Respondents 1-2 stars	Respondents 3-5 stars
1	1	59
2	3	57
3	7	53
4	6	54
Exam	1	59

But the specific results still show a slight variation in the motivational level (Fig 7). These results indicate that the learners begin with a high level of motivation, with a slight decrease through module 2-4. At the end, after passing the exam, the motivational level increases again. Even though the overall motivational level never goes below 3,6 (Fig 6), yet the respondents' motivation trend downwards as they go through the course.

The fact that the participants start off with a high level of motivation, then perceive it to be a bit lower, and then experience an increase after finishing the test, might just confirm a general notion about learner motivation. Learners tend to be motivated when beginning a course, and then, for instance because the level of difficulty increases or the level of perceived novelty decreases and more effort is needed, the motivation is harder to maintain. After going through a number of learning activities, trying and failing, using efforts to understand and incorporate new information with existing knowledge, however, the learner is rewarded when completing the test. As a result, the level of motivation increases.
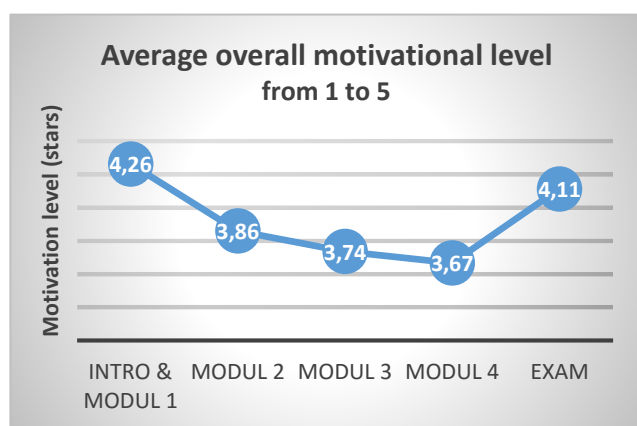
FIGURE 6. Overall trend in motivational change

More specifically, the very high score on motivational level after module 1 can be interpreted in light of the initial intended motivational impact (figure 6). By including a highly motivating movie to set the ground and capture the learner's attention, module 1 is supposed to boost the motivation and give the learner a "flying start". While the rest of the modules do use movies, these do not include storytelling to the same extent. Rather, in the remainder of the modules film is used more instructional, included to show concrete situations like handing over unused ammunition (Fig 3 screenshot D). Looking at the results from this perspective, suggests that the use of film and storytelling in module 1 is an effective motivational device. To validate this finding, however, more detailed questions and research would be needed. Furthermore, the participants' perception of their overall motivation indicates that there are elements in module 2, 3 and 4 that affect learner motivation, and cause a slight decrease in how satisfied the participants are with the course. This decrease can be caused by factors such as 1. the choice of multimedia elements, 2. The structure of the modules, 3. the amount of feedback, 4. the interactive tasks, 5. the navigation, 6. other features of the program or 7. The amount of text. The nature of the general data collected cannot reveal any certain tendency or answers about which of these factors (if any) are predominant or decisive for motivation, but the results disclose a necessity to look further into each module. The data from the subsequent questions can be used to analyze and discuss ways in which module 2, 3 and 4 can be improved, and demarcate a plan for how all of this can be researched further.

Results from ARCS-V Categories
When looking at the content in each module in context of the results from the data collection, the categories from the ARCS-V model make it possible to draw more conclusions, albeit yet indecisive, about how effective or motivating the program is and why. To explain the slight decrease from module 1 to 4, we need to take a closer look at each category in the ARCS-V model.

As seen in figure 7A, the learners report that the course is able to maintain their **ATTENTION** throughout the course, but also has a minor decrease in module 4. As expected (Table 2) the variation of different types of engaging multimedia elements, tasks and film with storytelling, seems to secure the learners attention throughout the course.

RELEVANCE has the highest score and never drops below 4. As mentioned before, module 1 starts off with a motivational trailer showing the learners how lack of knowledge, in worst case, can result in death or serious injuries among fellow soldiers. The situation illustrates the importance of acquiring the knowledge, and the learner is explicitly showed "what's in it for me". When interpreting the data in this context, this effect is likely to be the reason why the introduction/module 1 has the highest score in relevance, and why the score remains high throughout the course.

In general, the respondents report a level of **CONFIDENCE** slightly above acceptable. At the same time, the data from the confidence category show the lowest score from all the collected data (Fig 7C). Self-confidence and self-efficacy are areas
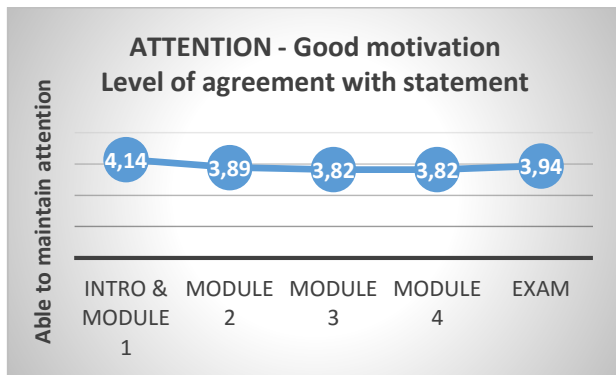
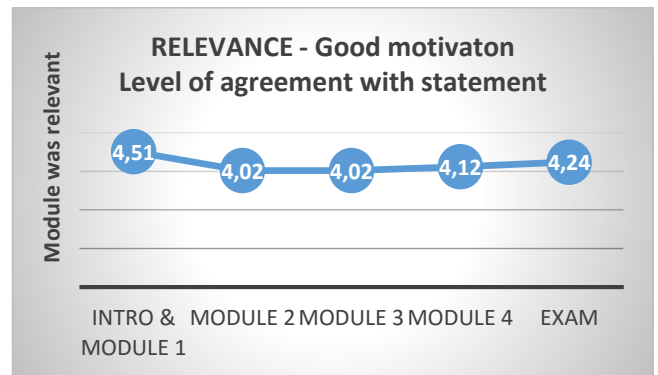**FIGURE 7A. Overall trend in motivational change**
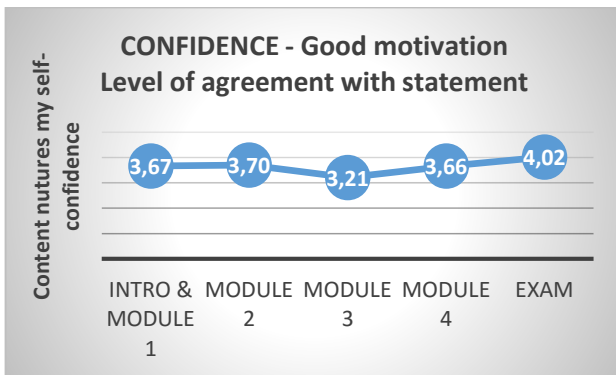
FIGURE 7B. Overall trend in motivational change

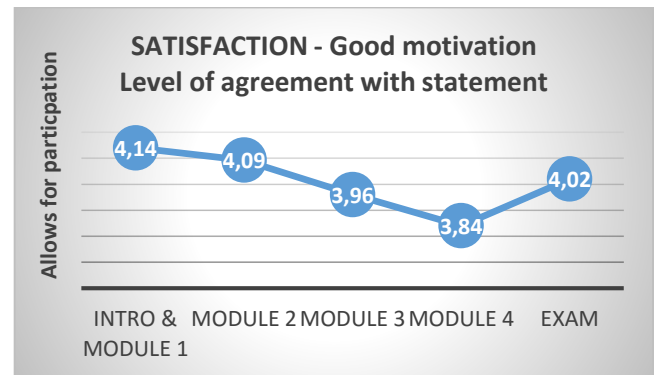**FIGURE 7C. Overall trend in motivational change**

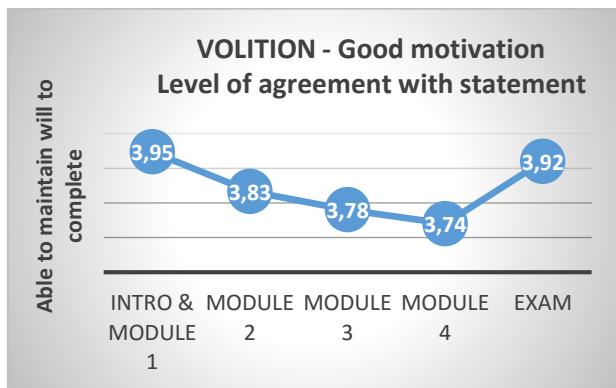**FIGURE 7D. Overall trend in motivational change**

FIGURE 7E. Overall trend in motivational change

with great individual differences. Where one person can be overconfident, another can undervalue him- or herself. Despite individual differences, however, the marked decrease in the average level of confidence, urge us to consider reasons why. One reason may be that the severity of the general subject matter causes fear of missing something crucial or misunderstand certain rules or procedures. This can make the learners uncertain about their ability to learn what is required and necessary to avoid accidents. These findings indicate a need to consider an inclusion of certain means to reassure the learner. More specifically, the level of confidence reported from module 3 shows the lowest score from all the recorded data. This draws attention to whether there are elements in the module causing the learner to feel less confident.

One issue might be the way in which the subject matter is communicated. When going through the rules for safety regulations for exercise grenades, the learners are supposed to learn this by finding the right answers on their own, choosing from a set of answers, without having gone through the specific information first. These kinds of tasks may increase the number of wrong answers, a demotivating factor for some learners.

At the same time, tasks with an appropriate level of difficulty and positive feedback seem to secure an acceptable level of confidence during the entire course. This falls in line with the expectation that the motivational impact on the confidence category would be good or above (table 2). Module 4 presents an exception, however. The motivational impact was thought to be very high (4-5), but the level of confidence reported from the respondents was 3.66. In module 4 the learner is introduced to a new type of interactive task, and we expected this to have a very positive effect on the motivation. By using film-based

storytelling, the learner is challenged to stop a situation if he/she detect a breach in regulations or a dangerous occurrence (Fig 7B). If the learners miss the situation, the program stops and explains what he/she failed to detect. There are responses relaying all necessary information whether the learners detect the situation in time or not. Accordingly, it is possible to miss all the situations and still be allowed to continue. The learner will be informed what he/she should have detected and why. Such a learning path will give some learners an experience that have a negative impact on their confidence and thus motivational level.

Even though **SATISFACTION** has a high score throughout the course, a significant drop is recorded after module 3 (fig 7D). Module 3 continues to focus on safety regulations, a topic that may be considered necessary but somewhat "boring". Module 3 also includes less activating tasks, and includes an expository animation about the technical construction of the hand grenade DM68. Together these factors leave the learners more passive than in the preceding modules. The reduction in activity could be one of reasons why the level of satisfaction decreases after module 2. The lowest score in this category is recorded after module 4. The somewhat complex stop exercise, discussed earlier, could also be perceived as too difficult by some learners and consequently decrease the satisfactory level.

VOLITION is mainly about learners maintaining their strong intentions of completing the course and allowing them to take actions and self-regulate during the course. As found in last year`s I/ITSEC paper, the volition category can be a challenging one when it comes to e-learning (Isaksen & Hole, 2015). Accordingly, this level was expected to receive a lower score than the other categories. More specifically, the decrease perceived will to finish the course after module 1 and throughout the course was partly expected because of the linear learning path and the fact that the learner has to watch all the films and animations in order to continue. On the other hand, the course navigational design allows for repetition of content and modules and pausing the course, features that give the learner some degree of control.

SUMMARY & CONCLUSION
The aim of this project was threefold: 1) to collect information about the learners' perceived motivation during their engagement with the e-learning course, 2) to find whether such data can aid IDs when considering improving a course, 3) to gather further experience for more specified and advanced evaluations in the future. The assumption was that such information would enable IDs to adjust or change multimedia elements or content that have a negative impact on learner motivation. In course of the trial we have 1) succeeded using a method where the learners can self-report on their perceived motivation, 2) gathered data and indications as to how certain parts of the course and motivational design might need improvements or adjustments.

While the number of respondents is lower than it could have been in a more advanced trial, their answers and the results have given us specific indications about which modules the learners regard to have a negative impact on their motivation. This feedback enables us to look further into what kind of tasks, concept and motivational elements that can be improved in future course revisions. One example is the interactive "stop the situation" task in module 4 (fig 3 screenshot B)). This task presents an instance where the learner's level of confidence and satisfaction seems to have been negatively affected

Based on this trial and our findings, xAPI represents a suitable technical solution and method for analytics of instructional- and motivational design in e-learning. xAPI gives the opportunity to track an endless range of information about learning experiences from an e-learning course. However, in order for the data not to become superfluous, the information that is tracked should be defined according to the intended usage and purpose.

WAY AHEAD
An extension of the work underdone in this trial could be to ask the learners to evaluate and self-report using smaller segments of the course, such as specific interactive tasks, multimedia elements, amount of feedback, wording or even structure, and tracking their responses. Having gained some experience using xAPI, this kind of elaboration will be considered as a next phase in our research on tracking using the xAPI specification. As such, IDs can obtain more detailed information and immediate feedback from the learners, and more insight about the motivational design etc. Advancing on the amount and nature of the data we track, however, will require a more advanced and functional reporting system. Thus, we will look further into the use of the dashboard developed by the ADL Initiative. Another approach we will consider, however, is to conduct in-depth interviews with the participants in the trial, in order to uncover more details about our data and seek more certain answers to the questions posed about module 3 and 4 specifically. Regardless of the approach, however, the continuation of the collaboration project, the results from presented pilot will be used to refine and advance a potential procedure for evaluating and revising our e-learning programs, optimized for the learners' needs and motivation.

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