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From face-to-face to e-learning

by

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From face-to-face to e-learning

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Abstract

The aim of this project is to evaluate whether the e-learning material, that has been converted from face-to-face course material to e-learning material on the basis of the revised version of Bloom's taxonomy and learning strategies, is pedagogical in the sense that the students realize the categories of the three domains of learning in Bloom's taxonomy.

To achieve the aim of this project a face-to-face course will be converted to an e-learning course; that will then be evaluated. The results show that the e-learning material is pedagogical in the sense that the students realize the categories of the three domains of learning in Bloom's taxonomy, and the discussion indicates that the material is pedagogical to a certain extent. That is, some categories and aspect of the three domains of learning appear to have been realized, for example remembering, understanding, practicing, and adapting. The report includes a discussion on positive and negative aspects concerning attention, motivation, imitating, etc.

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1 Introduction
Over the last few decades the technological development has skyrocketed and made its way into our homes, schools and workplaces. There are many areas of use for this technology, for example it can be a tool to simplify the daily life, a way of communication or a source of information. Human kind appear to strive for knowledge in different ways in order to make our daily lives better and sometimes simpler and even thought the technological development has reached further than before, humans still search for more information and knowledge. They also search for a way to distribute this knowledge or information to other people who can benefit from it and today technology is a part of that distribution.

SAAB is a global company with around 14000 employees (Saabgroup, 2012) all over the world working on a vast amount of different projects. That means that there is a vast amount of information circling that needs to be distributed to the right people at the right time. The use of digital equipment for the transfer of information has decreased the costs somewhat but there appear to still be some areas in which the costs are high and possibly could be more cost efficient, for example “in-company” courses. To develop ones skills can be crucial to achieve goals or perform some tasks and to do so SAAB provides courses in the necessary areas. Some of these courses are so called “face-to-face” courses which are occasions when there is a teacher standing in front of a class trying to communicate the important information to the students. These face-to-face courses demand a lot of time and are costly for the company.

In today’s era of technology there is the possibility of using e-learning, digitalized courses that can be used on the students own terms (time wise). There is no need to book a classroom or conference room, there is no need to take a day or two away from the office to attend the course and the course can be completed almost anytime and/or anywhere. There may of course be some restrictions due to security and there might also be a time limit depending on at what time the knowledge that is supposed to be obtained is needed for different work purposes. To design completely new e-learning courses takes time and may not be as cost efficient as would be preferred, especially when there are face-to-face courses that have all the information that is required. The idea behind this project is to use the information already provided in the face-to-face material and use it for e-learning courses. SAAB would like this new e-learning material to be pedagogical in the sense that the students are achieve the learning objectives and are motivated to do so. To achieve the pedagogical aspects learning taxonomies are to be used and for this particular project Bloom's taxonomy of learning has been chosen as it considers not only the cognitive skills but also affective aspect and physical skills (O'Neill & Murphy, 2010).

1.1 Aim/goal
The aim of this project is to evaluate whether the e-learning material, that has been converted from face-to-face course material to e-learning material on the basis of the revised version of Bloom's taxonomy and learning strategies, is pedagogical in the sense that the students realize the categories of the three domains of learning in Bloom's taxonomy.
1.1.1 Research Questions
How does the e-learning material, that has been converted from face-to-face course material to e-learning material on the basis of the revised version of Bloom's taxonomy and learning strategies, realize the categories of the three domains of learning in Bloom's taxonomy?

a) How are the seven categories of Bloom's revised cognitive domain (remember, understand, apply, analyze, evaluate and create) realized in the e-learning material based on the perspective of the intended users?

b) How are the five categories of Bloom's revised affective domain (attention and awareness, reaction and motivation, valuing, organization, and characterization) realized in the e-learning material based on the perspective of the intended users?

c) How are the four categories of Bloom's revised psychomotor domain (observing, imitating, practicing, adapting) realized in the e-learning material based on the perspective of the intended users?

1.2 Limitations
When appropriate and necessary the constructed method has to follow the Swedish Armed Forces’ guidelines for e-learning and ADL (advanced distributed learning) due to the method being developed for SAAB AB.
2 Learning
Every day people discover and learn something new and will most likely continue doing so, but what is learning? According to the Oxford dictionaries (OED Online, 2014) learning is defined as “the acquisition of knowledge or skills through study, experience, or being taught”. That’s a wide definition and the acquired knowledge can be as simple (perceived simple or mundane) and ordinary as how to boil water or as complex as how to model oscillation in a bathtub. To get a better idea of what learning is, an attempt to answer how and why we learn is made below.

2.1 How do we learn?
When trying to explain how a person learns there are several areas to consider like for example the neurological or brain area (how learning occurs in the brain, which nodes need to connect) or the ideas and strategies used when acquiring knowledge. There are several theories and ideas of how we learn in circulation and some of them contradict each other and some of them are connected to the debate of nature versus nurture (Krishnan & Carey, 2014). There are developmental psychologists that believe that humans have functions or mechanisms that are innate (Spelke & Kinzler, 2007); that we are born with for example the ability to learn or process sensory input. The opposite point of view refers to the idea of tabula rasa, i.e. that a person is born as a blank slate and learn as he or she interacts with the environment (Sternberg, 2009). This would mean that a person does not inherit characteristics from predecessors, nor would emotions be innate.

Krishnan and Carey (2014) suggest that perhaps neither tabula rasa nor the idea that we are born with built-in functions for learning is favorable on their own, but a combination of these points of view is to be preferred. This would entail that a person may acquire knowledge with the help of innate functions while interacting with the environment (Perruchet & Pacton, 2006), for example when identifying the use of a "new" word or a new meaning of a word. This may even have occurred without the intent to learn.

No matter which approach (innate functions and mechanism, tabula rasa or a mix) that is followed there are some aspects of how a person learns that they all have in common (Krishnan & Carey, 2014); the physical aspect, i.e. that neurons transmitting signals between each other. In our brain there are over billions of neurons that communicate with each other to convey messages through electrical pulses and chemical reactions (Sternberg, 2009). These messages can be used to convey knowledge. Whenever we acquire new information and learn something the brain "changes" (the information is stored and programmed into the brain) and this is referred to as the brain plasticity (Krishnan & Carey, 2014). The storage of information is not something we learn as we grow up (which goes against the idea of tabula rasa), but is an innate function supporting the notion of having built-in functions from birth. These processes are often unconscious and are therefore not reflected upon even though they may be of importance (Krishnan & Carey, 2014). Learning is one of these processes, although we know that we have acquired new knowledge we have not decided how and where to store the information.
The how and where we store this newly acquired knowledge differs for children and adults. Children have a higher brain plasticity (Krishnan & Carey, 2014) and during parts of childhood they learn a high speed by interacting with things around them, for example by interacting with people or their environment (which to a certain degree is associated with the idea of tabula rasa). Adults on the other hand don't appear to have the same ease of learning nor the same high plasticity. An example of this can be seen in connection of aphasia. Children who suffer a brain injury may not develop as a severe outcome as an adult who suffers the same injury but later in life (Bates, 1999). This indicates that there is a change or a difference in our brain from childhood to adulthood on the information we acquire (Lu, et al., 2007). Learning a new language is an example of this; where it is suggested that it becomes harder to learn another language over time (Zevin, 2012), which needs to be considered when for example creating a course. There could be individual differences in how the brain store the newly acquired knowledge, but what is learned may also be affected by why we learn.

2.2 Why do we learn?

The answer to why we learn is difficult to generalize as there can be several aspects to consider, like for example motivation, individual and common goal, and interests. Krishnan and Carey (2014) summarized it as a want for an outcome that requires the new knowledge. Out of the four examples (mention above) of aspects to consider, motivation could be seen as the highest contender, since motivation can be seen as the effort and attention that an individual gives in pursuit of a goal (Öhman, Flykt, & Esteves, 2001). Every person has his or her individual goals or personal reason to learn something new that motivate them to pursue this new knowledge. Dayan and Daw (2008) points out that a common motivator to why we learn is the reward. A reward is a wide term that can refer to for example monetary reward, social rewards, personal accomplishment, work related achievements, and dopamine release. Sometimes however; the motivator isn't reward but curiosity or the fear of defeat or even ridicule (Cross, 2004).

Fear is an emotion that appears to affect us more than some of us might admit. Emotions affect human beings both consciously and unconsciously, and they also influence some cognitive function like reasoning (Phelps, 2006) but also attention and awareness (Öhman, Flykt, & Esteves, 2001). An example of this is the so called "cocktail party effect" that in which a person can his or her name being mentioned in a static of stimuli (Sternberg, 2009, p. 152). According to Phelps (2006) emotions and personal value affect awareness, as well as attention. That indicates that if your personal values and goals in life affects the reasons to why we learn.

Most people are driven and motivated by personal individual goals and these goals may have to be linked to common goals of a company, organization or perhaps even a specific course. A common goal is as it sounds a goal that is to be strived for by more than one individual. It could for example be goals that are specific to a company, an organization, or a course. In the case of a company or an organization that is a person's work place it is important to keep in mind that there can be other goals and motivational factors (as mentioned above) that could affect the common goals or a main goal of a course.
After trying to get a better idea of what learning is by answering *how* and *why* we learn, how would learning be defined?

### 2.3 Definition of learning

The pedagogical view within the Swedish Armed Forces assumes that learning is a process, that it is created by the individual and that it is a process which alters understanding of a problem or a phenomenon (Lindholm, 2006). This correlates with the definition of learning according to the Oxford dictionaries, but within the pedagogical view of the Swedish Armed Forces there is a drive to ensure the students match the common goals of the company. Learning will in this report therefore refer to the acquisition of knowledge through common goal or company driven courses, i.e. via the information taught in courses provided for employees at a specific company (like the Swedish Armed Forces, or in this case, SAAB).

As mentioned earlier are several areas to consider when trying to explain how and why learning is achieved, but there is one aspect relevant to this report that is yet to be discussed; the ideas and strategies that individuals use to learn as well as how they can be seen as a motivation to learn. This report will now shortly look at different learning taxonomies, but with a main focus on Bloom's taxonomy (Bloom, 1956), followed by some ideas and strategies that individuals appear to use to acquire desired knowledge.
3 Learning Taxonomies

Taxonomies of learning are classifications of different types of characteristics and behaviors of learning and specifically learning outcome. The idea of a learning taxonomy is that the students attending a course is to develop the behaviors and characteristics described in the taxonomy in connection to the of the learning outcomes (or learning objectives).

In this project there is a wish from the external employer for an e-learning material that is pedagogical in the sense that there is a focus on the students' learning outcomes. The work and material also had to follow the Swedish Armed Forces’ guidelines for e-learning and ADL. Three different taxonomies, that have a student-centered focus, will be presented below.

The first taxonomy to be presented is the SOLO taxonomy (Structure of Observed Learning Outcomes) developed by Biggs and Collins (Atherton, 2005). The SOLO taxonomy describes how the level of complexity increases for a student's understanding, and is regularly used within universities and other form of Higher Education (Atherton, 2005). The taxonomy consists of five levels of complexity presented in Table 1 from to the simplest to the most complex. To progress to another level the criteria for the previous levels have to be met. It is worth mentioning that not everybody reach the all the levels.

Table 1. The categories of the SOLO taxonomy. Presented in order from the simplest to the most complex.

<table>
<thead>
<tr>
<th>SOLO Taxonomy</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Structural</td>
<td>No knowledge on the subject</td>
</tr>
<tr>
<td>Uni-Structural</td>
<td>Very few aspects of the subject are known (list, recall)</td>
</tr>
<tr>
<td>Multi-Structural</td>
<td>Several aspects of the subject are known (classify, describe)</td>
</tr>
<tr>
<td>Relational</td>
<td>The aspects are integrated into structures and can be view in relation to the whole picture (analyze, explain)</td>
</tr>
<tr>
<td>Extended Abstract</td>
<td>Knowledge is generalized and connections can be made to new areas/subjects ( theorize, reflect)</td>
</tr>
</tbody>
</table>

The second taxonomy is Finks Taxonomy (Fink, 2003) impart the structure to develop or redesign course content as well as assessing higher-order thinking. This taxonomy consists of six different levels, presented in Table 2 that are all interactive, which means that there is no hierarchy to follow and that all the levels can encourage each other (Fink, 2003).
Table 2 The categories of Fink’s taxonomy of significant learning. Presented in order from the simplest to the most complex.

<table>
<thead>
<tr>
<th>Fink’s Taxonomy</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundational Knowledge</td>
<td>Remember and understand (list, describe)</td>
</tr>
<tr>
<td>Application</td>
<td>Skills, critical and creative thinking (analyze, apply)</td>
</tr>
<tr>
<td>Integration</td>
<td>Make connections (integrate, describe)</td>
</tr>
<tr>
<td>Human Dimensions</td>
<td>Knowledge about self and others concerning in regards to learning (assess, reflect)</td>
</tr>
<tr>
<td>Caring</td>
<td>Motivation, emotions, interest, values (interpret, reflect)</td>
</tr>
<tr>
<td>Learning to learn</td>
<td>Long-term learning, becoming a self-directed learner (analyze, critique)</td>
</tr>
</tbody>
</table>

The third and the most commonly used (O’Neill & Murphy, 2010) taxonomy is Bloom’s Taxonomy developed in the middle of the twentieth century (Bloom, 1956). This was the taxonomy chosen for the thesis as it considers the physical skills of a person (the psychomotor domain) and how those skills are obtained from the beginning to the end (Simpson, 1972), which can be seen as a form of unconscious mastery (O’Neill & Murphy, 2010). The face-to-face course that is to be transferred to e-learning does not have a close connection to this domain, there is a belief that it is of use for other courses that will use this thesis as a base. Bloom’s taxonomy will now be explained below along with different knowledge types that can be connected to the taxonomy.

3.1 Bloom’s Taxonomy

Bloom’s taxonomy of learning (Bloom, 1956), is a theory and taxonomy that is widely used (Anderson, et al., 2000) and can be considered easy to understand as the main idea is that learning is a process after which the individual has acquired new knowledge, skills or attitudes. This correlates with the pedagogical view of Swedish Armed Forces where it is also assumed that knowledge and learning is a process that alters an individual’s understanding of certain information, problem or skills (Lindholm, 2006).

According to Bloom’s taxonomy there are three domains of learning: cognitive, affective and psychomotor. However Bloom focused more on the first two domains, cognitive and affective and overlooked the psychomotor category somewhat. Simpson (1972) argues that the psychomotor was overlooked since Bloom was believed to have a lack of experience in teaching manual skills. The psychomotor category was later further developed by other researchers like Simpson (1972), Dave (1975) and Harrow (1972). To clarify the taxonomy the different domains will be further explained.

The domain Cognitive refers to mental skills (Bloom, 1956), for example pattern recognition or recall. Within this category there are six categories that can be interpreted as levels of difficulty; knowledge, comprehension, application, analysis, synthesis and evaluation. It is believed that the first (or previous) level has to have been activated before the next can activate. The taxonomy was in the mid-1990s revised and various changes were made to the categories. There are according to Anderson et al. (2000) mainly two changes that stand out;
the names were altered from nouns to verbs and the rearrangement of the two most complex categories. That gave a taxonomy that is described in Table 3, in order from the simplest down to the most difficult or complex.

Table 3. The categories of the cognitive domain of Bloom's taxonomy. Presented in order from the simplest to the most complex.

<table>
<thead>
<tr>
<th>Taxonomy 1956</th>
<th>Revised taxonomy 2000</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Remember</td>
<td>Recollection of already acquired information (recognition, recall)</td>
</tr>
<tr>
<td>Comprehension</td>
<td>Understand</td>
<td>Understand and comprehend problems (meaning, interpretation, etc.). Ability to state a problem. (Interpreting, exemplifying, classifying, etc.)</td>
</tr>
<tr>
<td>Application</td>
<td>Apply</td>
<td>Practically using the acquired knowledge in a different situation (ex. knowledge from a course being used in work, executing, implementing). To organize the different information to understand its structure and to be able to make distinctions between them (differentiating, organizing, attributing).</td>
</tr>
<tr>
<td>Analysis</td>
<td>Analyze</td>
<td>Access the value of the information (checking, critiquing).</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Evaluate</td>
<td>Create new information (ex. meaning, structures and/or problems) by putting different pieces of information together (planning, generating).</td>
</tr>
</tbody>
</table>

The second category of learning according to Bloom (1956) is the Affective domain, which concerns the emotionality of the information, i.e. the feelings, motivations or attitude the person has towards the acquired knowledge. Five categories can be extracted from the Affective category (Krathwohl, Bloom, & Masia, 1973) and they are listed in Table 4, Table 4 in order of difficulty (from the easiest to the most difficult).

Table 4. The categories of the affective domain of Bloom's taxonomy. Presented in order from the simplest to the most complex.

<table>
<thead>
<tr>
<th>Taxonomy 1973</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiving phenomena</td>
<td>Attention and awareness</td>
</tr>
<tr>
<td>Responding to phenomena</td>
<td>Motivation and reactions</td>
</tr>
<tr>
<td>Valuing</td>
<td>Personal value of received information (ex. acceptance)</td>
</tr>
<tr>
<td>Organization</td>
<td>Organizing, comparing and relating values to each other</td>
</tr>
<tr>
<td>Internalizing values</td>
<td>Creating a personal value system that controls a person's behavior, (characterization)</td>
</tr>
</tbody>
</table>

The third and final category of learning according to Blooms taxonomy (Bloom, 1956), Psychomotor examines the physical skills a person possesses like for example coordination and movements (Simpson, 1972). This category also holds a few categories that are listed in Table 5, in order of difficulty starting with the simplest.
Table 5. The categories of the psychomotor domain of Bloom's taxonomy further developed by Simpson (1972), Dave (1970), and Harrow (1972). Presented in order from the simplest to the most complex.

<table>
<thead>
<tr>
<th>Taxonomy Mix</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observing</td>
<td>Observing behavior of another person or persons</td>
</tr>
<tr>
<td>Imitating</td>
<td>Copying behavior of another person or persons</td>
</tr>
<tr>
<td>Practicing</td>
<td>Repeatedly performing skills and movements to become automatic</td>
</tr>
<tr>
<td>Adapting</td>
<td>Skills can be modified to comply with different circumstances and/or requirements</td>
</tr>
</tbody>
</table>

In addition to the three domains of learning that concerns the process and skills of the individual there are also different types of knowledge that relate to what type of information that is to be acquired/learned. These will be presented below follow by their connection to Bloom's taxonomy.

### 3.1.1 Knowledge types

According to Bloom's Taxonomy there are three types of knowledge; knowledge of specifics (e.g. facts and terminology), knowledge of how to deal with specifics (e.g. conventions, methodology and classifications) and knowledge of universal and abstractions in the field (e.g. principles, generalizations and theories) (Krathwohl, A Revision of Bloom's Taxonomy: An overview, 2002). These knowledge types where revised along with the rest of the taxonomy and in his article Krathwohl (2002) states that there are four knowledge types that should be considered instead of three. The first three knowledge types are almost identical to the three types in Bloom's taxonomy, but the forth types provides information that was not as acknowledged when the taxonomy was developed.

The first knowledge type according to Krathwohl (2002) is *Factual knowledge* and it refers to the basic facts or elements that are needed for a basic understanding and basic problem solving ability within a field. The second knowledge type, *conceptual knowledge*, administers the relationship between the elements or facts and the knowledge on how they function together. *Procedural knowledge* is the third knowledge type and has to do with the theoretical perspective of how to follow a procedure or method, i.e. the knowledge on how to do something. The fourth and final knowledge type and the newest addition to Bloom's taxonomy according to Krathwohl (2002) is *metacognitive knowledge*. Metacognitive knowledge is a person's comprehension of his or her own cognition, such as self-awareness. Metacognitive knowledge can also be the understanding of cognition in general, such as strategic knowledge or knowledge of cognitive tasks.

When discussing the knowledge types and the categories of the cognitive domain Krathwohl (2002) indicates that objects (such as learning objective or learning goals) could be represented both in the categories and in the knowledge types, thereby creating a form of two-dimensionality. Krathwohl (2002) takes this further by using the categories of the cognitive domain and the knowledge types in a two dimensional table (see Figure 1) in which the learning objectives can be placed by using the nouns (or noun phrases) and the verbs. As an example let's use the learning objective "recall the parts of an oven". The verb "recall" is part
of the category knowledge/remember and the objective should therefore be placed in column 1 in the table (Figure 1). The noun phrase "the parts of an oven" refers to specific facts about an oven, i.e. factual knowledge which places the objective on the first row. Combining these two give a location of 1.1 (row 1. column 1), which is marked with an X in the table (Figure 1). If all categories of the cognitive domain and all knowledge types are to be part of for example a course then the table can deliver a view of what is or isn't included. It should be noted that not all categories nor all knowledge types need to be present in a course, only those that are relevant for the student to be able to achieve the learning objectives of the specific course.

<table>
<thead>
<tr>
<th>Remember</th>
<th>Understand</th>
<th>Apply</th>
<th>Analyze</th>
<th>Evaluate</th>
<th>Create</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factual knowledge</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conceptual knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procedural knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metacognitive knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Figure 1. Example of placement in a Taxonomy matrix, (Krathwohl, 2002)*

The use of learning objectives to measure the learning outcomes of the students can be useful, but to be able to present the material in an appropriate manner; ideas and strategies that individuals appear to use to acquire desired knowledge need to be addressed.
4 Learning strategies

There are several ways of gathering knowledge and people learn in different tempos as well as with different methods and tools (Marton, 2005). These methods are referred to as learning strategies, but what do they entail? A learning strategy is a simple technique that could be used to improve a student's learning outcomes (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013) as well as support cognitive processes (Magana, 2014).

When choosing which strategies and methods to focus on, Bloom's taxonomy can be made use of. Information associated with the categories that concern more passive behavior or a lower level of performance, for example remembering (recognition or recall) in the cognitive domain or attention and awareness in the affective domain, can normally be taught with more passive strategies like a listening to a lecture (Clark, 2001).

Categories of a higher level complexity, on the other hand may demand more interaction from the student, like activities that could include strategies such as coaching or self-study (Pohl, 2000). It is important to note that just because a category be referred to as a category of lower or higher level of performance does not mean that the strategies used have to be of a complexity that matches the level of the category. Some behaviors and actions may be automated and would therefore appear as simpler than they may be and vice versa (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013). Which strategy to choose depends upon the learning objectives and to which category of the learning domain the objectives can be connected to. Table 6 is used to illustrate how to choose a strategy based on Bloom's taxonomy and the strategies mentioned in Ekwensi, Moranski and Townsend-Sweet (2006) book on e-learning concepts and techniques.

Table 6. The distribution of learning strategies based on the categories of the three domains of learning in Bloom's Taxonomy.

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Cognitive Domain</th>
<th>Affective domain</th>
<th>Psychomotor domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio/visual, reading, guided observation</td>
<td>Remember</td>
<td>Receiving phenomena</td>
<td>Observing</td>
</tr>
<tr>
<td>Discussions, reflections, case studies, CBT</td>
<td>Understand, Apply</td>
<td>Responding to phenomena</td>
<td>Observing, imitating</td>
</tr>
<tr>
<td>On-the-job training, practice by doing</td>
<td>Analyze</td>
<td>Valuing</td>
<td>Imitating, practicing</td>
</tr>
<tr>
<td>Informal learning (self-study, trial and error)</td>
<td>Evaluate</td>
<td>Organization</td>
<td>Practicing, adapting</td>
</tr>
<tr>
<td>IRL, High level activities</td>
<td>Create</td>
<td>Internalizing values</td>
<td>Adapting</td>
</tr>
</tbody>
</table>

These strategies can be used as a help or a guide when choosing what media to present the material in, which in turn may result in the student reaching the learning objectives both in classroom teaching and through e-learning courses.
5 E-learning

E-learning is learning through or with the help of electronic resources (Alonso, López, Manrique, & Viñes, 2005) like ICT, for example an internet course or a CD-ROM with the course. How e-learning is distributed to its students depend on the company or organization that requisitioned the course.

The term “e-learning” was established by Cross in 1998 although the concept of teaching via ICT was developed some time before that in the late 1900s (Cross, 2004). The idea that one could learn and teach without spending money on facilities as well as teachers intrigued companies and organizations. As a start these courses were administered with the use of CD-ROM due to the low cost compared to teachers in real life.

Although the courses on the CD-ROM were cheaper the field met some resistance in the form of its students who did not want to go through the course sitting in a room by themselves without the support of classmates and teachers (Cross, 2004). This suggests a divide in what the companies want and what their employees (supposed to do the courses) want or think they need. Therefore some alterations were required before the concept could be more successful and as time went by the technological development evolved and with it the concept of e-learning.

Today e-learning come in several different forms and are used at companies all over the world as well as other organizations and universities. It is not uncommon that courses are done over internet or a company’s own intranet. This form of learning is often termed online learning or web-based learning. According to Mayer (2003) e-learning is just like other mediums a way of delivering learning and therefore it has its advantages and disadvantages.

As in the 1990s one of the most sought after advantages is the cost-effectiveness that is advertised. If facilities and teacher need not be hired every time there is a course to be held costs should eventually decline. However to make a course as cost-effective as possible there is the risk of it affecting the material or the pedagogical aspects of the course (how to best teach the students versus what needs to be thought) and vice versa; if focus is on only pedagogical aspects the costs may increase. Therefore costs can be seen as both an advantage and a disadvantage.

Another disadvantage that is becoming more apparent is that the use of the Internet and ICT to this extent when it comes to online learning has an impact on cognitive load (Verhoeven, Schnotz, & Paas, 2009). It is not the Internet or ICT themselves but what can be found online. There are so much stimuli that can be found that is can prevent our minds from being creative or thinking deeply both consciously and unconsciously (Carr, 2011). On the other hand, the Internet and ICT can also be seen as a extended storage unit for the minds that does not have to keep as much information stored in the brain. (Mason, 2012).

The term e-learning is a wide concept and therefore there can be different ways to create e-learning and the Swedish Armed Forces uses a method of learning referred to as Advanced Distributed Learning (ADL) to create these courses. This method uses the technological developments that now are available (current ICT) as well as the ideas and strategies that have
been used for a longer period of time, such as using both audio and visual stimuli, having the student interact with the material in assignment, etc. (Försvarsmakten, 2008). The use of existing standards and Information and Communication Technology (ICT) can distribute the learning pretty much anywhere and anytime (Försvarsmakten, 2008). To achieve this, a comprehensive Learning Management System (LMS) is used that can handle the course with the results as well as administrative tasks. In this sense the Swedish Armed forces indicates that through the use of ADL the teachers and students don’t necessarily need to communicate face-to-face and the knowledge can still be reached when needed (Försvarsmakten, 2008).

There are pros and cons with everything, ADL is no exception. According to the Swedish Armed Forces (Försvarsmakten, 2008) some of the pros (for an organization) of using ADL are that it reduces costs, maintenance of the material becomes simpler and there will probably be increase productivity. There are also pros for the individual attending the ADL developed course since the course will be more flexible (than course not using ADL) and they have a higher degree of control over their education and learning. Note that not all courses may be suitable as ADL (Försvarsmakten, 2008) and that it as to be considered when creating an e-learning course.

Alonso et al. (2005) states that something to be considered when creating and e-learning course is that it should be based on psycho pedagogical elements that take into account learning theories, by using a variety of different media and tasks, i.e. using text and video, reflecting questions and multiple choice, so on and so forth. That is not to be taken as a light task as it cannot be possible to please everyone at all times, which isn't possible for face-to-face courses either for that matter. A way to try to ensure at least some of the students achieve the learning objective would be to incorporate the learning strategies mentioned above. How do you build the course?

5.1 Building a course

When building any course one of the first aspects to look at is the goals of learning or learning objectives, i.e. what the student is supposed to have learned at the end of the course. To find these objectives it is of importance to have some knowledge of the subject or work loosely with somewhat who holds this information. The difficulty would be in ensuring a high enough pedagogical standard. When identifying the learning objectives and comparing them with Bloom's taxonomy and the knowledge type, an idea of the complexity of the material is formed and illustrated by the two-dimensional matrix (Figure 1). Applying the information from the matrix to the learning strategy table (Table 6), gives the idea of which methods or strategies that are appropriate to use in presenting the material.

When it comes to transferring a course from face-to-face to e-learning there may already be media in use to present the information. If this choice of media can be displayed using the strategies derived from the learning strategy table, than some time has been saved. If creating a course the choice of media may depend upon what type of information is to be presented; some materials for example a list of lesson topics may not possible nor suitable (depending on the topics themselves, the idea behind the course and who the target users are) to view as an image or as a video, but should then perhaps be presented through text and/or sound. Mayer
(2001) points out that according to the Cognitive Theory of Multimedia Learning students learn more deeply when presented with information in both images and words as opposed to them separately. A mix of different media may therefore be to prefer. No matter if a course is being transferred or created; it is important to choose the strategy/method before the media of presentation since not all information can be delivered in the same media (Clark, 2001). There may however be other types of restraints or limitations in how to present the information that have to do with the programs of production used.

Once the information is gathered, the objectives are defined and the strategies/methods and media are chosen the course needs to be structured and produced. A simple course structure might include a chapter/lesson, which in turn is built up by sections. Every section then consists of pages or slides with media files (for example text, images or videos). (Försvarsmakten, 2008).

In an attempt to ensure that the students have achieved the learning objectives in the e-learning course some form of testing should be done. According to ADL and the Swedish Armed Forces (Försvarsmakten, 2008) there mainly three types of test that could be used; tests of knowledge, mock exams and final test. A interpretation on two of these tests (tests of knowledge and final test) has been made by the researcher, for more detailed information on all three test see Försvarsmakten (2008). The test referred to as tests of knowledge are questions delivered throughout the course and different lessons. These questions will not be graded and are present for the student to give an indication on whether he or she is keeping up with the information. The final test is a test taken place at the end of the course to test whether the learning objectives have been achieved through questions on the entire course material. The result for this test will be recorded in the learning management system and is a way of certifying the student. There is a possibility for the student to retake the test if he or she fails.

The last and final step when creating a course is that it will eventually need to be evaluated. Some courses will be evaluated on a test group before being released while others may be used for a while before being evaluated. How and when the courses should be evaluated depends on the company/organization that will use them. One can keep in mind that the final test can be seen as an evaluation in itself on whether the learning objectives are reached or not; whether the knowledge has stuck. Another alternative to evaluating the course at the end of the production is to evaluate iteratively throughout the production process, which may save some time on larger modifications.
6 Method
The following chapter contains the method used in answering the research questions.

6.1 Equipment
The e-learning material was transferred from several PowerPoint presentations (one for each lesson) into Articulate Storyline (Articulate) on a PC.

The audio material contained a synthesized voice that was used to mediate that which in the face-to-face course was presented by the teacher. This voice was created in Virtual Speaker developed by Acapela Group. Acapela Group delivers 100 voices in 30 different languages (Acapela Group) and in this project a voice of woman, called Heather, speaking American English was used.

6.2 Procedure
The material of the face-to-face course was originally presented with the help of a power point presentation and was provided both in digital and on paper at the beginning of the project. All the material was reviewed two times to identify possible learning objectives, i.e. the description of goals which the student should have achieved during the scope of or at the end of the course. These objective should be formulated as follows

“The learner should be able to [add verb that describe the action to be taken] X”

The learning objective were then compared to already existing learning goals to determine if the necessary information was present in the physical material. Once an understanding of the material and the learning goals were obtained the material was compared to Bloom's taxonomy to illustrate how to present the material in the e-learning environment while taking into account the three domains of learning coined in Bloom's taxonomy (Bloom, 1956). This was done with the help of the two-dimensional Taxonomy matrix (see Figure 1, for the full categorization and learning objectives, see Appendix A - Categorization).

A proposal on how to present the material was made and presented to Saab. Once approved the material was transferred from PowerPoint presentations to Articulate Storyline (Articulate). Only five lessons were to be transferred (3, 5, 6, 1 and 2 in that order) and the persons involved with developing the original course were asked to write questions that could be used to test the students acquired knowledge. The questions had to be constructed in such a way that they could be corrected by the program (in this case Articulate Storyline). After adding the questions to the lessons; each slide in the project was equipped with a audio file of a synthesized voice, named Heather (Acapela Group), that conveyed the information of the slide. The first version of the e-learning course was then complete.

A rough draft of guidelines on how a transfer could be made was constructed based on the e-learning course and notes taken during the entire process of transfer. The guidelines also included an approximation of time that would be spent on the different tools of presentation within Articulate Storyline. Before completing the guidelines (Appendix D – Guidelines) an evaluation of whether the e-learning material, that has been converted from face-to-face course material to e-learning material on the basis of the revised version of Bloom's taxonomy
and learning strategies, is pedagogical in the sense that the students realize the categories of the three domains of learning in Bloom's taxonomy was conducted. Some adjustments were made to both the template and the e-learning course after comments in the evaluation.

6.2.1 Evaluation
The evaluation consisted of three parts; an introduction to the course (and the different controls in the course), lesson 3 and a survey containing 23 questions (Appendix B – Survey questions). Lesson 3 was chosen for the test since that lesson included material that in the categorization had connections to all categories of the cognitive domain as well as the diversity in the presentation to test the inclusion of both the affective domain and the psychomotor domain.

The survey generated qualitative data as well as some quantitative data. Nineteen out of the 23 questions were connected to the categories of the domains of learning. Table 7 illustrates which questions are connected to what category or categories. There were two question (question 9 and 11) in which the participants were asked self-evaluate their perception on motivation and attention on a Likert scale of 1 (strongly disagree) - 5 (strongly agree). The other questions were mainly free text answers in which the participants were allowed to answer in Swedish or in English. The answers that are used in the report, which were presented in Swedish, were translated to English by the researcher.

<table>
<thead>
<tr>
<th>Question</th>
<th>Domain</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cognitive</td>
<td>knowledge/remember</td>
</tr>
<tr>
<td>2</td>
<td>Cognitive</td>
<td>knowledge/remember</td>
</tr>
<tr>
<td>3</td>
<td>Cognitive</td>
<td>knowledge/remember</td>
</tr>
<tr>
<td>4</td>
<td>Cognitive</td>
<td>comprehension/understand</td>
</tr>
<tr>
<td>5</td>
<td>Cognitive</td>
<td>evaluation/evaluate, synthesis/create</td>
</tr>
<tr>
<td>6</td>
<td>Cognitive</td>
<td>evaluation/evaluate, synthesis/create</td>
</tr>
<tr>
<td>7</td>
<td>Cognitive</td>
<td>knowledge/remember</td>
</tr>
<tr>
<td>8</td>
<td>Cognitive</td>
<td>comprehension/understand, analysis/analyze, evaluation/evaluate</td>
</tr>
<tr>
<td>9</td>
<td>Affective</td>
<td>receiving phenomenon (attention)</td>
</tr>
<tr>
<td>10</td>
<td>Affective</td>
<td>valuing</td>
</tr>
<tr>
<td>11</td>
<td>Affective</td>
<td>responding to phenomenon (motivation)</td>
</tr>
<tr>
<td>12</td>
<td>Affective</td>
<td>valuing</td>
</tr>
<tr>
<td>13</td>
<td>Affective</td>
<td>responding to phenomenon (reaction), valuing</td>
</tr>
</tbody>
</table>
Pilot test
A pilot test of the evaluation was conducted on three persons that had attended the course in real life before. There were three questions in the survey in which the participants were asked motivate their answers with the questions "Why/Why not?". The participant were not sure on what they were supposed to write and asked what it meant in this context. With the reply that they should motivate their answer they continued on with their answers. The three questions were altered from an end with "Why/Why not?" to an end with "Motivate!" before the evaluation.

Evaluation
Ten participants (3 female), who either worked with or had an interest in technical information, participated in the study. All participants worked at different departments at Saab and were compensated by the company for attending the test. The test had an average completion time of approximately 1 hour.

6.3 Method of analysis
The result was analyzed using IBM SPSS Statistics 21 and the participants written answers were interpreted to emphasize the statistical results
7 Result

The following chapter attends to the result and analysis of the evaluation. The result show that the affective domain and the psychomotor domain is more realized than the cognitive domain as illustrated in Table 8. The result also generated some ideas of improvement which can be seen in Appendix E – List of improvements. A closer look will be taken on the three sub-questions concerning the individual domains of learning.

Table 8. Descriptive statistics over whether the e-learning material realize the categories of the three domains of learning, n=10

<table>
<thead>
<tr>
<th></th>
<th>mean</th>
<th>SD</th>
<th>minimum</th>
<th>maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive Domain</td>
<td>.44</td>
<td>.25</td>
<td>.07</td>
<td>.82</td>
</tr>
<tr>
<td>Affective Domain</td>
<td>.79</td>
<td>.13</td>
<td>.58</td>
<td>.97</td>
</tr>
<tr>
<td>Psychomotor domain</td>
<td>.35</td>
<td>.17</td>
<td>.00</td>
<td>.50</td>
</tr>
<tr>
<td>Psychomotor domain</td>
<td>.78</td>
<td>.25</td>
<td>.25</td>
<td>1.00</td>
</tr>
</tbody>
</table>

7.1 Cognitive domain

Although the average for the cognitive domain was low (.44, see Table 6), a repeated measures ANOVA showed that there was significant difference between the six categories of the cognitive domain, \( F(5,45)=3.79, p=.006, \eta^2=.30 \) (Figure 2). A Sidak post-hoc test confirmed a difference between the category remember and the category create, as well as a difference between the category understand and the category create.

![Figure 2. Mean distribution of the cognitive domain. Error bars indicate 95% confidence interval, n = 10.](image)

7.2 Affective domain

A repeated measures ANOVA showed that there is no significant difference between the categories of the affective domain, \( F(2.97,26.75)=1.23, p=.32, \eta^2=.12 \) (Huynh-Feldt corrected, \( \varepsilon=.60 \)), se Figure 3.
Figure 3. Mean distribution of the affective domain. Error bars indicate 95% confidence interval, n = 10.

The free text answers point to that the participants put value in the material and indicate that the material can be useful for them even if they may have worked in the field for a while, as stated by participant 3.

"even tho I'm working with the specifications that were mentioned, I'm not 100% familiar of the specification build up. The presentation gave me a better basic understanding of this." (P3)

The statement was backed up from persons who aren't directly working within technical publications although they may come in contact with technical publications for different reasons. One person in particular states that he sees the value in the material both today but especially in the future.

"yes, I believe it has value. Especially maybe in the future - if I were to become a writer, because then it will be very good to have an overview about how everything around TP works" (P2 - translated from Swedish by researcher, TP = technical publications)

In addition to whether the participants valued the information given in the part of the course, which was presented in the evaluation, there were two question that concentrated on the participants motivation and on whether the participants felt like they were being directed towards important information (attention). When the participants assessed how the presentation of the material motivated them they gave an average score of 3.8 (SD=1.03). Participants appeared to like that there are different interactions in the course and that those interactions gave a higher motivation.

"It keeps the pupil's level of interest up throughout the lessons." (P1)
"It makes it easier to stay awake compared to if there would only receive a text in front of oneself that one could read." (P2 - translated from Swedish by researcher)

As indicated in the quotes motivation is important for interests, but also in how much attention a person gives the course. When asked about whether the participants felt like they were being directed towards important or valuable information the participants gave an average score of 3.4 (SD=1.07) on the Likert scale. Participant 9 indicates that loss of concentration in his/her case might have deferred the attention towards something different and might therefore have lost some of what might be considered important information.

"To a certain degree I followed the text/information heared, but mid into the chapter I felt I lost part of my concentration. A bit to massive text block." (P9)

Participant 10 might have had a higher level of concentration than participant 9 since this person felt that the information which was of importance was indicated in the material and therefore easy to find. There can be other reasons for this that will be addressed in the discussion.

"Relevant issues were highlighted/mentioned" (P10)

Although there have been some criticism most participants (.90, see Figure 3) reacted positively towards the material and the presentation of the material. The overall view of the course can be summarized as stated by participant 6.

"With some fine tuning I believe that it can be a valuable course for everyone who are to write techpub at Saab regardless if one comes from Saab or from the outside" (P6 - translated from Swedish by researcher, techpub = technical publications)

7.3 Psychomotor domain

The result for the psychomotor domain will be presented with two different analyses depending on interpretation of two of the variables; observing and imitating, as their definitions can be interpreted literally or figuratively.

The first analysis concerns the literal interpretation of the definition (a person's behavior is to be observed and imitated). A repeated measures ANOVA indicated that there was significant difference between the four categories of the psychomotor domain $F(3,27)=15.83$, $p<.01$, $\eta^2=.64$ (Figure 4). A Sidak post-hoc test confirm a difference between the category observing and the categories practicing and adapting. The post-hoc test also showed a difference between the category imitating and the categories practicing and adapting.
The second analysis of the categories observing and imitating concerns the figurative interpretation of the definitions of the variables observing and imitating (an action or a behavior, not necessarily stemming from a person, is to be observed and imitated). That kind of behavior is present in the course mainly through the use of different controls and actions. A repeated measures ANOVA showed that there is no significant difference between the four categories of the psychomotor domain, $F(3,27)=1.00$, $p=.41$, $\eta^2=.10$ (Figure 5).

The third category, show the results in both analysis, has to do with practicing and repeating. Throughout the course the participants have to repeat some actions and behavior and in the
end of the evaluation most participant appeared to use the controls and perform the actions as they were supposed to be used (independent on ). It indicates that the more a control is used the easier it is perceived, as stated by participants.

"common interface is good, high recognition after a few slides." (P1)

"It was good to know that different controls was available. How they were used was intuative" (P5)

"It was clear and simple. Requires no more." (P6)

This also has a connection to whether the participants felt like they were able to adapt their behavior in new situations. In this case the adaption of behavior (category four) has to do with whether the participants could adapt the different controls/actions in the different slides and displays the same result in both analysis. Participants 1, 5 and 6 indicate in their quotes above that it was easy to adapt their behavior to the different slides. Participants 3 and 4 had a different view as can be seen in the statements below.

"It wasn't always obvious how one should use the different controls2 (P3)

"... one could use a little bit of more information when one should do the different things. Say like a small text down in some corner 'When you're ready click Next' or something like that" (P4 - translated from Swedish by researcher)
8 Discussion
This chapter attends to the discussions of the result and the method.

8.1 Result discussion
The results will firstly be discussed one domain at a time, which is followed by and overall discussion.

8.1.1 Cognitive domain
As the results show there was a low average score for the cognitive domain (.44) which indicates that e-learning material may not be realized in some categories. The first taught is that Bloom's taxonomy is not a suitable taxonomy in this circumstance. The question that rises at that point is: why not? There are several plausible reasons, such as the material isn't diverse in complexity or the evaluation was not performed in an optimal manner. Another reason could be the use of learning strategies that are not suitable to present the material. To better answer the question of why Bloom's taxonomy might not be a suitable taxonomy in this circumstance as well as discuss the e-learning materials effect on the cognitive domain, the results for the different categories within the domain will be discussed.

There are differences between the categories of the domain. The simpler categories appear to be easier to achieve than the more complex categories. According to Pohl (2000) this might depend upon the cognitive capacity. The higher complexity the more resources and cognitive capacity appears to be needed. That in turn may indicate a greater need for concentration and attention which might be difficult as stated by some of the participants in the evaluation. At some points in the lesson it was pointed out there was a lot of information and a loss of concentration occurred. If these losses of concentration occurred at a point in which material is presented that is connected to the learning objective placed within a category of higher complexity, for example synthesis/create, there could be a possibility that the criteria for that category will not be met. In that case there is an error in the presentation, which in return can be adjusted and corrected.

As the participants are better at recalling and recognizing basic facts (66%), which is typical processes part of the category knowledge/remember, as well as exemplifying and classifying (60%), a processes connected to the category comprehension/understand. It might be a problem with the material not delivering information that needs to be processed on a higher level in the mind (material that falls under a more complex category) as was first believed. That there is no need for the students to process the information on a higher level of the cognitive domain. That either means that the materials don't represent the learning objectives or that the learning objectives have been misinterpreted. It then follows that the strategies and media used to represent the material may be incorrect as well. Perhaps there is no need for the student to use strategies that respond to the categories of for example evaluate or create to understand the information. If that is the case then the information should not be presented in such a matter. Therefore the learning objectives and the material should be examined again sometime before the e-learning course is presented to the intended user group.
However, if we assume that the learning objectives has been interpreted correctly the low result can be based on issues that can be found in the implementation of the evaluation, like asking the wrong questions or misinterpretations of free text answer.

Other factors that could have affected the low average score for the cognitive domain are some of the reasons why a person learns or participate in a test/evaluation, such as motivation, interests and other personal values (Öhman, Flykt, & Esteves, 2001). If there was a lack motivation or interest in the course and the evaluation, there is a risk that participants didn't take the time he or she needed to give a complete answer. Therefore he/she might have scored higher on the questions that concerned for example recalling factual knowledge that only required a few words, than on questions where there was a need for deeper understanding and analysis and more thorough answers.

8.1.2 Affective domain

Although it is important that the students achieve the learning objectives and complete the course; it is also of value to think about why it is done. A motivated student pays attention to the material (Krathwohl, Bloom, & Masia, 1973) and that would indicate that the student in question acquires more knowledge than a student who isn't motivated. Attention and awareness may be part of the simplest category (process) of the affective domain, receiving phenomena, but is a key element when creating a course (Glaser, 1976) as it has to do with directing the students’ attention towards the most important information. The results show that attention and awareness got an average score of .68. That score is based on the participants’ self-evaluations of whether they believed the different interaction directed them towards an important information. The score is just above neutral indicating that they generally experienced an tolerable product, but there is still work that could be done to improve their experience. The question that arises is why they felt the way they did?

As can be seen in the quotes taken from the evaluation there are those who find that the most important information was "highlighted/mentioned" (P9) and some that found the vast information made them loose concentration and therefore also paid less attention to the material. This difference may have been due to the notion that people use different learning strategies when they acquire knowledge (Marton, 2005) and these strategies may have been different than the ones used when converting the material of the course. Perhaps the use of other learning strategies would have given a higher level of attention or awareness of the information of the course, which in turn would have resulted in a higher overall score of the affective domain. Although it is important to take the idea that different people uses different learning strategies into account when creating as well as converting a course (Clark, 2001), one should also remember that it unlikely that all strategies can be used at the same time for the same information. That means that all strategies cannot be utilized and neither should they, which will affect how some users experience the course.

Although the participants were a small sample of the intended user group there was a differences between the them concerning how they experienced the material. Statically there was no significant difference, but the free text answers still indicated that such a difference was possible. An example can be found between participants 9 and 10 who had very different
free text answers. It appeared as if participant 10 might have had different learning strategies, that corresponded with the strategies used in presenting the material, than participant 9 since this person felt that the information which was of importance was indicated in the material and therefore easy to find. There are other possible factors for this, such as level of concentration, motivation or interests (note that these factors does not simple comply with participants 9 and 10).

Level of concentration can be affected by many factors as well affect many factors, and is an import aspect to acknowledge as it can be easily lost both in a direct manners, as in someone knocks on the door and interrupt, and in a more indirect manner where the student's thoughts wanders to perhaps that dessert he had after dinner yesterday. When discussing concentration in this context it is equivalent to mainly attention and awareness (first category of the affective domain). The results show that attention got an average score that was above neutral, which indicates that probably was a higher focus on the material that was of interest than on other information including the environment. These results can be analyzed as skewed as it is based solely on the participants’ self-evaluation on this matter. That means that environmental factors such as sounds from other offices or outside may have had an effect, but may not have been accounted for by the participants as they were not asked about it. Neither were the environmental factors controlled for or tested. That might have given a different result. One factor (that was tested) that is relevant when trying to focus attention is motivation (Phelps, 2006).

As mentioned earlier in the report; every person has his or her individual goals or personal reason to learn something new that motivate them to pursue this new knowledge (Öhman, Flykt, & Esteves, 2001). Motivation can be based on several things; for example a person's interest in technical publications, or the emotions connected to different experiences, and is an important factor in e-learning. If there is a lack of motivation, there may be a lack of attention and a loss in information gain from the course. It is also a tricky thing to measure as it can be difficult to interpret how motivated another person is a certain point in time. When measuring motivation through self-evaluation, the results showed that motivation was given an average score of .76, which indicate that the participants were motivated when attending the evaluation, but what kept the motivated. The question that measure motivation was linked to whether the presentation of material kept them motivated to continue. That only measure just that, and leaves out other factors of motivation such as interests and emotions. Emotions should not be forgotten as they affect several of the aspects that have been tested; attention, reactions, personal value (Phelps, 2006). This could mean that the participants answered based upon their emotions towards the presentation of the material instead of how that motivated them.

Another thing that might keep the students attention and awareness as well as keep the motivated is if they feel that the information given in the course is of value or could be of value to them. Eighty-three percent of the participants experienced that the material was in one way or another of value or could be of value to them in their work. That means that a majority of the participants reacted well towards the information in the material, but they had some ideas of changes that should be made to help keep for example concentration up. The
most common suggestion among the participants was progress information. The idea of how much they had left on a lesson could affect how much attention they gave the course if there were other pressing matters to attend to outside of the course. That could also be a motivating factor as it can be seen as a reward system that indicates how far a student has gotten in a course, which corresponds with what Dayan and Daw (2008) points out in their article; that a common motivator to why we learn is the reward. This reward is neurological and could possibly affect our physical skills.

8.1.3 Psychomotor domain

*Observation* and *imitation*, the first two categories of the psychomotor domain, will start of the discussion of this domain as they in the results have been presented with two different interpretation based on how the category themselves were interpreted. If viewing the definition of the categories literally the students have to observe and imitate another person's behavior. In the course there is no person that the students can be observe and imitate. A solution to that problem could possibly be (based on own experience) to include videos of persons performing tasks and actions that is relevant to the material. The question would then be whether that recorded person would be as flexible as a person would be in real life. That has not be researched for this project but would be an interesting aspect to investigate further in future projects. Another solution would be to create characters that perform the tasks and actions as a person would have. Perhaps that solution could already be considered as part of the definition as a character probably would have to have specific behavior just as a person would. If any of these solutions were included in the course than the students can perform to the criteria of the first two categories of the psychomotor domain. If not the categories of the psychomotor domain would not be met and the question that rises at that point, do they have to?

If the meaning of the categories instead are interpreted as the students are to observe and imitate a performance or an action, instead of a person, the categories of observing and imitating can be shifted to for example an information slide that illustrates how and what, when it comes to actions (such as interactions with the material). Another example could be using interactive screen recordings, which are screen recordings that have been altered into tutorials in for example Articulate Storyline (Articulate). Using this interpretation allows for a wider scope of possible actions or behaviors and does not exclude the first interpretation of observing and imitating a person's behavior. The "solutions" mentioned in the previous paragraph can be applied in this interpretation as well. If this interpretation is used in this project the results show that the e-learning material to some degree realizes the categories of the psychomotor domain.

When choosing which interpretation to use an idea is to look at the relevance the different categories have for the student to be able to acquire relevant information. For this particular course the second interpretation is more relevant as there is no need for imitation of another person's behavior in order to obtain the information given in the course. It is however useful to know how the material is presented and how to navigate within the material in order to obtain the information in the first place.
The other two categories; *practicing* and *adapting*, have received positive result indicating that they have an easy time to follow the course physically. But there has been some criticism that has to do with the structure of the course and more specifically the controls and the objects the participants could interact with in the course. Some would have preferred more interaction others less which is connected to the participants individual learning strategies (Clark, 2001; Marton, 2005). There are however the same controls and type of object that are used throughout the course which gives the participants the time to "practice" (category of the psychomotor domain (Simpson, 1972)) and repeat the interactions until they are familiar. The results states that the more the participants used the controls the more easily they perform them. This was backed up by what most participants wrote in the evaluation. They found the controls easy to use once they had gotten used to them, but they felt that at times it was inconsistent and difficult to adapt to new situation.

Adapting to new situation or surroundings, which is the last (and most complex) category in the psychomotor domain, is of importance when it comes to this course. As information is presented in different ways the students need to be able to figure out which control or interaction is to be used at what slide. An observation made by the researcher during the evaluation seemed to indicate that ability to understand the controls and interaction as well as adapt to different situation appeared easier the younger the participants were. This observation may not be scientifically accurate due to this type of data not being collected, but it could be of interest in future evaluation. That kind of information may be of interest when creating a course to match the intended user group. In this case the user group is vast both in previous knowledge and in age and it should not be assumed that students are to be able to adapt to new situations without a little help. Participant 4 put it simply in one of his/her answers.

"... one could use a little bit of more information when one should do the different things. Say like a small text down in some corner 'When you're ready click Next' or something like that" (P4 - translated from Swedish by researcher)

To be able to adapt, it is also of importance to know which controls and interactions that are available. One could let the students explore more freely and figure them out on their own, but that might not be cost-effective, time wise, for the student.

### 8.2 Method discussion

A concern that might affect the results of the cognitive domain that has some correlations to the interpretation of the answers in the evaluation has to do with the categories of the cognitive domain and their sequential or hierarchal order. As noted during the presentation of the different categories the categories has to be activated in order, i.e. that for the students to be able to work on a level that involves the category *understand* the student first has to have activated the processes involved with the category *remember* (Anderson, et al., 2000). What if the categories aren't hierarchal but interactive and can encourage each other as with Finks taxonomy of significant learning (Fink, 2003)? What if it becomes easier to remember something because there is an understanding for it?
The same problem can be seen in the affective domain concerning attention which is an aspect of the first category (responding to phenomena), that demands the lowest level of performance of the mind according to Bloom's taxonomy (Anderson, et al., 2000). This is somewhat backed up by Öhman, Flykt and Esteves (2001) who points out that attention can build as well as be seen as a part (perhaps even subcategory) of motivation. However they also point out that emotions and personal values influence cognitive functions (Phelps, 2006) such as attention and awareness (Öhman, Flykt, & Esteves, 2001). As the only used measurement of motivation was whether the presentation of material kept them motivated to continue there is no way of knowing if the participants were motivated by other aspects or phenomena, such as personal value or emotions (Cross, 2004; Phelps, 2006). That would be an aspect for future studies as that might bring about a better understanding on which taxonomy will be more suitable in this context. If personal values is something that drives motivation and attention as suggested by some researchers (Dayan & Daw, 2008; Phelps, 2006; Öhman, Flykt, & Esteves, 2001) then the categories are interactive with each other and Finks Taxonomy would have been a better choice of taxonomy.

What goes against Finks taxonomy and works as an advantage for Bloom's taxonomy is the use of the psychomotor domain. Even though the cognitive skills were of greater importance to this course (based on the learning objectives, see Appendix A - Categorization) than the psychomotor domain there may be a need for it in other courses or future courses. In this project we did try to measure the categories of the psychomotor domain, but realize at the end of the project that we may have measured the physical skills on a system level which differs from the type of learning that has been discussed throughout the report. If this is the case it is unfortunate, but can be corrected for future studies.

As been discussed above, Bloom's taxonomy may not be the most suitable choice of taxonomy after having performed the evaluation. However, that error may be more linked to the researcher and the given material than the adequacy of the taxonomy. Using the taxonomy in this way appears to require more work with the information in the material than was done within this project. This refers mainly to the work done before transferring the material to the e-learning environment; when the material was reviewed for learning objectives, which were then compared to existing learning goals and discussed with Saab. This part of the project should have been done more thoroughly by making sure that the material could be presented with the help of the learning strategies in such a way that the it was clearer how and that it would measure up to the objectives. That would entail that with some more thorough work Bloom's taxonomy may be an adequate taxonomy to use despite the negative discussion surrounding the evaluation.
9 Conclusion

By converting a preexisting face-to-face course to e-learning a company like Saab will most likely save money as there is no more need for hiring a person to hold the course, nor to book a classroom, nor to pay for traveling expenses (etc.), but will the material still be pedagogical? After the evaluating whether the e-learning material is pedagogical in the sense that the students realize the categories of the three domains of learning in Bloom's taxonomy, the discussion indicate that the material is pedagogical to a certain extent. That is, some categories and aspect of the three domains of learning appear to have been realized, for example remember, understand, practicing, and adapting. There has also been some negative aspects up for discussion concerning, among other, attention, motivation, imitating, etc. A big question that should be further investigated some time is how all of these aspects differ from the preexisting face-to-face course. Something that has become evident is that their need to be certain clarity on what learning objectives are to be achieved by attending the course and what categories they fall under, and this has to be reflected in the material. This goes for both e-learning courses and for face-to-face courses.
Bibliography


**Equipment**
Articulate Storyline, Articulate
Heather, Acapela Group
IBM SPSS statistics 21, IBM
Microsoft Office Word 2007, Microsoft
Virtual Speaker, Acapela Group
Appendix A - Categorization
This appendix includes the categorization of lessons 1-3 and 5-6 as they were the lessons that were of most importance to the project.

Lesson 1:

Table 9. Placement of the learning goals of lessons one in Taxonomy table. LO = learning objectives

<table>
<thead>
<tr>
<th>Lesson 1</th>
<th>Knowledge</th>
<th>Comprehension</th>
<th>Application</th>
<th>Analysis</th>
<th>Evaluation</th>
<th>Synthesis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Remember</td>
<td>Understand</td>
<td>Apply</td>
<td>Analyze</td>
<td>Evaluate</td>
<td>Create</td>
</tr>
<tr>
<td>Factual knowledge</td>
<td>LO-1, LO-2,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LO-3, LO-4,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LO-5, LO-6,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LO-7, LO-10,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LO-12, LO-16,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LO-17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conceptual knowledge</td>
<td>LO-8, LO-9,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LO-11, LO-15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procedural knowledge</td>
<td>LO-13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LO-18, LO-19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meta cognitive knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 10. Learning objectives and goals for lesson one

<table>
<thead>
<tr>
<th>Learning objectives</th>
<th>Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The learner should be able to list Saabs BA</td>
</tr>
<tr>
<td>2</td>
<td>The learner should be able to list different locations for different BAs</td>
</tr>
<tr>
<td>3</td>
<td>The learner should be able to know approximately how many resources at each BA working with TechPub.</td>
</tr>
<tr>
<td>4</td>
<td>The learner should be able to list different roles within the TechPub area</td>
</tr>
<tr>
<td>5</td>
<td>The learner should be able to list products for each BA</td>
</tr>
<tr>
<td>6</td>
<td>The learner should be able to list publications for each BA</td>
</tr>
<tr>
<td>7</td>
<td>The learner should be able to list target groups for the publications.</td>
</tr>
<tr>
<td>8</td>
<td>The learner should be able to know the purpose with the CC</td>
</tr>
<tr>
<td>9</td>
<td>The learner should be able to know what responsibility the CC has.</td>
</tr>
<tr>
<td>10</td>
<td>The learner should be able to know what resources the CC has.</td>
</tr>
<tr>
<td>11</td>
<td>The learner should be able to know where in the organization the CC is placed.</td>
</tr>
<tr>
<td>12</td>
<td>The learner should be able to list areas the CC is working with</td>
</tr>
<tr>
<td>13</td>
<td>The learner should be able to know how to communicate with the CC</td>
</tr>
<tr>
<td>14</td>
<td>The learner should be able to describe what Saab common look and feel is.</td>
</tr>
<tr>
<td>15</td>
<td>The learner should be able to know the purpose with the CC TechPub SharePoint</td>
</tr>
<tr>
<td>16</td>
<td>The learner should be able to find the CC TechPub SharePoint</td>
</tr>
<tr>
<td>17</td>
<td>The learner should be able to describe what kind of information you can find on the SharePoint.</td>
</tr>
<tr>
<td>18</td>
<td>The learner should know how to get news and changes on the SharePoint</td>
</tr>
<tr>
<td>19</td>
<td>The learner should be able to navigate on the CC TechPub SharePoint.</td>
</tr>
</tbody>
</table>
Lesson 2:

Table 11. Placement of the learning goals of lessons two in Taxonomy table. LO = learning objectives

<table>
<thead>
<tr>
<th>Lesson 2</th>
<th>Knowledge</th>
<th>Comprehension</th>
<th>Application</th>
<th>Analysis</th>
<th>Evaluation</th>
<th>Synthesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conceptual knowledge</td>
<td>LO-2</td>
<td>LO-6, LO-10, LO-14</td>
<td></td>
<td>LO-16</td>
<td></td>
<td>LO-1, LO-6, LO-9, LO-16</td>
</tr>
<tr>
<td>Procedural knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meta cognitive knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 12. Learning objectives and goals for lesson two

1. The learner should be able to state in general a products life cycle.
2. The learner should be able to state in general what ILS is. (ILS is maintenance refinement of design data.)
   The learner should be able to state that maintenance engineering specify the requirements regarding:
   - maintenance
   - spare parts
   - tools
   - recourses
   - facilities.
3. The learner should be able to list examples on ILS data. (Design data, maintenance data)
5. The learner should be able to describe in general the flow of data all the way from design to TechPubs.
6. The learner should be able to list that maintenance engineering can practically be done in various ways dependent on the complexity of the product.
7. The learner should be able to list examples on ILS tools and their purpose.
8. The learner should be able to state why ILS data not should be handed to the customer for free.
9. The learner should be able to describe why ILS data must be processed to make it understandable in the publication.
10. The learner should be able to state the connection between the maintenance engineering requirement areas and the various publication types.
11. The learner should be able to state the necessity with TechPubs regarding:
   - operation
   - traceability
   - a products maintenance over time and usage
   - functionality (funktionsduglighet)
   - personal safety
12. The learner should be able to describe that TechPub is the documentation that the customer use.
13. The learner should be able to describe that publications are adapted to a specific target group.
The learner should be able to list examples of different types of documentation connected to different parts of a product's life cycle.

The learner should be able to list examples on common customer requirements.

The learner should be able to describe how customer and regulations requirements affect TechPubs.

Lesson 3:

Table 13. Placement of the learning goals of lessons three in Taxonomy table. LO = learning objectives

<table>
<thead>
<tr>
<th>Lesson 3</th>
<th>Knowledge Remember</th>
<th>Comprehension Understand</th>
<th>Application Apply</th>
<th>Analysis Analyze</th>
<th>Evaluation Evaluate</th>
<th>Synthesis Create</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factual knowledge</td>
<td>LO-1, LO-4, LO-6, LO-7, LO-8</td>
<td>LO-2, LO-9, LO-12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conceptual knowledge</td>
<td>LO-5, LO-10</td>
<td>LO-3</td>
<td></td>
<td></td>
<td></td>
<td>LO-5</td>
</tr>
<tr>
<td>Procedural knowledge</td>
<td></td>
<td>LO-3</td>
<td></td>
<td></td>
<td></td>
<td>LO-3</td>
</tr>
<tr>
<td>Meta cognitive knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 14. Learning objectives and goals for lesson three

<table>
<thead>
<tr>
<th>Learning objectives</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The learner should be able to list examples of publication types in a general publication package.</td>
</tr>
<tr>
<td>2</td>
<td>The learner should be able to state general content of publication types.</td>
</tr>
<tr>
<td>3</td>
<td>The learner should be able to describe how the division of a system into subsystems and sub-subsystems are reflected in the publication package.</td>
</tr>
<tr>
<td>4</td>
<td>The learner should be able to list examples of techpub specifications that we use at Saab.</td>
</tr>
<tr>
<td>5</td>
<td>The learner should be able to describe differences between standards/specifications and their various field of application.</td>
</tr>
<tr>
<td>6</td>
<td>The learner should be able to list examples of differences between working according an international specification and a &quot;local standard&quot;.</td>
</tr>
<tr>
<td>7</td>
<td>The learner should be able to list the preferred specification.</td>
</tr>
<tr>
<td>8</td>
<td>The learner should be able to list Saab's representative ASD S1000D working group.</td>
</tr>
<tr>
<td>9</td>
<td>The learner should be able to list examples of typical sections in a publication standard.</td>
</tr>
<tr>
<td>10</td>
<td>The learner should be able to describe what Business Rules (BR) are.</td>
</tr>
<tr>
<td>11</td>
<td>The learner should be able to list examples of versions of each standards/specifications.</td>
</tr>
</tbody>
</table>
Lesson 5:

Table 15. Placement of the learning goals of lessons five in Taxonomy table. LO = learning objectives

<table>
<thead>
<tr>
<th>Lesson 5</th>
<th>Knowledge Remember</th>
<th>Comprehension Understand</th>
<th>Application Apply</th>
<th>Analysis Analyze</th>
<th>Evaluation Evaluate</th>
<th>Synthesis Create</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedural knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meta cognitive knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 16. Learning objectives and goals for lesson five

<table>
<thead>
<tr>
<th>Learning objectives</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The learner should be able to describe why writing rules are needed. (Alignment, etc.)</td>
</tr>
<tr>
<td>2</td>
<td>The learner should be able to list the sequence of rules from specification-BR-WG/STE/Hand books/Checklists.</td>
</tr>
<tr>
<td>3</td>
<td>The learner should be able to list examples of BR.</td>
</tr>
<tr>
<td>4</td>
<td>The learner should be able to list examples of writing rules. (Terms, active voice, etc.)</td>
</tr>
<tr>
<td>5</td>
<td>The learner should be able to describe the essence of WG. (Writing rules and what the document and publication must look like.)</td>
</tr>
<tr>
<td>6</td>
<td>The learner should be able to list examples of typical sections in a WG.</td>
</tr>
<tr>
<td>7</td>
<td>The learner should be able to list examples of additions (WG/hand books/checklists)</td>
</tr>
<tr>
<td>8</td>
<td>The learner should be able to list examples of why hand books are needed.</td>
</tr>
<tr>
<td>9</td>
<td>The learner should be able to describe the essence of hand books/checklists. (Working procedure, how you perform the work)</td>
</tr>
<tr>
<td>10</td>
<td>The learner should be able to list examples of why you have to align names and terms.</td>
</tr>
<tr>
<td>11</td>
<td>The learner should be able to list examples of where writing rules agreements with customer is documented.</td>
</tr>
<tr>
<td>12</td>
<td>The learner should be able to list examples of documented writing rules are named at different BA.</td>
</tr>
<tr>
<td>13</td>
<td>The learner should be able to list examples of why STE exists.</td>
</tr>
<tr>
<td>14</td>
<td>The learner should be able to list examples of what STE contains.</td>
</tr>
<tr>
<td>15</td>
<td>The learner should be able to list examples of STE &quot;ten golden rules&quot;.</td>
</tr>
<tr>
<td>16</td>
<td>The learner should be able to list examples of deviations from STE is documented.</td>
</tr>
</tbody>
</table>
Lesson 6:

Table 17. Placement of the learning goals of lessons six in Taxonomy table. LO = learning objectives

<table>
<thead>
<tr>
<th>Lesson 6</th>
<th>Knowledge Remember</th>
<th>Comprehension Understand</th>
<th>Application Apply</th>
<th>Analysis Analyze</th>
<th>Evaluation Evaluate</th>
<th>Synthesis Create</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conceptual knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procedural knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LO-23</td>
</tr>
<tr>
<td>Meta cognitive knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LO-9</td>
</tr>
</tbody>
</table>

Table 18. Learning objectives and goals for lesson six

<table>
<thead>
<tr>
<th>Learning objectives</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The learner should be able to state that a CMS is for structured information.</td>
</tr>
<tr>
<td>2</td>
<td>The learner should be able to list examples of CMS.</td>
</tr>
<tr>
<td></td>
<td>The learner should be able to list examples of different parts of a CMS. (workflow, version control, planning, editing, review, delivery, configuration)</td>
</tr>
<tr>
<td>3</td>
<td>The learner should be able to list examples of different modules in the CMS environment.</td>
</tr>
<tr>
<td></td>
<td>(CMS, DB, editor, pdf, IETP)</td>
</tr>
<tr>
<td>4</td>
<td>The learner should be able to list examples of different roles in the CMS.</td>
</tr>
<tr>
<td></td>
<td>The learner should be able to state that a CMS contains a set of rules. BR are incorporated in the system.</td>
</tr>
<tr>
<td>5</td>
<td>The learner should be able to list examples of different editors.</td>
</tr>
<tr>
<td>6</td>
<td>The learner should be able to list examples of how documents are being prepared for delivery.</td>
</tr>
<tr>
<td>7</td>
<td>The learner should be able to state that when writing SGML/XML needs an editor with built-in functions.</td>
</tr>
<tr>
<td>8</td>
<td>The learner should be able to list examples of advantages by using SGML/XML.</td>
</tr>
<tr>
<td>9</td>
<td>The learner should be able to list examples of why you need to writing in SGML/XML.</td>
</tr>
<tr>
<td>10</td>
<td>The learner should be able to state that SGML is an ISO-standard.</td>
</tr>
<tr>
<td>11</td>
<td>The learner should be able to list that by using SGML/XML the presentation can be done in different ways.</td>
</tr>
<tr>
<td>12</td>
<td>The learner should be able to state that by using SGML/XML the information is future safe.</td>
</tr>
<tr>
<td>13</td>
<td>The learner should be able to state that by using SGML/XML the information is reusable.</td>
</tr>
<tr>
<td>14</td>
<td>The learner should be able to state that by using SGML/XML provides traceability.</td>
</tr>
<tr>
<td>15</td>
<td>The learner should be able to state that SGML/XML is platform independent.</td>
</tr>
<tr>
<td>16</td>
<td>The learner should be able to state that a mark-up language only is for text. A link is created to illustrations, resources and other documents.</td>
</tr>
<tr>
<td>17</td>
<td>The learner should be able to state what a schema/DTD is.</td>
</tr>
</tbody>
</table>
The learner should be able to state why you need FOSI and layout.
The learner should be able to state the master concept.
The learner should be able to state the use of inline applicability.

The learner should be able to list examples of other ways of working if you don’t write structured information.
Appendix B – Survey questions

1. Which publication is usually a part of the operational publication?
2. What benefits does an existing publication specification offer?
3. Why is it important to analyze maintenance levels, users of the publication, system breakdown and set of information needed for a new publication package?
4. Explain the objective of technical publication specifications.
5. What problems can you identify concerning technical publication specification?
6. If you are to construct an information structure for a new product, how would you go about doing so and why?
7. Organize the following layers of business rules (S1000D BR, Saab BR, Military/Civil BR, Aviation BR, Project BR)
8. Explain why you organized the layers of business rules in the previous question in that order.
9. Do you agree or disagree with the statement “The material directed my attention towards useful information”? (Presented with a Likert Scale 1-5, strongly disagree – strongly agree)
10. Why do you agree/disagree with the statement "The material directed my attention towards useful information."?
11. Do you agree or disagree with the statement “The use of different interactions, such as the lesson assessments, hovering and being able to click on different images and objects, kept you motivated to continue”? (Presented with a Lickert Scale 1-5, strongly disagree – strongly agree)
12. Why do you agree/disagree with the statement "The use of different interactions, such as the lesson assessments, hovering and being able to click on different images and objects, kept you motivated to continue”?
13. How did you experience the presentation of the material overall taking the sound, text, images, and the hovering feature into account? Did they complement each other? Motivate!
14. Was the information in the course, or could it be, of value to you and your work. Why/why not?
15. Was there some kind of information that was of more value to you than another? Motivate!
16. Do you believe the material could affect how you perform at work? Why/why not?
17. Where the different controls (buttons and objects) easy to use? Why/why not?
18. Was the "Course explanation" a help in understanding how to use the different controls? Motivate!
19. How did you experience the variation in different controls? Was it noticeable when what control is to be used?
20. Have you attended the course before?
21. With a maximum of 3 sentences, please write down what you thought of the course?
22. Would you consider doing the full length course as an e-learning course?
23. Are there any other thoughts you would like to share?
Appendix C – The course
The e-learning course consist of 9 parts, or scenes as they are called in Articulate Storyline (Articulate); introduction to the course, lessons 1-7 and a final test (used to test the students acquired knowledge). The introduction introduces the student to the course, the structure of the course and to the controls available. At the end of the introduction there is a lesson overview slide (Figure 6) that can be seen as the hub of the course. On this slide the student can obtain information on what each lesson attends to as well as navigate to the lesson of which the student want to partake in at that moment.

![Image: Saab](https://example.com/lesson-overview-slide.png)

Figure 6. Lesson overview slide, base layer. Image: Saab

To view information about a specific lesson the student simply clicks on the blue button with the lesson of choice. This opens a layer on the slide with a small summary of the lesson (see Figure 7). In some slides there is the possibility to click on different images or buttons to reveal more information on the topic of the slide. To return to the main layer of that slide one simply has to click on the object or image again. When wanting to start a lesson (if on the lesson overview slide) or move on to the next slide the student should click on the next button in the navigation panel.
The navigation panel (see Figure 8) is located at the bottom of the player on all slides (excluding the very first slide which displays the Saab logo for five seconds). It contains four controls; the next button that takes the student to the next slide, the previous button that navigates the student to the previous slide he/she viewed, the lesson overview button which takes the student back to the lesson overview slide (Figure 6), and the text button.

The text button is somewhat different from the other buttons in the navigation panel as it is only visible when there is audible information that is not presented in the slide itself. When clicking on the text button a layer (see Figure 9) opens up with the audible information written down. This layer can be removed by clicking on the X button.
Sometimes clicking on an specific object or image might not be the most suitable, like in Figure 10. Here the information is not connected to a specific object or image, but to an area that might contain more than an object or image. In these cases a function called hotspots was used. The hotspots, generated as a green square (can also be done as an oval or freeform) in Figure 10, indicates which area can be interacted with by for example clicking on it. The green color is there for the person working with the material, but is not visible in the published version, i.e. the version the students see. However the function is present and the students can interact with the area. It is possible to indicate to the students that they can interact with the area with the help of states which will be explained below.

Figure 10. Illustrating hotspots. Image: Saab

Along with the ability to click on some objects and images for more, there was also the possibility to hover over an image (see Figure 11), i.e. to hold the cursor over the image without clicking. Once the cursor was removed from the object the information was once again hidden. The hovering function was also used to indicate what objects could be clicked. This function was possible with the help of so called states. An object could have several states to present different information, for example the shading on a button can be altered if the user holds the cursor over it or the same button can get a new color when it has been selected, visited or so on. After the results of the evaluation had been compiled there was an interest from several participants that there should be a clearer indication of what they had view on the different slide. This request was fulfilled with the help of the states mentioned in the example. Another change that was made was after the evaluation was the creation of a progress system in the form of a numbering on each slide to indicate how many more slides that had on each lesson.
Throughout the lessons there will be some assessments in the form of questions the students have to answer (see Figure 12). Assessment are used as a way to assess whether some of the information presented have been absorbed by the students. All questions in the assessments were created by people who had been part of creating the face-to-face course. There were several different ways how to present the questions such as multiple choice question, multiple response questions, true/false questions, pick one/pick many questions, or different version of drag and drop questions. All of these different alternatives of assessments are explained further in the Guidelines (see Error! Not a valid bookmark self-reference.).

At each of these assessment the students have two attempts to answer the questions correctly, before moving on to the next question or slide. Feedback is given after they have answered, see Table 19.
It was decided along with the supervisor at Saab (who had been involved in the development of the face-to-face course) that the students was not able to continue to the next slide unless they had answered the questions.

Once the student felt ready, there was another form of assessment he/she could do; the final test. The final test consisted of 14 questions drawn randomly from a Question Bank consisting of 37 questions all in all (for example question see Figure 13). There were however some questions that were always to be a part of the 14 questions presented and were therefore "locked" (a term used in Articulate Storyline for questions/quizzes that are always to be present). These locked questions were selected by people in charge of the face-to-face course. All questions in the Question Bank were the same as the questions within the lessons but during the final test the students only have one attempt to answer correctly and no feedback was given for the individual question. Instead a percentage of correctly answered questions was given at the end of the test along with the information whether the student passed the course or not. To pass the course the student had to answer 12 questions correctly which is approximately 80 %.

Figure 13. Final test question slide. Image: Saab.
# Appendix D – Guidelines

## Guidelines

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Anna Svedberg

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*Table of contents updated to page numbers for this report*
1 Aim and scope
The aim of these guidelines is to illustrate how to convert face-to-face course material to e-learning material in a pedagogical and cost efficient way. To do so a method that identifies how to transfer the material to e-learning using Bloom's taxonomy will be presented.

2 Bloom's taxonomy
Bloom's Taxonomy is a theory and a framework for categorizing knowledge as a way of distinguishing questions within education. In the framework exist of three domain which the educators should focus on; the cognitive domain, the affective domain and the psychomotor domain. The categories of the different domains are operating on different levels of complexity and the higher levels include the lower levels. When containing all domains, a thorough course can be created that can inspired a higher level of learning.

The cognitive domain deals with mental skills or knowledge and is presented in Table 20. These categories can be used to develop learning objectives and later in the combination with the learning objectives help in identifying knowledge types.

Table 20. The categories of the cognitive domain of Bloom’s taxonomy. Presented in order from the simplest to the most complex.

<table>
<thead>
<tr>
<th>Categories</th>
<th>Explanation</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge/remember</td>
<td>Recollection of already acquired information.</td>
<td>Recognition, recall</td>
</tr>
<tr>
<td>Comprehension/understand</td>
<td>Understand and comprehend problems. Ability to state a problem.</td>
<td>Interpreting, exemplifying, classifying, summarizing, inferring comparing, explaining</td>
</tr>
<tr>
<td>Application/apply</td>
<td>Using the acquired knowledge in a given situation.</td>
<td>Executing, implementing</td>
</tr>
<tr>
<td>Analysis/analyze</td>
<td>To organize the different information to understand its structure and to be able to make distinctions between them.</td>
<td>Differentiating, organizing, attributing</td>
</tr>
<tr>
<td>Evaluation/evaluate</td>
<td>Access the value of the information.</td>
<td>Checking, critiquing</td>
</tr>
<tr>
<td>Synthesis</td>
<td>Create new information by putting different pieces of information together.</td>
<td>Planning, generating</td>
</tr>
</tbody>
</table>

The affective domain concerns the emotionality of the information, i.e. the feelings, motivations or attitude the person has towards the acquired knowledge, and is presented in Table 4. As with the categories of the cognitive domain the categories of the affective domain can be used when developing learning objectives, but can also
be used to as a tool when creating the presentation of the course to keep students interested and observant.

Table 21. The categories of the affective domain of Bloom’s taxonomy. Presented in order from the simplest to the most complex.

<table>
<thead>
<tr>
<th>Category</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiving phenomena</td>
<td>Attention and awareness</td>
</tr>
<tr>
<td>Responding to phenomena</td>
<td>Reactions and motivation</td>
</tr>
<tr>
<td>Valuing</td>
<td>Personal value of received information (ex. acceptance)</td>
</tr>
<tr>
<td>Organization</td>
<td>Organizing, comparing and relating values to each other</td>
</tr>
<tr>
<td>Internalizing values (characterization)</td>
<td>Creating a personal value system that controls a person's behavior</td>
</tr>
</tbody>
</table>

The psychomotor domain refers to the physical skills a person possesses and is presented in Table 5. This domain can as with the other two domains be a contributing part to the learning objectives and can also be a contributing factor in how the material should be presented.

Table 22. The categories of the psychomotor domain of Bloom’s taxonomy further developed by Simpson (1972), Dave (1970), and Harrow (1972). Presented in order from the simplest to the most complex.

<table>
<thead>
<tr>
<th>Taxonomy Mix</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observing</td>
<td>Observing behavior of another person or persons</td>
</tr>
<tr>
<td>Imitating</td>
<td>Copying behavior of another person or persons</td>
</tr>
<tr>
<td>Practicing</td>
<td>Repeatedly performing skills and movements to become automatic</td>
</tr>
<tr>
<td>Adapting</td>
<td>Skills can be modified to comply with different circumstances and/or requirements</td>
</tr>
</tbody>
</table>

3 How to create a course

The following steps are undertaken to transfer a face-to-face course to e-learning using Bloom’s taxonomy and Articulate Storyline.

1. Identify and define the ‘Learning objectives’
2. Identify ‘Knowledge types’ and place objectives in the table
3. Follow ‘Transfer Lesson’

3.1 Course structure

The same structure used in the face-to-face course can be used for the e-learning course. A simple structure should contain:

1. An introduction – introduction to course and possible controls/actions (≈ 5 min)
2. Lesson(s) – containing the main topics of the course (≈ 30-40 min)
3. Final assessment (≈ 5-10 min)
The number of lessons depends upon how many are present in the face-to-face course. Note that no lesson should be longer than approximately 30-40 minutes to keep the student focused on the material.

4 Learning objectives

Learning objectives are descriptions of goals which the students should have achieved during the scope of or at the end of the course. As these courses are existing and some may be in use there are also existing objectives (referred to as Enabling Objects or Eos) in place. They are formulated as below.

“The learner should be able to [list, describe or explain] X”

These enabling objects need to be reviewed to include the categories of the learning domain that is of use to deliver the intended information of the course. Not all categories need to be included. Once reviewed the objectives should be worded in the following way to simplify the task of identifying knowledge types (see 5 Knowledge types).

“The learner should be able to [add verb that describe the action to be taken] X”

5 Knowledge types

Knowledge types are categorization of different types of information or knowledge. There are four types of knowledge according to Bloom's Taxonomy (Krathwohl, 2002) and they are presented in Table 23.

Table 23. The four knowledge types with explanations and examples.

<table>
<thead>
<tr>
<th>Knowledge type</th>
<th>Knowledge of:</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factual Knowledge</td>
<td>Basic facts or elements that are needed for a basic understanding and basic problem solving ability within a field.</td>
<td>Facts, terminology</td>
</tr>
<tr>
<td>Conceptual Knowledge</td>
<td>Administers the relationship between the elements or facts and the knowledge on how they function together</td>
<td>Classifications and categories, principles and generalizations, theories, models and structures</td>
</tr>
<tr>
<td>Procedural Knowledge</td>
<td>How to follow a procedure or method, i.e. how to do something.</td>
<td>Subject-specific skills and algorithms, subject-specific techniques and methods, criteria for when to use appropriate procedures</td>
</tr>
<tr>
<td>Metacognitive Knowledge</td>
<td>A person's comprehension of his or her own cognition and general knowledge of cognition.</td>
<td>Self-awareness, strategic knowledge, knowledge of cognitive tasks.</td>
</tr>
</tbody>
</table>
The categories of the cognitive domain and the knowledge types can be used to create a two-dimensional table (Figure 14), to which learning objectives (4 Learning objectives) can be applied. The columns in the table represent the categories of the cognitive domain and the rows represent the knowledge types. When adding a learning objective to the table the following steps are to be taken:

1. What is the student to do? Compare the verb used in the learning object with the categories of the cognitive domain.
2. What kind of information does the learning objective communicate? Compare to the different knowledge types.
3. Place the learning objective in the cell that represents both the knowledge type and the category of the cognitive domain.

Note that some learning objectives can be classified into different cells. There can also be two or more different learning objectives in the same cell.

<table>
<thead>
<tr>
<th>Knowledge Types</th>
<th>Comprehension</th>
<th>Application</th>
<th>Analysis</th>
<th>Evaluation</th>
<th>Synthesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factual knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conceptual knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procedural knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metacognitive knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 14. Two dimensional taxonomy table for identifying knowledge types with the help of learning objectives.

6 Transfer Lesson
Open up Articulate Storyline and select ‘New project’ or ‘From project template’ in the list on the left hand side under ‘Create a new project’. When selecting a project template choose ‘Mall_Saab’ and decide which slide templates to use.

The project template contains settings according to Saab Brand Portal.

The ‘Storyview’ will present on the screen in front of you, on this you can navigate through your course and the different scenes.

6.1 Scenes
A scene is a collection of slides and one scene should contain only one lesson.

To add a new empty scene, press the button labeled ‘New Scene’.

6.2 Slides
The slide contains the information of the lesson as it does in the face-to-face course. The project template ‘Mall_Saab’ contains template slides that can be used to transfer material manually.
To add a new slide, press ‘New Slide’ and select what type of slide to add:

- Templates
- Basic layouts
- Quizzing
- Screen recordings
- Import

For more information on different templates see 7 Templates

**6.3 How to import lesson**

Lessons can be imported from Microsoft Office Power Point, Articulate Quizmaker, Articulate Engage and Articulate Storyline. To import a lesson or specific slides from a lesson follow these steps:

1. Click on the button labeled ‘New Slide’
2. In the list on the left hand side, press ‘Import’
3. Choose the format the lesson file is saved in
4. Choose lesson and press ‘Open’
5. Choose which slides to import by clicking on them
6. At the bottom of the Insert Slide window, select where to insert the slide
7. Click on ‘Import’

Note that the slides that are imported do not include the same navigational panel as the rest of the slides imported from the project template.

**6.4 Interface settings**

The interface which in Articulate Storyline is called ‘player’ is located around the slides. There are several settings that can be adjusted concerning the interface and they will be discussed below.

For the project template Mall_Saab there is a saved ‘player’ (Mall_Saab_Player) with customized settings to fit with the Saab brand according to the Saab Brand Portal. Use this saved player as often as possible.

To adjust interface setting click on the 'Home' tab and then click on 'Player'.

**6.4.1 Features**

There are several built-in features such as 'Player tabs' and 'Controls'. You choose the features on the left hand side and can see the preview on the right hand side.

To choose a feature, simply click in the square next to the feature.

*Player tabs*

Player tabs are used to offer additional information or content to the course such as a menu, resources, glossary and notes. If the player tab you are interested in it is possible to create new. Just follow these steps.

1. Click on the icon for new objects.
2. Type in name
3. Decide where to place the tab
4. Tell Storyline what action should be done when the player interacts with the tab
5. How the player should interact with the slide
6. Click ‘OK’

The built-in feature will have a preset placing but you decide the location of all the player tabs by moving it to the desired place using the light blue arrows.

To add information to the Resource tab, follow these steps.

1. Click on the button ‘Resources’ at the top of the window.
2. Next to ‘description’ enter the text you want the users to see when they press the Resources tab.
3. Click on the icon for new objects.
4. Type in a title
5. Select one of the following.
   a. URL: enter URL
   b. File: browse for file
6. Click ‘Save’
7. If you want to add more resources repeat steps 2-6

To add terms to the Glossary tab, follow these steps.

1. Click on the button ‘Glossary’ at the top of the window.
2. Click on the icon for new objects.
3. Enter the term
4. Enter description
5. Click ‘Save’
6. If you want to add more terms repeat steps 2-6

Controls
You can also decide which of the built-in controls that should be available during the course. You can choose from volume, Search, Seekbar and Logo.

There are navigational controls (previous, next and submit), but they cannot be altered here. Settings for them can be altered for the individual slide using the Slide Properties pane.

6.4.2 Colors
You can change the Color Scheme for the project but in the project template ‘Mall_Saab’ the color scheme has been set to match the Saab Brand according to Saab Brand Portal.

6.4.3 Browser setting
You can control some behavior that the browser will have after the course has been published. The following aspects can be altered; browser size, if the course window can be scaled to the browser or vice versa, and if the course should be launched in a new window.
You can make these adjustments by clicking on 'Other' in the pane at the top of the window.

6.4.4 Saving
Before you shut down the Player Properties window, make sure to save.

1. Click on ‘Current Player’
2. Select 'Save'

6.5 Preview and Publishing
Once your course is complete make sure to preview the entire project. Click on the arrow beneath the Preview icon in the top pane and select 'Entire Project'.

When you are ready to publish your course, click on Publish and choose one of the following options of output.

- Web
- Articulate Online
- LMS
- CD
- Word

For more information on how to publish to the different outputs, please visit the Articulate community online:


7 Templates

7.1 Slides
The following slides templates are available in the project template for the introduction slide and the lessons. For information on slide templates concerning assessments, see 9 Assessments.

7.1.1 Introduction

Intro Slide
Lesson Title

This Lesson title template is used as title slide for all lessons

Name Slide

Used in the introduction

Course Explanation

Explains the different possible controls

Goals

States the goals of the course.

Lesson Overview

Text field contains information on the different lessons

The buttons are equipped with ‘Triggers’ that will navigate the students to the slide layer of that specific lesson
Lesson overview slide layer (example)

Text field contains a small summary of the lesson.

When clicking on the next button when in a specific lesson the student will jump to the beginning of that slide

Lesson Title

This Lesson title template is used as title slide for all lessons

Topic Slide

What are the topics of the lesson?

Simple Outline Slide w/ text layer

Contains layer that is located in the lower corner on the right hand side in Articulate Storyline
**Simple Outline Slide w/ text layer**

The text layer

**Slide layout w/ clickable image**

Includes two layers, one for each image

**Slide layout w/ link and hover state**

The shape is equipped with a hovering state (more information becomes visible when the student holds the cursor over the object without clicking)

Link to URL

**Slide layout w/ hotspots as hover function**

The green areas have triggers attached to change to a hover state for the images

**Final Lesson Slide**

Is to be used at the end of each lesson (excluding Final Test)
Lesson Title

This Lesson title template is used as title slide for all lessons.

Explanation

Describe the test.

Result Slide (base layer)

Displays the student’s score and the passing score.

Includes button; so the students can retake the test and print the results.

Result Slide (success layer)

Informs the students of passing result.
Result Slide (failure layer)
Informs the students of failing result.

Final Slide (Fail)
Informs student of the course not completed.

Final Slide (Pass)
Informs student of the course completion.
Includes exit button that closes down the course.

7.1.4 Question Bank
Which of the statements are accurate for the quiz type "true/false"?
- A question that requires the user to drag and drop items in the second column.
- A question that requires the user to click on the correct area.
- A question that requires the user to select a single correct choice out of two possible answers.
Multiple Response Slide

More information, see 9.2 Multiple response

True/False Slide

More information, see 9.3 True/false

Pick one slide

The pick one question is a free form question that contains of several objects or shapes. The student can pick one shape when answering by clicking on it.

Pick many

Pick Many Slide

More information, see 9.5 Pick many
Matching Drop-Down
More information, see 9.6.1 Matching Drop-down

Sequence Drop-down
More information, see 9.6.2 Sequence Drop-down

Matching Drag and Drop Slide
More information, see 9.7.1 Matching drag and drop

Sequence Drag and Drop Slide
More information, see 9.7.2 Sequence drag and drop

Word Bank Slide (base layer)
More information, see 9.7.3 Word bank
7.1.5 **Navigational panel**
The slides included in the project template 'Mall_Saab' contains a navigational panel located at the bottom of the slide (Figure 15). It contains four controls:

1. **Next** – navigates the student to the next slide
2. **Previous** - navigates the student to the previous slide he/she viewed
3. **Lesson overview** - navigates the student back to the lesson overview slide that in the project template is located in the introduction scene
4. **Text** – Opens up a layer on the specific slide containing written information

![Navigation panel](image.png)

Figure 15. Navigation panel. Image: Saab.

**8 Functions**
The functions below are present in the project template. More information on how to use the different functions as well as tutorials can be found at the Articulate community online:
8.1 Layers
Layers can be added to each slide and allow you to display additional information to the students without having to create additional slides. The layers can be connected to each other with the help of ‘Triggers’.

It is a simple function to use, but if you are not custom to working with layers it may take a few tries. To add a layer, follow these steps.

1. Go to the slide in question (if in storyview double click on the slide)
2. Do one of the following
   a. Click on the insert tab and then click on ‘Slide Layer’
   b. At the Slide Layers panel (bottom right corner) click on icon for new object
   c. At the Slide Layers panel (bottom right corner) right click on a layer and select duplicate to get a duplicate
3. Add content

You can change properties of the slide layer by clicking on the gear symbol of the specific layer in the Slide Layers panel (bottom right corner)

The time spent using this function depends on the number of layers, but after a few tries each layer will take approximately 10-30 minutes (depending on content).

8.2 States
Any object can have different states that can be altered based on the students’ interactions with the material. This can be done either with the help of built-in states or with the help of ‘Triggers’

It is a simple function to use, but if you are not custom to working with states it may take a few tries. To add a state to an object, follow these steps.

1. Go to the slide in question (if in storyview double click on the slide)
2. Open the Timeline, States and Notes panel (click on the double arrow at the bottom right corner next to the Slide Layer Panel)
3. Click on the States tab to open the States panel
4. Click on the object you wish to add a state to
5. Click on ‘Edit States’ in the States panel
6. Click on the icon for a new object
7. Give the state a name or choose a built-in function and name
   a. If choosing to create own state, triggers will have to be added after you have completed step 11.
8. Click ‘Add’
9. Add content to the object or slide
10. To add another state to the same object repeat step 6-9
11. Click on ‘Done Editing State’ when finished

To edit a state follow steps 1-4 and select the state to edit. Then modify the content and do step 11 when you’re finished.
The time spent using this function depends on the number of states as well as the number of objects that require a new state, but after a few tries each state will take approximately 5-15 minutes (depending on content and whether a built-in function has been used).

8.3 Hotspots

Hotspots are invisible (to the student) interactive areas that can be used instead of buttons or for example to create a one clickable area for two objects or a hovering function for shapes made up out of several objects. To make the hotspots interactive add ‘Triggers’.

It is a simple function to use and only take a few seconds to add (becomes a few minutes when adding triggers). To add a state to an object, follow these steps.

1. Go to the slide in question (if in storyview double click on the slide)
2. Go to the ‘Insert’ tab
3. Click hotspot and select one of the following shapes
   a. Oval
   b. Rectangle
   c. Freeform
4. On the slide draw the hotspot and a shape that is semi-transparent will appear. Once the project is published the hotspot will be invisible.
5. Add trigger for interactivity

8.4 Triggers

Triggers are used to create interactivity with objects and are easy to use. To add a trigger, follow these steps.

1. Go to the slide in question (if in storyview double click on the slide)
2. At the Trigger Panel (at the right hand side), click on the icon for a new object
3. Choose from the drop-down menus in the ‘Trigger Wizard’ the following
   a. What happens (choose action)
   b. Where it happens (choose what slide/layer/object/etc.)
   c. When it happens (event)
4. Click ‘OK’

Adding a trigger takes approximately a minute if you know what you want the trigger to do.

8.5 Variables

Variables are used to remember information throughout the course, for example a student’s name, but they can only hold one value at a time. There three types of variables; text (holds text based values e.g. names), number (holds numeric values, e.g. scores) and true/false (holds one out of two values, e.g. true or false, on and off).

To add a variable, follow these steps.

1. In the Trigger Panel (at the right hand side), click on the icon for ‘Manage project Variables’ (χ)
2. Click on the icon for a new object
3. Name the variable
4. Set the variable type to one of the following
a. Text
b. Number
c. True/False
5. Set the value according to the following
   a. If Text is the type: leave blank
   b. If Number is the type: leave blank
   c. If True/False is the type: false)
6. Click 'OK'
7. To add another variable follow steps 2-6
8. Click 'OK' when finished

9 Assessments
Assessments are used throughout every lesson to create interactivity and to assess whether some of the information presented have been absorbed by the students.

To present the questions use a questions bank. Per occurrence there is only to be a maximum of 3 questions. More questions can be added to the questions bank but only three can be presented at a time.

For every question the student has two attempts to answer the question correctly and should receive feedback (Table 24).

**Table 24. Feedback to answers in the assessment. Replace X with correct answer.**

<table>
<thead>
<tr>
<th>Answer</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct</td>
<td>That's right! You selected the correct response.</td>
</tr>
<tr>
<td>Incorrect (1st attempt)</td>
<td>That is incorrect. Please try again.</td>
</tr>
<tr>
<td>Incorrect (2nd attempt)</td>
<td>You did not select the correct response. The correct answer is &quot;X&quot;.</td>
</tr>
</tbody>
</table>

Assessments are also used in the final test, but then the students have only one attempt.

There are five different types of assessments that are to be used.

- Multiple choice question
- Multiple response questions
- True/false questions
- Pick one
- The pick one question is a free form question that contains of several objects or shapes. The student can pick one shape when answering by clicking on it.

- Pick many questions
- Drag and drop questions
- Drop down questions

The different types of questions will be described below
9.1 **Multiple choice**

The multiple choice question is a graded question that consists of a maximum of 10 choices. There is only one correct answer and the student can only select one answer by clicking in the circles in front of the choices.

9.2 **Multiple response**

The multiple response question is a graded question that consists of a maximum of 10 choices. Several choices may be correct and the student has to pick all correct choices to score. The student answers by clicking in the boxes in front to the choices.

9.3 **True/false**

The true/false question is a graded question that consists of two possible choices. Only one choice can be correct and the student can only select one answer by clicking in the circles in front of the choices. The question can be written also be written as a statement that the student has to decide if it is true or false.

9.4 **Pick one**

The pick one question is a free form question that contains of several objects or shapes. The student can pick one shape when answering by clicking on it.

9.5 **Pick many**

The pick many question is a free form question that contains of several objects or shapes. The student can pick several shape when answering by clicking on it.

9.6 **Drop down**

There are two different versions of drop-down present in the project template 'Mall_Saab'

9.6.1 **Matching Drop-down**

The matching drop-down question is a graded question that consists of a maximum of 10 matching pairs. The
student have to decide which of the choices (or item) in a drop-down menu (left column) is matched with the question (or item) in the right column. All matches must be correct for the student to score.

9.6.2 Sequence Drop-down
The matching drop-down question is a graded question that consists of a maximum of 10 items. The student has to place the items in the right sequential order by picking the correct items from drop-down menus. All matches must be correct for the student to score.

9.7 Drag and drop
There are 3 different versions of drag and drop question.

9.7.1 Matching drag and drop
The matching drag and drop question is a graded question that consist of a maximum of 10 matching pairs. The student have to decide which of the choices (or item) in a the right column matches the question (or item) in the left column. All matches must be correct for the student to score.

9.7.2 Sequence drag and drop
The sequence drag and drop question is a graded question that consist of a maximum of 10 items. The student has to place the items in the right sequential order by dragging and dropping them. All matches must be correct for the student to score.

9.7.3 Word bank
The word bank question is a graded question that consists of a maximum 10 choices. There is only one correct choice and the student has to place the correct choice in an empty box to score.
9.8 Question Banks

Question banks are used to manage different groups of questions and to simplify the use and reuse of the questions without having to duplicate them. When using question banks; create one for each lesson and one bank including all questions.

It takes time to create a question bank with questions, but it saves time in the end if a question for example needs to be modified or changed. The changes made will apply to all places where the questions are included in a "draw".

To create a question bank with questions, follow these steps.

1. Go to Storyview
2. Select the 'Home' tab and click on 'Question Bank'
3. In the drop-down menu select 'Create Question Bank...'
4. To add questions do one of the following
   a. Click on 'Graded Question' to create a new graded question
   b. Click on 'Survey Question' to create a new survey question
   c. Click on 'New Slide' to create a new slide (with or without a question)
   d. Click on 'Import Question' to import a questions (or slides) from scenes in the course or from other questions banks.
      i. Select from where to import the slide
      ii. Select which slides to import.

9.8.1 Draw from the question banks

When you want to use the questions you can "draw" the questions from the question banks. To do so follow the following steps.

1. Select the scene to place the "draw" in
2. Do one of the following
   a. Through 'Storyview'
      i. Go to Storyview
      ii. Select the 'Home' tab and click on 'Question Bank'.
      iii. In the drop-down menu select ' New Draw from Question Bank'
   b. Through 'New Slide'
      i. Click on 'New slide'
      ii. Select 'Quizzing' in the list on the right
      iii. Select 'Draw from Bank' from the tabs
3. Decide which questions bank to use
4. Decide whether to draw questions randomly or in order
5. Decide how many questions is to be presented
6. Specify for each question if it should be included in this draw (randomly, always, never)
7. Click on 'Insert'

10 Media

Below follows restrictions and information concerning the media.

10.1 Text

Not everybody have the ability or the need to read the information given in the course. Nor is everybody able or need to listen to the same information. Text should therefore be included. How it is included depend upon the Learning objectives.
10.2 Images
Images and photos should have a high resolution and should be used according to Saab Brand Portal. See webpage for more information.


10.3 Sound
The most cost-effective alternative, both concerning time and money, would be to not add sound, but that is not pedagogical.

The second alternative is to add a synthetic voice. It is less cost-effective when it comes to time. The license for a synthetic voice to be used commercially is a onetime cost which is cost effective for the budget in long term.

The third alternative, which is the most pedagogical, but least cost-effective when it comes to money, is to have a recorded voice of a human being.

Whichever alternative that is chosen, sound is added to Articulate Storyline by importing audio files, recording narration or from importing slides from other sources (e.g. Microsoft Office Power Point). Audio files can be imported by following these steps.

1. Go to the 'Insert' tab and click on the arrows below 'Sound'
2. In the drop-down menu select 'Sound from File...'
3. Browse for correct file

Applicable file formats are:

- AAC
- AIF
- AIFF
- M4A
- MP3
- OGG
- Wav
- WMA

10.4 Video
Videos are not a necessity and the decision whether they should or could be included in the course depends upon the Learning objectives.

Video also include animation. Animations can and should mainly be done using Microsoft Office Power Point. A work order for a flash animation or video will have to be made.

To add a video, follow these steps:

1. Go to the 'Insert' tab and click on the arrows below 'Video'
2. In the drop-down menu select 'Video from File...'
3. Browse for correct file

Applicable file formats are:

- FLV
- MP4
- SWF

Some file formats may be converted to MP4 when imported. For more information see the Articulate Community online.

To add a flash file, follow these steps:

1. Go to the 'Insert' tab
2. Click on 'Flash'
3. Browse for correct file

10.5 Color

The colors used in the course should be used according to Saab Brand Portal. See webpage for more information.

Appendix E – List of improvements

The following list contains suggestions of improvements derived from the evaluation.

1. Change the voice to a human’s voice.
2. Insert a form of progress report, for example numbering the slide or a progress bar.
3. Indicate when to proceed.
4. Highlight that which is being talked about.
5. Insert a hover indication to what objects that are clickable.
6. Insert a visited state to illustrate that which has been looked at.
7. Consider not having Swedish images when the course and audio information is in English.
På svenska

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