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DESIGNING LESSON TO SUPPORT MEANINGFUL LEARNING

IN HIGHER EDUCATION: EXPERIENCES FROM THE FIRST DESIGN CYCLE

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Because of the globalization and technology advancement, the continuously changing society demanded for more than just education that emphasizes rote memorization of knowledge, but an education that promote problem-solving skills, collaboration, communication, critical thinking, and creative thinking as part of 21st century skills. The opposite of rote learning is meaningful learning, where prior knowledge connects with the new knowledge and leads.

Previous studies of Teaching and Meaningful Learning model (Hakkarainen, 2011; Hakkarainen, Saarelainen, & Ruokamo, 2007) had been using action research, which later developed into design-based research as research design method; focusing on case-based teaching method as the pedagogical design. In this Teaching and Meaningful Learning model, meaningful learning is described by learning outcomes and process characteristics. In accordance with previous studies, this study was designed as the first cycle of design-based research with aim to design a lesson to support meaningful learning in higher education context, the expected outcome of this first design cycle was a set of pedagogical activities that had been designed in accordance of learning theories to support meaningful learning.

The designed pedagogical activities set was conducted in a classroom as a part of Learning Environment and Technologies classroom in University of Oulu, Finland. The classroom topic was “Making Clear Slide Design”. The classroom activities were designed in basis of integration between learning domains, namely, cognitive, affective and psychomotor.

Meaningful learning process characteristics emerged during classroom was examined through semi-structured interview to the participants; these interviews were coded using NVivo and an inter-rater reliability test was conducted to examine the reliability. Most notable emerged meaningful learning process characteristics were critical thinking, self directed and reflective.

Several meaningful learning process characteristics were identified from interviews. A set of pedagogical activities to support meaningful learning, that featured integration of learning domains, had been produced in this study; however, refinement of coding process is needed to enhance the inter-rater reliability. The produced framework, as it is outcome of the first design cycle, should be iterated on the next cycle; some iterations suggestions listed are the ways of integrating learning domain, the way of accommodating different number of learners, and the refinement of inter-rater reliability.

Keywords: Design-based research, meaningful learning, meaningful learning process characteristics, learning domains, teaching and meaningful learning
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1 Introduction

The advancement of technology in last few decades has given tremendous change in the way we live. New ways of solving problem are found, new cultures are formed, and new job fields are emerging. Two decades ago, there was only “marketer”, or “telemarketer”; but now the field of marketing has expanded to new media, creating new jobs such as social media influencer, social media manager, and digital marketing specialist. Once very costly computer and mobile phone has grown cheaper and more sophisticated; creating more chance to more technology advancement, which will lead to another change. There is no telling how the future will look like.

In a society and era that is susceptible to continual change, uncertain, complex, and ambiguous (Bennett & Lemoine, 2014) the way education works so far was questioned; was is still relevant to educate children the way people were being educated 20 years ago? Most of education at that time strived to train human to become good labor worker (Dolence & M. Norris, 2018; Godin 2012; Lujan & DiCarlo, 2006; Robinson 2010; Rose 2012); who will be doing meticulous, detailed, tedious jobs that currently being shifted to be worked by automated machines—given that machines could do just the same quality of work in much quicker, efficient way.

This education system, first adapted in U.S. by Horace Mann from Prussian Model (Rose, 2012), was intended to humanize, to civilize the society and to promote tolerance by applying discipline and equality. As quoted by Rose in his article, Mann grew up in religiously tense situation between Catholics and Protestants; where the schools were reinforcing more division. In contrary, Prussian Model “was designed to build common sense of national identity.” Because of this, Mann had an idea for students to learn together so that the division between the groups would be dissolved; establishing more unified, egalitarian society. This idea was in alignment with the fact that, at that time, factory line was the most efficient way to productivity.

Partnership for 21st Century Learning proposed the skill framework for 21st century needs, which was widely known as 4C: Creative Thinking, Critical Thinking and Problem Solving, Collaboration, and Communication (“Framework for 21st Century Learning”, 2015). The framework proposed that education should teach people to be more creative and critical thinkers, in which non-21st century education has little to offer. It drives student to be learn not just
in a rote way, memorizing information by information, only to be called later, and books weren’t allowed to be read during test because that is cheating (whereas in society, it would have been called collaboration (Robinson, 2010).

Technology advancement has provided much efficient way for that—smartphone reminders and search engines, for example. The opposite of rote learning is meaningful learning, where learner connects the prior knowledge to existing knowledge, instead of just being spoon-fed with hefty amount of information. Unfortunately, even though this notion has influenced many, the area of improvement is very wide. This study comes in that gap, exploring how to support meaningful learning, using existing resources and known methods, in a new way.
2 Theoretical Background

In this chapter we will discuss theories about meaningful learning and learning domains. Meaningful learning theory (Ausubel, Novak, & Hanesian 1978) will be discussed in Chapter 2.1, Teaching and Meaningful Learning (TML) model (Hakkarainen, 2011; Hakkarainen et al., 2007; Löfström & Nevgi, 2007) will be discussed in Chapter 2.2, and learning domains (Kapp, 2012; Krathwohl, 2002; Nkanginieme, 1997) and effective teaching methods according to learning domains (Kapp, 2012) will be discussed in Chapter 2.3.

2.1 Meaningful Learning

According to Ausubel et al. (1978), meaningful learning is where new information is built and converges on learner’s prior knowledge structure. Novak stated that “Through the process of meaningful learning, concepts and propositions are organized into the cognitive structure of our brains” (Novak, 2011). As the name implies, new meaning emerges from the learning task into the relevant part of cognitive structure. In meaningful learning, the learning itself and retention are not dependent on human capacity of retaining arbitrary and verbatim information as isolated concept, which therefore increases temporal span of retention. The opposite of meaningful learning is rote learning, which focus to the retention of information by repetition (Ausubel et al. 1978) without interrelation (Kilic & Çakmak, 2013; Novak, 2010) and with less effort or emotional commitment (Novak, 2011).

There were three pre-requisites of meaningful learning: 1) students should have well organized, relevant knowledge structure) 2) there should be conceptually clear subject matter 3) learner must choose to learn meaningfully (Bretz, 2001; Novak, 2011; Novak & Cañas, 2008). In relation of teacher and learner roles in this matter, only one of these conditions could be dictated by the teacher (Bretz, 2001) which is to clearly organize the subject matter.

2.1.1 The Importance of Concept Maps in Meaningful Learning

The need of explicitly showing how concepts and their relationships exist in a knowledge structure drove the development of concept map and it was also found that concept map helps student learn how to learn (Novak, 2010). Concept map is a graphical tool that shows knowledge structure in visual form; specifically, nodes connected with lines. Each node rep-
resent concept and each line represents the relationship between those concepts (Wei & Yue, 2016), making it a tool to organize, connect and synthesize information (Kilic & Çakmak, 2013).

What makes concept map different with mind maps in general is the fact that in concept maps, “concepts are represented in a hierarchical fashion with the most inclusive, most general concepts at the top of the map,” (Novak & Cañas, 2008). That is also to say that most specific concepts of the knowledge are located at the bottom of concept maps. This hierarchical structure depends on the context of knowledge and thus, it was deemed best to start constructing concept maps by context to refer to, in which Novak called focus question (Novak & Cañas, 2008). Another distinct characteristic of concept maps was the cross-links, which are the links or relationships between different sections of concept map. Cross-links often represent the creative leaps of the concept map creator, which then also a proper tool to encourage creative thinking. Those facts about structure above were only the start of the concept map’s importance towards meaningful learning; the focus question provides further context on knowledge, supporting the conceptual clarity of subject matter, and the cross-links encouraged the meaning creation between concepts.

That is why, when attempting to further foster meaningful learning, concept maps were suggested by various studies. Concept maps work as a scaffold, or template, to organize knowledge (Novak & Cañas, 2008). Wilson, Mandich, & Magalhaes (2016) argued that concept maps are encouraging meaningful construction of knowledge and giving benefits to learner by its ability visualize their knowledge in organized way (Kilic & Çakmak, 2013; Wei & Yue, 2016; Wilson et al., 2016). Furthermore, it gives opportunity to think about connections between concepts and reflect on their understanding, which might help providing clarity of the concept (Kilic & Çakmak, 2013). The act of concept mapping alerts students that they do have some prior knowledge regarding certain subject matter (Bretz, 2001) and in addition, concept mapping is in alignment with conceptual scaffolding; it is assisting learner in simplifying complex concepts, which affects the allocation of relatively limited cognitive resources (Hill & Hannafin, 2001).

2.2 Teaching and Meaningful Learning (TML) Model

Quoting from Hakkarainen et al. (2007), meaningful learning is understood as “an upper level concept that can be realized through various pedagogical models or approach”. This under-
standing was in alignment with pre-requisites of meaningful learning (see Chapter 2.1 above) as it didn’t specifically mention specific pedagogical model or approach. This model was developed as an action research (which later evolved to design-based research) and emphasizing case-based teaching method as the pedagogical design (Hakkarainen, 2011; Hakkarainen et al., 2007). Specifically, the case the teaching was based on was the production of digital video in network based education.

Furthermore, in this Teaching and Meaningful Learning (TML) model, meaningful learning is defined by its outcomes and process characteristics. (Hakkarainen, 2011; Hakkarainen et al., 2007). The outcomes are 1) domain-specific knowledge and 2) transferable, generic skills such as information literacy, metacognition, problem recognizing, and higher-order thinking skills such as critical thinking, creative thinking, reasoning, planning and analyzing. The summary of TML can be seen at figure below:

![Figure 1. Teaching and Meaningful Learning Model (Hakkarainen, 2011)](image)

The development of the meaningful learning process characteristics could be traced back to study about Network-based Education by Ruokamo, Tuovinen, Tella, Vahtivuori, & Tissari (2002), which was also built based on characteristics of meaningful learning by David H. Jonassen in 1995, 2000 and 2003, Heli Ruokamo & Seppo Pohjolainen in 2000 and Heli Ru-
okamo in 2001 (as cited in Hakkarainen et al. 2007). Over the years, the characteristics were developed and used in various studies (Hakkarainen, 2011; Hakkarainen et al., 2007; Löfström & Nevgi, 2007) within field of ICT and network-based education. The model also suggests that meaningful learning was not simply a result of the teaching; instead, teaching and meaningful learning has reciprocal relationship. That is to say, both process characteristic and learning outcome contribute to the design of learning environment and the support or guidance for students’ meaningful learning, as stated in the model.

It is important to highlight that, even though in this model, meaningful learning is defined by process characteristics and expected outcomes, in this study we will be focusing only on the process characteristics. Additionally, Author used the latest meaningful learning characteristics in Hakkarainen’s study (2011) about the use of digital video in problem-based learning situation. In total, there was 14 meaningful learning process characteristics described in the study; which, as well as this study, were described as several statements in relation with the problem-based learning, as follows:

*Constructive* was described with these statements: 1) I was able to utilize my prior knowledge about the course topics 2) the course deepened my understanding of what I had learned before. Similarly, *experiential* was described by two statements: 1) I was able to apply my own practical experiences during the course, 2) I was able to utilize my own experiences as starting points for learning in the PBL tutorials. *Active* was described with 3 statements: 1) Students’ role was to actively acquire information 2) Students’ role was to actively evaluate information 3) Students’ role was to actively apply information.

*Cooperative, Conversational, Collaborative* was described by: 1) the students were committed to collaboration and 2) cooperation with my partner was successful. The *self-directed* was described as: 1) I was able to influence the content and realization of our video assignment 2) the students directed their own studying process in the PBL and 3) I was able to evaluate my own learning during the course. *Contextual* was describe as “the course promoted the learning of skills and knowledge needed in working life”. *Goal-Oriented* was described as “the studying enabled the achievement of my personal goals”. *Individual* was described as 1) I was able to apply my own practical experiences during the course and 2) studying enabled the achievement of my personal goals.

*Reflective* was described as “I was able to evaluate my own learning during the course.”. *Abstract* was described as “On the course practical examples were studied in a theoretical
framework.”. *Multiple-perspective-oriented* was described as “The course helped me to understand different perspectives related to the topics under study.”. *Critical* was described as “The studying developed my critical thinking skills.”. *Multi-representational* was described as “The targets of learning were examined through several forms of presentation (text, diagrams, pictures, video, etc.).”. *Creative* was described as 1) The PBL sessions encouraged creative thinking and 2) our video assignment enabled creative thinking. *Emotional involving* was not described using statement, but rather seen from possible relevant emotions to learning: worry, comfort, boredom, interest, frustration, uncertainty, dispiritedness, disappointment, satisfaction, enthusiasm, tension, and embarrassment. In addition, these emotions were added: trust, sense of community, irritation, joy, stress, relief, feelings of inadequacy, and challenge.

### 2.3 Learning Domain and Teaching Methods

In this study, meaningful learning would be defined in alignment with TML model (process characteristics and learning outcome) and synthesized with a part of Ausubel’s theory in terms of considering the pre-requisites to pursue, mainly, the emergence of process characteristics presented in TML model, instead of the integration of knowledge structure or learning outcome such as transferable generic skills or domain-specific knowledge.

The reciprocal relationship suggested by TML model indicated that even though not always the case, the design, organization of learning environment, and guidance for students would be able to influence the emergence of process characteristics and outcomes. (Hakkarainen et al., 2007). Furthermore, even though it was stated that the purpose of this study was not mainly to pursue the domain-specific knowledge for students, domain-specific knowledge was part of meaningful learning outcome, as stated in the TML model. The reciprocal relationship then suggested that this outcome will also affect the teaching design – hence the importance of putting consideration of domain-specific knowledge in this study.

Domain-specific knowledge in TML model is topic-specific, angle-specific knowledge in contrast of “transferable, generic skills” such as knowledge in ICT, knowledge in geography, knowledge in management, and so on. Conceptual clarity, the pre-requisite of meaningful learning (see Chapter 2.1), would then be improved when knowledge is specified in that way;
as knowledge can be addressed from several angles, which then not necessarily construct the same meaning.

2.3.1 Domain-specific Knowledge and Learning Domain

Although similar in terms and both are contributing to the meaningful learning, domain-specific knowledge are not to be confused with learning domains, which was part of educational taxonomy by Benjamin Bloom and his colleagues (Dettmer, 2005; Krathwohl, 2002). Learning domain classification was firstly renowned by Bloom in 1956: cognitive, affective and psychomotor. The cognitive taxonomy was initially created to provide facilitation between educators, mainly when it comes to assessing learning and testing materials (Tyran, 2010). Cognitive, affective and psychomotor domain was relevant to meaningful learning, as elaborated by Novak (as cited in Bretz, 2001). More discussion about this relationship to meaningful learning will be presented at Chapter 2.3.3.

Cognitive domain involves the development of our mental skills and the acquisition of knowledge, and it includes the six level of thinking: knowledge, comprehension, application, analysis, synthesis, and evaluation. Affective domain involves feelings, emotions and attitudes; psychomotor domain involves the utilization and coordination of motor skills (Clark, 2015a, 2015b; Nkanginieme, 1997). The knowledge in cognitive domain consists of the following: knowledge of specifics, knowledge of ways and dealing with specifics, knowledge of universal and abstractions in a field. (Krathwohl, 2002)

These knowledges later emerge with different name, but substantially similar, in the Revised Bloom’s Taxonomy in the same order: Factual Knowledge, Conceptual knowledge and Procedural Knowledge. One new dimension named Metacognitive Knowledge was added, which was knowledge of cognition and awareness of one’s own cognition. Factual Knowledge deals with the basic elements that must be known in order to be familiarized with the subject matter, such as terminology. Conceptual Knowledge concerns interrelationships among the basic elements such as classifications, principles, and models; and Procedural Knowledge concerns about how to do something, such as skills, techniques and criteria for determining when to use them. (Krathwohl, 2002)

Some of these knowledges have different name with similar substance, for instance, factual knowledge has also been known as declarative knowledge, because declarative knowledge
also concerns facts, theories and names (J. R. Anderson, 1982; J. Hong, Pi, & Yang, 2016). A gamification expert Karl M. Kapp in his book *The Gamification of Learning and Instruction: Game-Based Methods and Strategies for Training and Education* separated the principles part from conceptual knowledge, naming it *rules-based knowledge*. The common form of rules was causal effect; when x is done, the result will be y.

**Affective domain,** in general, can be comprehended as domain that deals with emotions and feelings, including values, appreciation, enthusiasm, motivation and attitude (Krathwohl, Bloom, Masia, 1973 as cited in Clark, 2015a). It “deals with attitudes, values, beliefs, and emotions” (Kapp, 2012, p.185). Like cognitive domain, affective domain does have its own taxonomy; stated from the very simple to complex: *receiving phenomena, responding to phenomena, valuing, organizing, and internalizing value.* Elaborating further, receiving phenomena refers to awareness, willingness to hear and selected attention; such as listening with respect. Responding to phenomena refers to learner’s active participation, such as presenting a project or discussing about ideas. Valuing refers to the attachment to the particular phenomena, object or behavior, such as following an agreement or proposing a plan for specific problem-solving. The next stage is organizing the values that have been attached; contrasting the difference, resolving the conflicts between values and prioritizing one upon another. Finally, the values organized are internalized; become the force system that control behavior.

**Psychomotor domain** concerns physical movement, coordination, and motor-skill areas, which development requires practice (Clark, 2015b), and intersects physical skills and technique with cognitive skills (Kapp, 2012). Psychomotor skills thus ranges from manual tasks such as drilling a hole, cutting planks of wood, washing a car, and so on (Clark, 2015b). There are 7 categories of psychomotor, from simple to complex: *perception, set, guided response, mechanism, complex overt response, adaptation, origination.* Perception refers to the usage of sensory cues to guide motor activity, such as estimating where a thrown ball would land. Set is closely related with responding to phenomena in affective domain; it refers to the readiness to act; including mental, physical and emotional sets. The examples are recognizing one’s abilities and limitations or showing desire to learn a new process. Guided response includes imitation and trial-and-error; such as following instruction to build a model. Mechanism is a basic proficiency, where the learned responses have become habitual and could be performed with confidence. Complex overt response shows skilful performance; which its proficiency is indicated by accuracy, speed, and high coordination. Adaptation refers to the usage modifica-
tion of the procedure; and origination refers to the creation of new movement patterns to fit a particular situation.

2.3.2 Effective Teaching Method for Specific Learning Domain

One example from effective teaching methods is proposed by Karl M. Kapp, a gamification expert. Kapp proposed effective teaching methods for specific learning domains, in his aforementioned book, *The Gamification of Learning and Instruction: Game-Based Methods and Strategies for Training and Education*. In that book, Kapp argued on some methods to teach these domains—rules-based knowledge, conceptual knowledge, affective domain, psychomotor domain—more effectively.

*Rules-based knowledge*, as stated in his book, is “a statement that expresses the relationships between concepts. Rules provides parameters dictating a preferred behaviour with predictable results.” (Kapp, 2012, p.189). The effective teaching methods for teaching rules-based knowledge he proposed were providing examples and role-playing. Kapp also proposed *experiencing consequences* as a suitable element of gamification to be incorporated to teach rules-based knowledge effectively. Providing examples will clarify the rule, showing learners how does it work—and it is good idea to provide different ways of a rule being applied by several different examples; because it helps learner to generalize the idea of the rule application. Role playing will provide learners chance to experience consequences—the application—of the rules, instead of merely memorizing, or simply being aware that there are rules.

*Conceptual knowledge* is “a grouping of similar or related ideas, events, or objects that have a common attribute or a set of common attributes.” (Kapp, 2012, p.189). *Providing examples and non-examples, metaphoric devices and attribute classification* were proposed by Kapp to teaching conceptual knowledge effectively. The example of the first was showing the way to act safely in the laboratories and also the way to act *unsafely*; in order to teach the concept of “safety in the laboratory”. Metaphoric devices will help learner to link known elements in the device with the unknown concept they are learning; in here learners will analyze and compare their previous understanding and new understanding. Attribute classification helps learner to build the concept; as it defines the relevant and irrelevant attributes towards a certain concept. For example, the concept of money has relevant attributes such as some value and the ability to be traded for goods. The irrelevant ones were the round shape – not every round things are money and color – as money comes in many different colors.
In teaching affective domain effectively, Kapp claimed that a person can be encouraged to participate, or perform an important act, even though the act contradicts the person’s attitude; as the result, the change in the person’s attitude will occur. Complementing this technique, when instructors showing that success is possible, learner will be more motivated to work on it, because it is not rare that only when people think the goal is achievable, they will achieve it. Finally, celebrity endorsement influences how learner think toward something, so that they will shift their value, or beliefs, according to the celebrity they idolize.

Teaching psychomotor domain more effectively, according to Kapp (2012), can be achieved by observation, watching someone else doing things learner aim to learn. Observation provides general understanding of the steps and sequences of actions; and if learner couldn’t observe because of physical and resource limitation, demonstration is good idea to provide the overview of the steps and actions. These two methods will lead learner to better practice. Even though instructor tells, or shows, how to type in a keyboard so many times, learner won’t really understand it until learner really tries to type.
3 Aims and Research Questions

This study is conducted as pilot stage to design a short classroom session, in length of 2 – 3 hours, to explore how can a lesson plan will be able to induce meaningful learning. It is worth to note that initially, the goal of this pilot stage was to merely look for integration of knowledge structure—which is more related to learning outcome, which then shifted for looking towards meaningful learning process characteristics.

The lesson was constructed while considering the pre-requisites of meaningful learning: relevant and well-constructed prior knowledge (see Chapter 4.4.2 and Chapter 4.4.4), clarification of the lesson topic into simpler concepts, and integration of cognitive, affective and psychomotor domain (see Chapter 4.4.5). Moreover, small rewards were provided as part of motivational incentive (see Chapter 4.4.3).

As this study was conducted as a pilot stage, this study will first focus on the emergence of meaningful learning process characteristics (see Chapter 2.1). The primary aim can be formulated as follows: How can educator facilitate and induce meaningful learning in higher education context? In order to answer this aim, these research questions were defined:

1. How to design a lesson in higher education, that consider the pre-requisites of meaningful learning?
2. What process characteristics of meaningful learning emerge in that lesson?
4 Methodology

In this chapter we will be discussing the way the lesson was designed and the rationale behind it. Research design and participants will be discussed in Chapter 4.1 and 4.2, respectively; the rationale behind the lesson design, from pedagogical point of view, will be discussed in Chapter 4.3; data collection processes and artefacts collected in Chapter 4.4; and finally, the data analysis method, including usage of coding framework and rules of interpreting the transcripts will be discussed in Chapter 4.5.

Instead of referring classroom as a space to conduct teaching and learning, the terms ‘lesson’ and ‘classroom’ were interchangeably used and they were referring to each other; and that was also the case with the terms ‘learning outcome’ and ‘learning objectives’. When learning objectives were discussed, learning outcome was also in mind. The case is also the same between participants, students or learners.

On the other hand, from this point onwards, the distinction between participants and interviewees is made. Interviewees are specifically addressing only participants agreeing to be interviewed, whereas term ‘students’ and ‘participants’ concern everyone in the classroom, regardless their involvement in interview.

4.1 Research Design

The research design used in this study combines the characteristic of case-study approach (Yin, 2006) and design-based research (DBR) approach (T. Anderson & Shattuck, 2012). Yin (2006) stated that case study is “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident,”. In general, Yin continued, case study is also useful when dealing the question ‘Why’ and ‘How’; besides when dealing with contemporary, not historical phenomenon. As this study was aimed to develop a lesson plan to induce meaningful learning, those characteristics of case study fits well.

On the other hand, the goal of developing of lesson plan that could induce meaningful learning fits well to DBR. DBR is a method that “seeks to increase impact, transfer, and translation of education research into improved practice,” (T. Anderson & Shattuck, 2012, p. 16). A quality DBR can be seen when it is placed in real educational context, focusing on the design and
testing of significant solution, having practical impact in practice, involving collaboration between researchers and practitioners, compared to action research, involving multiple iterations, and evolving from design principles. Rather than isolating learners among themselves, this study involved complex social interactions (Barab & Squire, 2009).

Those things above are the characteristics of DBR method; it involves designing practical solution in real context that ends with a testing—these whole activities were considered a design cycle in DBR. DBR typically involves multiple design cycles, with iterations done on each; whereas those iterations were done after careful, systematic consideration of the last cycle’s testing/evaluating process.

As his study was done in real educational context, researcher was the practitioner, and it was focusing on designing and actual testing of a lesson plan, which has practical impact in teaching practice; it could be concluded that this study fulfilled DBR characteristics and was considered the first cycle of DBR. In addition, as part of the first cycle in DBR, a pilot test classroom, using the pedagogical design in Chapter 4.3, and pilot test interviews, using the questions in Chapter 4.4.1, was done before the actual study began. The purpose of this pilot tests was for Author to get familiar with the lesson proceedings and interview practices before the actual study was conducted.

4.2 Participants and Classroom Context

This class was scheduled under the subject of Learning Environments and Technologies class (see Appendix X for more details of the subject). The classroom was conducted on October 18th, 2017, from 12 pm to 4 pm, as part of Learning Environments and Technologies course. Although the course would run for a year, the classroom used for this study was run one time only, on the mentioned date. This course was run as face-to-face meeting session for about 4 hours every time; including 15-minute break given to students, after lesson has run for about 1 hours and 45 minutes to 2 hours.

The Learning Environments and Technologies course’ learning outcomes were for student to be able to apply theoretical ideas of the learning sciences to the context of emerging technologies, use emerging technologies as teaching and learning tools, and work in technology-rich teaching and learning environments as administrator, teacher or student. Therefore, this
course was chosen as part of working with technology-rich environment and using the emerging technologies as teaching and learning tool.

The class is part of International Master’s Degree’s Programme in Learning, Education and Technology (LET)\(^1\) curriculum for its 1\(^{st}\) year students. The participants of this class were either 1\(^{st}\) year students of LET programme, exchange students from various countries, or other faculty of education students as part of their minor subject studies, that was taking the Learning Environment and Technologies class. When this study was conducted, there were 22 participants in the classroom, 8 were male, 14 were female. All the students were coming from at least 10 different countries across Europe, Asia and Africa.

4.3 Pedagogical Design of the Lesson

The summary of pedagogical design of the lesson can be seen in the figure below:

**Table 1. Summary of Lesson Activities**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Learning Domain</th>
<th>Teaching Method</th>
<th>Time (Actual)</th>
<th>Coins Rewarded</th>
<th>Reward</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Introduction to treasure hunting and collecting coins.</td>
<td>Affective</td>
<td>Encouraging Participation</td>
<td>5 mins</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>2  Opening discussion, topic introduction</td>
<td>Cognitive</td>
<td>Encouraging Participation, Prior Knowledge</td>
<td>10 mins</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>3  Making pre-concept map</td>
<td>Cognitive</td>
<td>Prior Knowledge</td>
<td>15 mins</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4  Design one UNCLEAR slide each group</td>
<td>Cognitive, Psychomotor</td>
<td>Role Play (RP), Providing Examples (PE)</td>
<td>10 mins</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>5  Present UNCLEAR slide, audience give rewards (coins) for each successful group</td>
<td>Cognitive, Affective, Psychomotor</td>
<td>Experiencing Consequences (EC), RP, PE</td>
<td>10 mins (15 mins)</td>
<td>1 from each audience</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) For more information about LET programme: [http://www.oulu.fi/university/masters/let](http://www.oulu.fi/university/masters/let)
<table>
<thead>
<tr>
<th></th>
<th>Activity</th>
<th>Domain</th>
<th>Duration</th>
<th>Reward</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>BREAK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Scavenger Hunt: Finding Treasure Map</td>
<td>Affective, Psychomotor</td>
<td>10 mins</td>
<td>3 for each map found</td>
</tr>
<tr>
<td>8</td>
<td>Discussing what is wrong with the map (each group will get one), and how to fix it</td>
<td>Cognitive, Affective</td>
<td>15 mins</td>
<td>none</td>
</tr>
<tr>
<td>9</td>
<td>Design one CLEAR slide each group</td>
<td>Cognitive, Affective, Psychomotor</td>
<td>10 mins (20 mins)</td>
<td>None</td>
</tr>
<tr>
<td>10</td>
<td>Present UNCLEAR slide, audience give rewards (coins) for each successful group</td>
<td>Cognitive, Affective, Psychomotor</td>
<td>10 mins (20 mins)</td>
<td>1 from each audience</td>
</tr>
<tr>
<td>11</td>
<td>Making post-concept map</td>
<td>Cognitive</td>
<td>10 mins</td>
<td>1</td>
</tr>
</tbody>
</table>

Yellow: coin-related activities
Green: group activities

4.3.1 Classroom Topic and Equipment

The use of presentation slides has been a part in teaching and learning for quite some time, whether it is for lecturing, sharing ideas, or student assessment; and it is unlikely that the practice will have major change in near future. Presentation slides is one part of common technology used in education; especially in developed country. Besides the usage of delivering lesson, presentation slides were widely used as assignment; students are typically asked to summarize certain amount of knowledge and retell them to the peers and teacher.

The equipment used for presentation were relatively basic: a computer, a presentation software, a projector, and if necessary, a screen. In a context where the classroom has already had whiteboard instead of blackboard, typically, whiteboard is sufficient as screen replacement. Proper presentation softwares are developed everyday, and today we see many kinds of
presentation software: Microsoft PowerPoint, Google Slides, OpenOffice Impress, WPS Presentation, Visme, Prezi, PowToon, the list goes on; for this study itself, the specific software used is Google Slides.

Google Slides were easier to implement in this study; Google Slides enable seamless presentation making for group (see Chapter 4.3.3), there is no need for installation, and most of the students have Google account, which entitle them to use Google Slides for free. Moreover, it is easier for instructor to share and see presentation; eliminating the need of submission after finishing task. Instructor only need to open the Google Slides file shared to the students from his/her own computer, where they have been working.

This presentation practice itself involves verbal and visual communication technique, and this classroom focused more in the latter. In practice, it is quite often that presentation slides were not visually informative in terms of either excessive amount of information, improper use of visual, and improper use of colors. As Author’s part of expertise is in visual design, the topic making clear slide design was chosen.

Referring to the TML model learning outcome, this chosen topic making clear slide design was the domain-specific knowledge (See Chapter 2.2). Even though according to the research question, this learning outcome was not the focus of this study, but learning outcome was inseparable part of learning and it directly affected the conceptual clarity of subject matter; hence it was concluded unwise to not address this part further. More discussion of conceptual clarity in this classroom, see Chapter 4.3.5.

4.3.2 Concept Map

As the significance of concept map in meaningful learning had been discussed in Chapter 2.1.1., this section explains how concept map were pedagogically implemented. In this classroom, 4 concept maps need to be made by the students, individually, during the classroom; 2 in the beginning of the lesson, namely pre-concept map, and 2 in the end of the lesson, namely post-concept map. The pre-concept map was intended to activate students’ prior knowledge and to help them organize it. The post-concept map showed students’ knowledge structure after the classroom, therefore enabling comparison of knowledge structure before and after the classroom.
There were 2 focus questions, addressed in separate concept map: “What makes a presentation slide unclear?” and “What makes a presentation slide clear?”. Each focus question was addressed twice, once in pre-concept map and once in post-concept maps.

To anticipate students’ misunderstanding of concept map usage, due to the quick, short explanation and time limitation, the pre-concept maps were given with an example how to construct on them (see Figure 2), while post-concept maps had none of them (see Figure 3).

Figure 2. One of pre-concept map.
4.3.3 Teaming Up and Coins Reward System

The students in the classroom were grouped into several teams using simple ticket system. When a student entered the class, the student was given a piece of paper with certain shape: circle, square, triangle, pentagon, hexagon and stick. They were told to keep it because it will be used in the classroom (although not specified when). After making pre-concept maps, Author addressed the piece of papers and ask students having the same piece of paper to sit together as a team.

As a part of addressing affective domain, a reward system, as a part of feedback system in this classroom, was incorporated in the classroom. The coins were handmade, and even though the coins might have different shape and color, the function was exactly the same. Students were told in the introduction of the classroom that they will be roleplaying as treasure hunters, and they were told that the treasure would be in form of coin. There would be several chances of coin collecting event.
First, after students finish the pre-concept map and submit them to Author, each of them was given a coin, as a reward. This means every student would get 1 coin after submitting pre-concept map. Second, after a group presented of clear slide or unclear slide and if the other students, individually as audience, evaluate that the group had done the right thing, the audience would give the group a coin. There would be presentation for both unclear slide and clear slide, one each.

For time efficiency reason, this after-presentation reward will be done virtually using Google Slides (see Figure 5) as each student had online access to this Slide. For example, if they think Circle group did a right thing, they will put their coins by copy-pasting the existed coin outside the box into Circle group’s box. Third, any group whose member found a map treasure map seeking would be awarded 3 coins.
Figure 5. Virtual environment where coins are given after each presentation.

4.3.4 How the Classroom Activities Addressed Prior Knowledge

One of the requirement of meaningful learning is well-structured and relevant prior knowledge of the students. Students’ prior knowledge was activated and addressed in this study of meaningful learning through several ways: the first one was open discussion; where Author, as class facilitator, asked openly to the class, what is good slide design. The intent of this question was pointing out that the term “good” was widely interpretative and subjective. Then, after several answers emerged and discussed openly, Author proposed the term “clear” and “unclear”, which was more specific to either the visual part of the slide, or the use of words to construct clear message. To conclude the discussion, Author established the learning objectives. (See Figure 5 and 6 below).
Figure 5. Slide #4 and #5 - Redefining good and bad slide.

Figure 6. Slide #6 - Learning objectives.

In the end of this lesson: Understand the INCORRECT & CORRECT use of:
- COLOR
- SIZE
- IMAGE
in slide design.
Secondly, after the discussion above ended, students were asked to create 2 concept maps (pre-concept maps). The focus question of each concept map was *What is unclear slide design* and *What is clear slide design*. The pre-concept maps were not created from blank, but they were provided with an example, as it was easy to mistake concept maps with mind maps. Concept maps, as explained in Chapter 4.3.2., is a powerful to organize knowledge and therefore create good structure of it.

Thirdly, students would create unclear slide design in the group and then present it to the whole class. This activity was conducted right after everyone had finished their pre-concept maps, and it is important to mention that until that point, no specific knowledge about how to correctly use size, image and color to create clear slide design was given by the Author. Moreover, this activity addressed, again, their prior understanding of what unclear slide design was; and since it was done before addressing clear slide design, it could be argued that this activity could potentially be good basis of their knowledge structure; understanding the better ones by understanding the worse ones beforehand.

4.3.5 How the Classroom Activities Addressed Conceptual Clarity

The next requirement of meaningful learning, and the only one that instructor can directly influence, is a conceptually clear subject matter (see Chapter 2), the topic “Making Clear Slide Design” has been contextualized and specified to learning environments and technologies, with addition of visual design. The word *clear* was specifically chosen to clarify the intention of making the slide visually and meaningfully clear; in contrast of typically used “good” or “bad” slide design. “Good” and “bad” were widely interpretative and might hinder the conceptual clarity, which then their uses were avoided in this study.

Also, as argued in Chapter 2.3.1, the cognitive, affective and psychomotor learning domains need to be considered in this study of meaningful learning. More specifically, cognitive domain addressed here was *rules-based knowledge* (Kapp, 2012) which was elaborated as follows: rules are correlation between certain behaviour or procedure and certain results. Although has been separated, rules-based knowledge that Kapp proposed maintained the characteristic of conceptual knowledge as it addresses principles between elements. In this study, the concepts were procedure and result; “clear or unclear slide design” was the result, and “the way of using visual elements” was the procedure.
To further improve the conceptual clarity, the *how* in this topic was broken down into smaller, simpler, and more specific chunks of knowledge; namely, how coloring contributes to clear slide design, how sizing contributes to clear slide design and how images used contribute to clear slide design. These elements: color, size and image, were used as main constructs in this knowledge and thus, the learning objectives of this classroom were for students to understand the incorrect and correct uses of color, size and image in slide design, in which the incorrect uses would result in unclear slide design and correct uses would result in clear slide design.

Furthermore, with the same purpose, Author deliberately used teaching methods of *providing examples and non-examples* (Kapp, 2012), in which the examples were “clear slides” and non-examples were “unclear slides’. This teaching method was originally suggested to teach conceptual knowledge, which has been argued to have similarity with rules-based knowledge (see Chapter 2.2.1 and Chapter 4.3.2). How all this information is structured and told in the lesson is shown in Figure AA and AB above.

Next domain to be addressed is affective. Besides the need of integrating learning domains to support meaningful learning, the afternoon classroom situation itself might increases the need of addressing emotions and feelings of students, as they might have been studying the whole morning and might experience cognitively exhaustion by the time they came to slide design classroom.

As stated in Chapter 2, different learning domains requires different teaching method. To address affective domain, *encouraging participation* was one of teaching method suggested by Kapp (2012). Author attempted to encourage participation by using one of the teaching method for rules-based knowledge, *role-playing*. Students were addressed as treasure hunters in the beginning of the class, and they were informed there would be coin collection involved during the classroom (hence the treasure hunting).
Figure 7 Slide #2 – Encouraging students’ participation by introducing roleplaying as treasure hunters.

It has been stated that there were breaks in the course. Later in the classroom, a treasure-map seeking was done after break, as an icebreaking activity to encourage more participation. Not only acted as icebreaking activity, the maps collected were non-examples, the maps show how color, size and image were incorrectly used, which resulting in visually unclear design. There were 2 maps related with color, 2 maps for size and 2 maps for image – 6 maps in total. This treasure map seeking, or scavenger hunting, was done inside the classroom only.

Figure 8. Slide #13 – Encouraging students’ participation by doing scavenger hunt in classroom.
After all the treasure maps were collected, students were told that the maps show how color, size and image were incorrectly used, and then, they were asked to discuss which element is shown in their treasure map and why it was incorrectly used. Every time a map was discussed, an example of how the element should be correctly used was introduced. To sum up, this activity was arguably one of the integration between cognitive, affective and little bit of psychomotor domain.

Figure 9. Slide #27 – One of treasure maps. Example of how size was incorrectly used.

Figure 10. Slide #30 – Example of how this sizing problem could be fixed.

Last but not least, addressing psychomotor domain involves practical skills, in which there were chances for students in this class to practice the knowledge gained and to integrate their psychomotor skills of slide designing with cognitive, affective, or both. The creation and presentation of unclear and clear slide design required students to practice applying their knowledge. The acts of virtual coin giving and receiving after every presentation were a form of giving and receiving feedback, on their knowledge and practice. It was also part of the
treasure hunting because they were getting coins; and arguably, it was involving their affective domain in the process.

4.4 Data Collection

In this study, the slide design classroom itself is a process of designing lesson to support meaningful learning, and therefore it partially overlapped with the first research question: *How to design a lesson in higher education, that consider the pre-requisites of meaningful learning?* In this sense, Chapter 4.3 could be considered as a data collection method. However, there is also need to see whether there were meaningful learning process characteristics truly emerged, after "designing the lesson by considering pre-requisites of meaningful learning", therefore additional data sources were required.

The process of gathering those data were as follows. Before the class began, the students were asked whether they would like to be interviewed, and whether they allow their concept maps and reflection blog post to be studied; by filling a consent form via Google Form. Should they be willing to participate, they would also mention their time availability for interview in the next 4 days, while filling the form. No compensation was given to participants willing to be interviewed.

The total student attended the classroom and filling the consent form was 22, but the students willing to participate were only 14. The data used in this study were collected in semi-structured interview from some of the classroom participants with N=14; 9 of them were female, 5 were male. Almost all participants were coming from different countries, only 3 were coming from the same country. All interviews were conducted and recorded no later than 4 days after the class had finished, starting from the next day.

4.4.1 Semi-structured Interview

Semi-structured interview was chosen because on the initial planning, the goal of this study was only to see the integration of prior and new knowledge (see Chapter 3), instead of looking for meaningful learning process characteristics. Some studies had been done on this pursuit of measuring meaningful learning, but most of them were done in much larger number of participants—around hundreds—in comparison with this relatively small number of participants (Biggs, Kember, & Leung, 2001; Galloway & Bretz, 2015), some of them involved as-
sessing concept map created by students, in which some of the assessment were done using own developed algorithmic program (Calvo, Arruarte, Elorriaga, Larrañaga, & Conde, 2011; Miller, Panamá, & Conéctate, 2008; Taricani & Clariana, 2006; Wei & Yue, 2016), which were unfit for this context.

Therefore, semi-structured interview was chosen for its flexibility on getting more insight from participants while still giving clear guidelines, not to mention there was only one chance of interview per person (Cohen & Crabtree, 2006). The fact that it was preceded by observation classroom few days before was important, especially because it gave interviewees clearer context on interview topic, making it possible to give more detailed answer without straying away from the context. Mainly, this semi-structured interview addresses research question 2: *What process characteristics of meaningful learning emerge in that lesson?*

Even so, the questions were asking about the change in knowledge structure, the intention of learning meaningfully, general student’s motivation and confidence, and classroom situation, which were in alignment with the goal of seeking indicators of process characteristics. The questions that was asked and their purposes can be seen in Table 2.

### Table 2. Interview Questions and Its Purposes

<table>
<thead>
<tr>
<th>No.</th>
<th>Question</th>
<th>Purposes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I have your pre and post concept map here. Can you explain what you know before and after the slide design class?</td>
<td><em>Stimulus question for participant to recall the situation.</em></td>
</tr>
<tr>
<td>2</td>
<td>Were you motivated to learn something before the slide design classroom begins? Like earlier that day?</td>
<td><em>Building question towards question number 4. If the participant is motivated he/she might have bigger intention to learn meaningfully.</em></td>
</tr>
<tr>
<td>3</td>
<td>Did your motivation to learn something gets better along the way in the slide design classroom? Or it stays at that level?</td>
<td><em>Building question towards question number 4. If the participant is motivated he/she might have better chance to learn meaningfully.</em></td>
</tr>
<tr>
<td>4</td>
<td>The pre-concept map you created is called prior knowledge about slide design. Now, during the classroom, did you relate your prior knowledge with what I said? Or you just simply following the instruction because “the teacher said so”?</td>
<td><em>Checking if participant is aware about his/her knowledge integration process (if they'd want to learn meaningfully, supposedly they will be aware).</em></td>
</tr>
<tr>
<td>5</td>
<td>So, generally can I say you learn many new things / mostly reviewing?</td>
<td><em>Checking if what kind of learning they mostly have (learning new things or reviewing known things)</em></td>
</tr>
</tbody>
</table>
You said that in this class you can [either learn new things or review things]. What made you do that during the session?

Checking if there is any part of the classroom that contribute to their meaningful learning.

What do you think about music during lesson? How did it affect you during the lesson?

Checking if music contributed to their meaningful learning.

Imagine this scenario: you have to present your homework in the next few days. What do you feel about in scale 1 - 4, 4 being very confident?

Assessing the general confidence after participants (supposedly) learned meaningfully

Will that feeling (in previous question) be different if you didn’t attend the slide design class?

Assessing general confidence in hypothetical situations when students didn’t come to classroom then didn’t learn meaningfully

4.4.2 Concept Map and Reflection Blog Post

As the significance of concept map in meaningful learning had been discussed in Chapter 2.1.1., and the pedagogical implementation of concept maps had been discussed in Chapter 4.3.2, this section will just briefly state how were the concept maps collected; in contrast, this section will describe how reflection blog post was significant for this study.

As previous studies above stated, with correct tools, concept map could be one of meaningful learning indicators, and concept maps were created by students before and after the class. The initial plan for this concept map, as the goal was to merely look for integration of old and new knowledge (see Chapter 2.4), was to qualitatively examine the concept maps, to see how, if present, were the changes in the knowledge structure (however, this notion shifted to focus only on process characteristics, more explanation on Chapter 5). For this purpose, 4 concept maps (described in Chapter 4.3.2) from each student were collected. 2 pre-concept maps were collected just before forming a group and 2 post-concept maps were collected in the end of the lesson.

Moreover, to further elaborate the concept map, students’ reflection of the Slide Design classroom would be made. As part of the whole course assessment, students were also required to write a reflection for every lesson, in form of blog post. This notion was reminded in the beginning of classroom, where potential participants filled consent form, and just before the classroom ended. The reflection blog posts were intended to be another source of data that
complimented both interview and concept maps, and in this sense, these reflection addresses second research question as well.

The reflection outlined the lesson student learned during each classroom; ranging of what topic they learned today, were there any new tools or educational technology introduced, and if there were any, how to use them, what were the main function and the limitation of the tools, and what could be the possible outcome of learning this topic. With this range of information, the reflection blog post was expected to elaborate respective concept maps even further, clarifying (if any) ambiguous short-text information in concept maps and revealing deeper thinking that might not be able to be justified by only interpreting the concept maps. Arguably, the interviews were also done to elaborate the concept maps. One of the reason was to accommodate students who could explain better in oral communication, and that concept maps might not be a familiar learning technique to students, which could lead to inaccurate use.

4.5 Data Analysis

In order to choose appropriate coding method for this study, there are some matters to be considered. First, the artefacts collected are concept maps, learners’ reflection blog post, and interview transcripts; all of them are participant-generated data (unlike field notes). Second, concept maps are used to see the change in knowledge structure and interview transcripts are used to see meaningful learning process characteristics, while reflections are used to compliment both. Third, some data sources would be analyzed according to existing theoretical framework while some would not. All of these considerations determines the coding methods needed to analyze the data; and it is also important to note that while there were some studies in analyzing concept maps automatically (Taricani & Clariana, 2006; Wei & Yue, 2016), resource and time constraints unabling the analysis through such methods and hence the finding of appropriate coding methods for this study.

4.5.1 Coding Methods

*Structural, Process and Provisional Coding*

Coding methods used in this study were integration between several methods that could complement each other. In general, as this study aimed to harmonize with the conceptual frame-
work (TML model) and to answer research questions; and therefore, especially in respect of second research question, partially overlapping methods from Structural Coding, Process Coding and Provisional Coding methods was implemented to analyze interview transcripts and reflection blog post.

Structural Coding is useful in study that involves multiple participants, using semi-structured data gathering methods, and more useful in participants-generated rather than researcher-generated data source (Saldaña, 2010). Especially, structural coding also "applies a content-based or conceptual phrase representing a topic of inquiry...that relates to a specific research question" (p.66). Generally, "Structural Coding results in the identification of large segments of text on broad topics; these segments can then form the basis for an in-depth analysis within or across topics" (MacQueen et al., 2008, p.15 as cited by Saldaña, 2010, p.68), whereas in this study, not only Structural Coding promised better efficiency with multiple interview participants, not only this study also used semi-structured interview to gather participant-generated data, but also the process characteristics was expected to come from participants’ explanation instead of just single or two line of sentences, which might result to numerous long-text being coded.

To complement this, a Process Coding, which is suitable for searching "ongoing action/interaction/emotion taken in response to situations,” (Corbin & Strauss, 2008, pp. 96-7 as cited by Saldaña, 2010, p. 77) was used simultaneously. Process Coding was particularly useful as many of indicators of meaningful learning process characteristics were actions (see Chapter 4.5.2) and "it is not necessarily a method that should be used as the sole approach to data,” (Saldaña, 2010, p. 77), therefore, it was possible to integrate Process Coding with any other methods used.

Finally, a part of Provisional Coding method was needed as there was conceptual framework (Meaningful Learning Process Characteristics), there was need to redefine few ambiguous indicators of meaningful learning process characteristics, which literatures were reviewed in order to do so (See Chapter 4.5.2, Creative and Critical for more details on how Provisional Coding was done).

Using these methods, data from interviews and reflection blog post would be coded according to the actions that showed indicators, for example, student is able to self-evaluate learning during the lesson, is an indicator for self-directed characteristic. Because of the nature of structural coding, this support the coding of large chunk of text which includes the context of
why the interviewees indicated chance to self-evaluate during lesson (more discussion in Chapter 4.5.2)

In Vivo and Magnitude Coding

Moving on to the next data sources; concept maps were aimed to see the change of knowledge structure, which none of the literature studied provided sufficient framework or criteria, a combination between In Vivo Coding and Magnitude Coding (Saldaña, 2010) was chosen. In Vivo Coding ”can be used with several coding methods” (Saldaña, 2010, p.74) and Magnitude Coding ”is supplemental shorthand to add texture to codes” (Saldaña, 2010, p.58) and therefore possible to be simultaneously used.

In Vivo Coding, or literal, or verbatim coding, concerns words or short phrases found in actual data record; it is aiming to extract indigenous words or phrases from the data. In Vivo Coding is also useful in action research; which 1) can be a part of Design-based Research and 2) in this study, researcher is also a teacher (T. Anderson & Shattuck, 2012, p.17). In Vivo Coding would be used to discover the difference between knowledge structure in the pre-concept map and post-concept map, by examining participants’ indigenous description. In addition, Magnitude Coding potentially discovers the degree of knowledge change, whether the change was drastic, slight, or minimal.

4.5.2 Coding Frame

All interviews were transcribed using Microsoft Word into separate documents for each interviewee. Similarly, all blog posts were copy-pasted, and these documents were added into NVivo 11 to be coded. The unit of analysis for interview were interviewee’s answer to a question, that might include the ones were clarified by the Author’s subsequent questions. The unit of analysis of blog post would be the whole writing.

Coding frame used in this study indicated the process characteristics of meaningful learning used as background theory in Hakkarainen’s study (2011): constructive, active, self-directed, cooperative, conversational, collaborative, contextual, goal-oriented, individual, reflective, abstract, multiple-perspective oriented, critical, experiential, multi-representational and creative. The indicator of some process characteristics was modified to contextualize the study; e.g. constructive process was originally described as “I was able to utilize prior knowledge about the course topic and the course deepened my understanding of what I had learned be-
fore,” As this study concerns only a class and not a course, the word course was replaced with class. It is the same with video assignment; it was the topic in Hakkarainen’s study. The words “video assignment” get replaced with slide design. The changes were stated on Table 3, while all the framework used can be seen in Appendix 1.

Table 3. Changes in Original Framework’s (Hakkarainen, 2011) Indicators

<table>
<thead>
<tr>
<th>Process Characteristics</th>
<th>Original Indicator (Hakkarainen, 2011)</th>
<th>Modified Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constructive</td>
<td>I was able to utilize my prior knowledge about the course topics</td>
<td>I was able to utilize my prior knowledge about the <strong>class</strong> topics</td>
</tr>
<tr>
<td></td>
<td>The course deepened my understanding of what I had learned before</td>
<td>The <strong>class</strong> deepened my understanding of what I had learned before</td>
</tr>
<tr>
<td>Self-Directed</td>
<td>I was able to influence the content and realization of our video assignment</td>
<td>I was able to influence the content and realization of our <strong>slide design</strong></td>
</tr>
<tr>
<td></td>
<td>The students directed their own studying process in the PBL</td>
<td>The students directed their own studying process in the <strong>class</strong></td>
</tr>
<tr>
<td></td>
<td>I was able to evaluate my own learning during the course</td>
<td>I was able to evaluate my own learning during the <strong>class</strong></td>
</tr>
<tr>
<td>Individual</td>
<td>I was able to apply my own practical experiences during the course</td>
<td>I was able to apply my own practical experiences during the <strong>class</strong></td>
</tr>
<tr>
<td>Contextual</td>
<td>The course promoted the learning of skills and knowledge needed in working life.</td>
<td>The <strong>class</strong> promoted the learning of skills and knowledge needed in working life.</td>
</tr>
<tr>
<td>Reflective</td>
<td>I was able to evaluate my own learning during the course</td>
<td>I was able to evaluate my own learning during the <strong>class</strong></td>
</tr>
<tr>
<td>Abstract</td>
<td>On the course practical examples were studied in a theoretical framework</td>
<td>On the <strong>class</strong> practical examples were studied in a theoretical framework</td>
</tr>
<tr>
<td>Multiple-perspective-oriented</td>
<td>The course helped me to understand different per-</td>
<td>The <strong>class</strong> helped me to understand different perspec-</td>
</tr>
</tbody>
</table>

37
It is important to mention again, as stated by Hakkarainen et al. (2007), that these indicators are partly intertwined to each other – therefore, it is possible for one statement to become an indicator or partial indicator of multiple characteristics. Furthermore, as previous studies didn’t elaborate further about every indicator, Author needed to define and elaborate each indicator to make sure interpretation of interview transcripts is clear. Those modified indicators were further elaborated below – it is worth to mention that in here, due to the characteristics’ intertwined nature, some indicators from different characteristics would be explained under the same section.

**Constructive**

From constructive characteristic, one of the indicators was student is able to utilize prior knowledge about class topic, in which Author was looking for saying such “I knew that slide design...” and “Before, I only knew [prior knowledge] when designing presentation...”. There are 4 types of keyword on those sentences: first, past time indicators – before and knew, second is the class topic – designing slide for presentation, third is the understanding—knew, or understood, or learned, and finally, the statements would most probably a comparison between past and present situation.

The second indicator, “The class deepened my understanding of what I had learned before,” is understood from possible statements such as “I understand [new knowledge] from the lesson...” and “After I come to class, I learned about [new knowledge]...”. These sentences
have another 2 types of keywords; first is the place of event—the class or the lesson. As most questions asked about what happening in the slide design classroom, Author can safely say that when participants mention “the lesson” or “the class”, they would have to be the classroom conducted by Author. On rare occasions, Author have asked for clarification whether the context is Author’s class or not.

**Experiential**

“I was able to utilize my own experiences as starting points for learning in the class”, one of experiential was deemed the same as constructive’s “able to utilize prior knowledge”; which then the same rules of interpretation were applied—past time indicators and comparison. If there were statements fit into the utilization of prior knowledge, they are also automatically falling into experiential indicator.

There has been a fine line between applying and utilizing – and this is further problematized by the statement “I was able to apply my own practical experiences during the class”. To resolve this, the same rules for previous indicator was applied, but without the past time indicator and comparison rules; furthermore, when it comes to applying, Author is looking for more technical explanation of how student did what they did. It can be concluded that statements indicating application of student’s practical experiences will have more technical explanation and most probably wouldn’t be comparison between past and present knowledge; and where understanding of class topic presented in more procedural way than comparative way. It could also be inferred that any chance for learner to experience the learning, personally, is indicator that is being seek.

**Self-Directed**

Self-directed indicator of “I was able to influence the content and realization of our slide design” will be seen from statements such as “I do certain part...”, “We agree on...”, and “Our idea was...” The first statement is understood to show direct influence, while the second and third statement in understood to show indirect influence through agreement – which might not include the whole personal idea. The next indicator, “The students directed their own studying process in the class” need to be understood from context of previous study. It is important to note that in the original framework (Hakkarainen, 2011), video production assignment was meant to support problem-based learning (PBL) sessions, and the difference of session length between that study and this study was considerably huge. There were 5 PBL sessions, 4 hours
each; and in addition, there were 3 different workshops for video production assignments, 8 hours for each. Therefore, it made sense to see if students directed their own studying process, students will be able to choose how to study it, instead of simply following guideline or procedure from facilitator. However, given this point of view and the classroom situation where there were activities to follow, it might be highly unlikely that students will not be following a given procedure.

“I was able to evaluate my own learning during the class” was referring to statements such as “When we do this activity, I understand about...” or “First I do this during the class, then I realized it wasn’t as the lesson told...”. The keywords here were (again) the place of event, activity or class; and the evaluation of students’ own learning such as being realized of mistake, being understanding of connection or meaning, and seeing whether what was done is right or wrong, in relation with the lesson. It is important to note that another characteristic, such as reflective share the same indicator with self-directed; which make it is treated in the same way.

Active

In general, all of active indicators need the indicators of high frequency such as a lot, many, often, frequent, and so on. The rest of the indicators are intertwined to other characteristics, for example: the indicator “student’s role was to actively apply information” might be seen in the same way as one of experiential indicator; the difference between them is, in order it to be “actively”, frequency should be addressed in the statement. The case is the same with indicator “student’s role was to actively evaluate information”, and finally, the indicator “student’s role was to actively acquire information” will be seen from statements showing action of acquiring information such as questioning, looking at internet or other media sources, which were done frequently.

Cooperative, Conversational, Collaborative

Indicator “Case related, small group discussions on the discussion area helped me to learn” was interpreted to be seen when participants mentioned that there were meaningful discussions about the topic in the class. Indicator “The students were committed to collaboration” was interpreted to be seen when participants mention about how hard their group is working; and finally, “Cooperation with my partners was successful” was seen when participants said their group was working well.
Individual, Contextual, and Goal Oriented

In individual characteristic, there were 3 indicators: the first one was “I was able to apply my own practical experiences during the class” and would be identified the same with experiential’s “I was able to apply my own practical experiences during the class”. Indicator “It was possible for me to study according to my own personal style that suits me” would be identified when participants mentioned about flexibility of the class and how participants got benefit of it.

Finally, indicator “Studying enabled the achievement of my personal goals” would be identified when participants mentioned they were able to achieve their own personal goals (or the evidence that they achieve personal goals), and when they had goals that the class provide a way to achieve. This indicator was also the indicator of goal-oriented characteristic.

Contextual indicator was “The class promoted the learning of skills and knowledge needed in working life,”. This indicator would be identified if participants mentioned about how this class would be beneficial for their work; and could potentially overlap with personal goals, as participants’ goals might be related to working life. It is not impossible that the same saying could be fit into both goal-oriented and contextual because of this matter.

Abstract, Multiple Perspective and Multi-representational

Indicator of abstract characteristic was “On the class practical examples were studied in a theoretical framework” and would be identified when participants mentioned about certain theoretical framework studied in the class which led to practice, or any practice in the class that later would be explained through a certain theoretical framework.

Multiple perspective oriented characteristic was “The class helped student to understand different perspectives related to the topic” and would be identified when participants mentioned that in the class, they realized other way to understand the class’ topic apart from what they had known. This characteristic is not to be confused with multi-representational, which indicator was “The targets of learning were examined through several forms of presentation (text, diagrams, pictures, video, etc,)”. Multi-representational would be interpreted when participants mentioned about multiple forms of knowledge presentation, be it in text, diagrams, pictures, video or something else.
It is important to note that in the original framework (Hakkarainen, 2011), video production assignment was meant to support problem-based learning (PBL) sessions, and the difference of session length between that study and this study was considerably huge. There were 5 PBL sessions, 4 hours each; and in addition, there were 3 different workshops for video production assignments, 8 hours for each. In this study, both classroom and slide designing session was done within 3 hours and 30 minutes. This relatively big difference between sessions might be one of the reason why there were two different indicators of creative characteristic in the previous study.

Defining creative thinking led to finding for further resources. Partnership for 21st Century Learning defines thinking creatively as “using a wide range of idea creation techniques (such as brainstorming), creating new and worthwhile ideas (both incremental and radical concepts), elaborating, refining, analyzing and evaluating their own ideas in order to improve and maximize creative efforts”. According to American Psychological Association Dictionary (Vanderbos, 2006) as cited in Hong & Milgram (2010), creative thinking was defined “as mental processes leading to a new invention, solution, or synthesis in any area”. Navarrete (2013) argued that creative thinking could be seen as one’s capacity to construct original interpretation. The similarities between these definitions were that they involved the construction of meaning to new, original meaning.

The word “idea”, according to Cambridge English dictionary, can have meaning as either “suggestion” or “knowledge”. According to Oxford English dictionary, idea is defined as “a thought or suggestion as to a possible course of action”, “a mental impression”, and “an opinion or belief”. In respect of those definitions, in this study, idea would be seen as knowledge or mental impression, rather than a suggestion.

In addition, the word “enable”, according to both Cambridge and Oxford English dictionary means to make something possible, and to “encourage” means “to make something more likely to happen” according to Oxford, and in respect of encouraging creative thinking, means “to stimulate the development” according to Cambridge. There is fine line between those two terms and therefore, due to the limited resources, this study will treat them as if they are the same. That being said, with addition of the fact that both classroom and slide designing session were done at the same time (in comparison with previous study, which was done in dif-
ferent time and place), in this study *creative thinking* is seen from only one indicator, instead of two: “The class encouraged creative thinking”.

Therefore, when interpreting the interviews, Author looked for elements that supported (encouraged) this construction of new, original (according to students) meaning in students’ mind, encouraged the elaboration, refinement, analysis and evaluation of their own ideas, and encouraged the usage of wide range of idea creation techniques.

**Critical**

Similarly, *critical* characteristic was quite challenging to examine. The statement used to describe critical in Hakkarainen’s study in 2011 were “the studying developed my critical thinking skills” –which is quite different with most of the statements - most of other characteristics’ indicator coerce the fact that something is or is not there, for example, “the studying enabled…”, “I was able to…”, “The X was…”. However, according to Oxford’s and Cambridge’s English Dictionary, the meaning of “develop” could be seen not only from the point of “start to happen or exist”—which is similar to other characteristics—but also as “to grow,”. Previous studies have not clearly addressed this matter, and therefore for the sake of this study’s consistency, the first point of view was taken: *develop* here would be in the meaning of “start to happen or exist”.

For the same reason with defining *develop*, the next challenge was to define *critical thinking*. In this study, the definition of critical thinking was taken from a presented statement at the 8th Annual International Conference on Critical Thinking and Education Reform, Summer 1987 (as cited in The Foundation for Critical Thinking (n.d.)), which was “…intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action.” It is interpreted that any conceptualization, application, analysis, synthesis and evaluation of information is a critical thinking, but the word “actively and skillfully” implies that non-active and non-skillful conceptualization, application, analysis, synthesis and evaluation is not a critical thinking. That implication led to another question: how active and how skillful should those be, to be considered as “*critical thinking*”? Again, since no clear measurement has been stated by the authors of the definition and for the sake of consistency in this study, the occurrence of any conceptualization, application, analysis, synthesis and evaluation of information will be considered as *critical thinking*.
Below is the final coding frame used in this study:

**Table 4. Final Coding Frame**

<table>
<thead>
<tr>
<th>Process Characteristics</th>
<th>Modified Indicator</th>
</tr>
</thead>
</table>
| Constructive            | I was able to utilize my prior knowledge about the class topics  
The class deepened my understanding of what I had learned before |
| Experiential            | I was able to apply my own practical experiences during the class  
I was able to utilize my own experiences as starting points for learning in the class |
| Self-Directed           | I was able to influence the content and realization of our slide design  
The students directed their own studying process in the class  
I was able to evaluate my own learning during the class |
| Active                  | Student role was to actively apply information  
Students role was to actively evaluate information  
Student role was to actively acquire information |
| Cooperative, Conversational, Collaborative | Case related, small group discussions on the discussion area helped me to learn  
The students were committed to collaboration  
Cooperation with my partners was successful |
| Contextual              | The class promoted the learning of skills and knowledge needed in working life. |
| Goal Oriented           | The studying enabled the achievement of personal goal. |
| Individual              | I was able to apply my own practical experiences during the class  
Studying enabled the achievement of my personal goals |
It was possible for me to study according to my own personal style that suits me

Reflective

I was able to evaluate my own learning during the class

Abstract

On the class practical examples were studied in a theoretical framework

Critical

The studying developed my critical thinking

Multiple Perspective Oriented

The class helped student to understand different perspectives related to the topic

Multi-Representational

The targets of learning were examined through several forms of presentation (text, diagrams, pictures, video, etc.)

Creative

The studying encouraged construction of new, original meaning (according to students) in students’ mind

The studying encouraged the elaboration, refinement, analysis and evaluation of their own ideas

The studying encouraged the usage of wide range of idea creation techniques.

4.5.3 Inter-rater Reliability

Inter-rater reliability check for open-ended interview was done as suggested by Silverman, (2001, 2013). It was done by making copies from the NVivo file (from now it will be called Master File) and giving them to a peer. The Author would then code one copy and the peer code another copy. The copied file had everything the Master File had but it hadn’t been coded at all. The participants’ names were changed into number 01 through 14. If the peer coder used different operating system, the file would be converted accordingly. After peer had finished coding, both copy of the files would be merged into one file. Then, a coding comparison query was done between the peer’s part and Author’s part. As there was a time and resources limitation, peer coder was only asked to code a part of the data:

1. Examine and code Participant 02’s transcript for all meaningful learning characteristic coding frame
2. Examine and code every participant’s transcript for critical thinking indicator.
This approach is Author’s own brainstorming; the reason Participant 02 was chosen was because Participant 02 gave rigorous description of learning process compared to other participants; while critical thinking indicator was chosen because it was one of meaningful learning characteristic in which the indicator needed further elaboration.

The rules of coding were explained in e-mail, memo inside the copied file and verbally told from Chapter 4.5.2. The rules of coding that were unstated in Chapter 4.5.2 were as follows:

1. Always check which classroom was the participants referring to, as there were conversations about slide design classroom and another classroom.

2. When coding the answer, I sometimes include affirming words like "mm-hmm", "yes", “okay”, “I see”, “alright”, and “right”.
   a. According to Sage Publications and Lavrakas (2008), open-ended questions are necessary to be coded in verbatim way.
   b. Reason: sometimes the answer after the affirming words explains the answer before it.
   c. Reason: sometimes the answer is long, but separated by the affirming words

3. When coding the answer, I sometimes include the P and I.
   a. Reason: the answer is long, but separated by the affirming words etc.
   (same as 1b)

The average Cohen’s Kappa for all meaningful learning characteristics in Participant 02’s interview is 0.31 and the average Cohen’s Kappa for Critical Thinking across all participants is 0.38. The detailed coding comparison results can be found in Appendix 2 and 3.
5 Results

The chapter states the result of coded interview transcripts according to meaningful learning process characteristics indicators. The concept map and reflection blog post were both eliminated from coding or any analysis process, mainly due to 1) shifted focus towards process characteristics instead of the knowledge structure and 2) limited number of participants submitting blog post. Thus, the concept maps were used only for pedagogical part of the study and not as part of empirical study; it serves as students’ own basis to organize and visualize their prior knowledge about the classroom topic.

This result emerges from interview analysis; percentage used in this indicator is always relative with total participants interviewed (not the total students attended the classroom as some of them refused to be interviewed), which was 14. Table CC summarize the findings for second research question. Each indicator was indicated by certain number of interviewee, and since some process characteristics is defined by several indicators, there is possibility that some interviewee experienced and showed only one from several indicators, therefore, total interviewee indicating process characteristics (N) is not necessarily the sum amount of interviewee indicating indicators.

Table 5. Summary of Emerged Meaningful Learning Process Characteristic

<table>
<thead>
<tr>
<th>Process Characteristics (PC)</th>
<th>Indicator</th>
<th>Numbers of Interviewee Indicated PC</th>
<th>Total Interviewee Indicating PC (N)</th>
<th>% Characteristic Occurrence (N/14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical</td>
<td>The studying developed my critical thinking</td>
<td>14</td>
<td>14</td>
<td>100%</td>
</tr>
<tr>
<td>Self-Directed</td>
<td>I was able to evaluate my own learning during the class</td>
<td>14</td>
<td>14</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>I was able to influence the content and realization of our slide design</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

47
The students directed their own studying process in the class.

<table>
<thead>
<tr>
<th></th>
<th>Reflective</th>
<th>Constructive</th>
<th>Experiential</th>
<th>Creative</th>
<th>Individual</th>
</tr>
</thead>
<tbody>
<tr>
<td>I was able to evaluate my own learning during the class</td>
<td>14</td>
<td>14</td>
<td>100%</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>Utilize my prior knowledge about the class topics</td>
<td>The class deepened my understanding of what I had learned before</td>
<td>I was able to apply my own practical experiences during the class</td>
<td>I was able to utilize my own experiences as starting points for learning in the class</td>
<td>The class encouraged creative thinking</td>
<td>I was able to apply my own practical experiences during the class</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Studying enabled the</td>
</tr>
</tbody>
</table>
It was possible for me to study according to my own personal style that suits me.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Value</th>
<th>Value</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active</td>
<td>Student actively apply info</td>
<td>10</td>
<td>11</td>
<td>78.57%</td>
</tr>
<tr>
<td></td>
<td>Students actively evaluate info</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Student actively acquire info</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperative, Conversational, Collaborative</td>
<td>Case related, small group discussions on the discussion area helped me to learn</td>
<td>8</td>
<td>11</td>
<td>78.57%</td>
</tr>
<tr>
<td></td>
<td>The students were committed to collaboration</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cooperation with my partners was successful</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple-Perspective Oriented</td>
<td>The class helped student to understand different perspectives related to the topic</td>
<td>9</td>
<td>9</td>
<td>64.28%</td>
</tr>
<tr>
<td>Abstract</td>
<td>On the class practical examples were</td>
<td>8</td>
<td>8</td>
<td>57.14%</td>
</tr>
</tbody>
</table>
As author was looking for direct indicator for emerged process characteristics from the semi-structured interviews, first, *critical thinking* showed on all 14 interviewees; from which it can be inferred that all interviewees had either conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered; which in alignment with the purpose of almost all activities during the classroom. For example, a participant has evaluated her own learning by saying these:

Participant (P): I think I add more and, and I also know a little bit about color and (.) and also—yeah, and also the size of the word and everything. Well, I have, I had some prior knowledge about like making Powerpoint but actually I have no idea about, like, what color—which kind of color should be together or something like that.

Interviewer (I): Sure.

P: Then I know better, I think.

Another example of participant that had evaluated her own learning:
P: No, no. I learned—I [inaudible] There are some things that I have learned and I add to my knowledge—to my prior knowledge.

**Figure 11. Interviewees indicated self-directed characteristic**

There are indicators of *self-directed* characteristics, where all (100%) participants reported to be able to self-evaluate their own learning, and this also showed the *reflective* characteristic of meaningful learning. The transcript example would be the same as critical thinking (evaluation) above.

In contrast, only 3 (21.43%) participants reported that they were able to influence the content and realization of assignment, and only one (7.14%) participant reported that students were able to direct their own studying process during learning. In total, there are 4 participants indicated self-directed characteristic. Example of both indicators, in respective order:

But fortunately, and first thing we did, uh, was we wanted to talk about music bands. So, we include—well, we discuss which are music—our favorite music bands, which are The Beatles and Coldplay.

P: The time, like the—the [stutters], uh, the amount of work and the time, uh (..), organization was like, we had much more time for doing the task, which I really like because, as I said before, I need more time for all those things, I guess, compared to, maybe, some others, so I really enjoyed that it was enough time to do our tasks and also practice a little bit about them, and it
was not the fear that you somehow miss something, so, I would say that was a main point that my—my motivation was good.

![Diagram showing the distribution of constructive indicators](image)

**Figure 12. Interviewees indicated constructive characteristic**

*Constructive* indicators of ‘able to deepen understanding’ occurred in 12 out of 14 interviews (85.7% of total participants). Interestingly, only 7 (50% of total participants) pointed out the chance of utilizing prior knowledge. Below is example of participants’ transcript that indicated ability to deepen understanding:

For example, having two to three maximum colors with the font, it’s very important, and I didn’t know that before. I was using, maybe using, plain colors, white or black, yes. I think, well, I now would point out one more thing: about the background. That, of course, it should be—there should always be contrast with black and white, or dark, sorry, black and yellow, something like that. But, for example, something that I—I’ve found very interesting was if we put an image as the background, if we don’t—if we don’t just want it to look nice, but we want to emphasize the title or the heading, that we can blur it, or make it less transparent, let’s say. I think that. Yeah, that was, sorry, less transparent? Make it—yeah, make it, like, blurry. Yeah, that’s (.). yeah. I—I didn’t know that after, uh, before. That was very interesting.

And example of ability to utilize prior knowledge:

I didn’t—if I would rely just on my previous knowledge, I wouldn’t have cut the images from the bands.
Figure 13. Interviewees indicated experiential characteristic

Partially different 12 participants, suggested that the lesson was *experiential*, 11 (78.57%) of them were able to apply personal practical experiences during the class and different 11 utilize their own experiences as starting point of learning. Below is example of participants’ transcript that indicated ability to utilize personal practical experiences during the class, same with the one in constructive characteristic above:

I didn’t—if I would rely just on my previous knowledge, I wouldn’t have cut the images from the bands.

And this is example of ability to apply personal practical experiences during the class:

P: Yeah, but (.) and the first thing we did, uh, instead of putting that color background, we choose an image; but it wasn’t fitting at all. So we have to change it. So I—calling to my previous knowledge, I would have maybe use an image as a background; but then, I think it was meaningful but it could be disruptive. So as we said in the—in the presentation when we were doing these bad slides, the—the background if there is an image, or an GIF, for example, the one we had, it could be disruptive. It could—no, not have you understanding the concept. So I—we changed this. So I think that when we, at least in my case, I connect my previous knowledge with the, yeah.
Figure 14. Interviewees indicated active characteristic.

10 participants (71.4%) indicated that they were able to actively apply information during the class, in terms of applying information. 7 participants (50%) suggested they were able to actively evaluate information, but in contrast, only 3 (21.43%) suggested that they were actively acquire information. Example of actively evaluate and apply information is the same with “apply personal practical experiences”, while example of actively acquire information is:

Because you have—you implement—you learn the concept, and then you implement and then it’s about—I mean not getting more information from the teacher, but getting information from—learning from each other.
Figure 15. Interviewees indicated individual characteristic.

11 participants showed the indicators of individual characteristic. All of 11 (78.57%) reported to be able to apply their own practical experiences during the class, which the example was the same as one of experiential’s indicator “I was able to apply my own practical experiences during the class”.

2 (14.29%) reported that the studying enabled the achievement of their personal goals:

I was truly interested in learning how to design because I, me, I have problem when I am doing presentation, normally I changed it so often.

and only 1 (7.14%) was able to study according to his/her personal style that suits him/her.

P: The time, like the— the [stutters], uh, the amount of work and the time, uh (..), organization was like, we had much more time for doing the task, which I really like because, as I said before, I need more time for all those things, I guess, compared to, maybe, some others, so I really enjoyed that it was enough time to do our tasks and also practice a little bit about them, and it was not the fear that you somehow miss something, so, I would say that was a main point that my— my motivation was good.

9 participants (64.2%) reported that the class helped them understood different perspective (multiple-perspective oriented). The example would be:
And in this case what I think that help a lot was, uh, that we put our hands on the work. So we have to create these slides: we have to create the good slide and the bad slide, and I think, yes, by trying, okay, is this background matching with the font, is the color going well? Even our colleague of us were, uh, taking her phone out and looking online the webpage you showed us. Okay, is this color matching?

8 (57.14%) participants agreed that in the class was abstract, where practical examples are studied under theoretical framework.

P: So, with bad aspects, you’ve actually told us what we have to do and, we sketched something, like, adding colors, or necessary colors,

I: Hmm.

P: Then, the background, and then the text, and everything, there is no kind of coherency in the—

I: Hmm.

P: in the text and background color of the design. All these things affect, uh, the design.

![Diagram](image)

**Figure 16. Interviewees indicated cooperative, conversational, and collaborative characteristic**

8 participants (57.14%) also agreed that the case related, small group discussions helped them learn, even though there were only 2 (14.28%) participants indicate success with their part-
ners and only 4 (28.56%) reported commitment to collaboration. In total, there are in total 12 participants indicated the emergence of cooperative, conversational and collaborative.

6 participants (42.85%) reported that the class was contextual, promoting skills and knowledge needed in working life; 4 (28.57%) reported they have goal of learning PowerPoint, where 2 (14.28%) of them reported the class enabled them to achieve their goal (goal-oriented).
6 Discussion

Before discussing, it is important to remember what was stated on previous chapter: concept maps and reflection blog posts were eliminated from being the data source in this study. The limited number of students writing reflection blog post, the minimum resource to thoroughly assess concept maps and the fact that there was question about prior and new knowledge structure in relation of pre- and post-concept maps (the first interview question), made interview transcripts as sole and primary source of data.

6.1 RQ1. How to design a lesson in higher education, that consider the pre-requisites of meaningful learning?

The idea of meaningful learning, as stated by Bretz (2001), was enriched by perspective of human constructivism by Novak, which states that “meaningful learning underlies the constructive integration of thinking, feeling, and acting, leading to human empowerment for commitment and responsibility.” Furthermore, Novak stated that such experience, which leads to empowerment, occurs within either cognitive, affective or psychomotor domain. It is concluded that constructive integration of cognitive (thinking), affective (emotion), and psychomotor (acting) in education would be the emergence of meaningful learning (Bretz, 2001). Cognitive, affective and psychomotor were learning domains. Secondly, the conclusion above is not everything that matters about the relation between learning domains and meaningful learning. Learning domains dictate which techniques are effective to teach them, “one-size-fits-all doesn’t work” (Kapp, 2012). Moreover, defining specific learning domain help to define point of view of subject matter. For example, a subject matter “Clear Slide Design” could be seen from the point of view of declarative knowledge, that is, verbal knowledge or factual knowledge, an association between two or more items, linked by memorization (Kapp, 2012). The way to see it from declarative point of view is by presenting some visually clear slide designs. However, the same topic can also be discussed from the point of view of procedural knowledge, that is, step-by-step instructions for performing a task (Kapp, 2012). This multiple possibility of perspective potentially add complexity and hinders the conceptual clarity of subject matter – whether it is “how to”, “how”, “why”, “what”, and so on. As clarity of subject matter is one of meaningful learning pre-requisite and, as it has discussed earlier, is the only one thing teacher could dictate, it would not be wise to leave learning domain out of meaningful learning study.
Third matter, perhaps most important point to discuss about RQ1, is the learning domain integration within the class activities. It is important to mention the way of integrating learning domains didn’t refer to activities that addresses all 3 domains at all time, throughout the classroom. Instead, it was rather 1) there are some activities that addresses 2 or 3 of the learning domains at a time and 2) the learning domains are all individually addressed throughout the classroom (See Chapter 4.3). These different ways of integrating learning domains could be a critical point where the support of meaningful learning could be described and further analyzed. Each learning domain mentioned in Chapter 2.3.1 has different taxonomy; for example, cognitive domain, which related to thinking skills, starts with remember, which escalates to understand, apply, analyze, evaluate, and create (Krathwohl, 2002). This taxonomy is also known as Bloom’s Revised Taxonomy. Providing that all of these happen in thinking level, neither emotional nor procedural level, the taxonomies were clearly distinguished, which subsequently distinguishes the teaching / learning strategies for specific learning domain.

In this study, the cognitive taxonomy undoubtedly went to the create level – as learners’ task were to create unclear and clear slide design. Since create is the most complex cognitive level according to Bloom’s Revised Taxonomy, there were need to address the lower-level cognitive processes first; in the beginning of the class, students were evaluating the concept of what is good and bad slide design, which were analyzed in the class to be highly subjective and therefore redefined to be ‘visually clear’ and ‘visually unclear’. Even the term ‘clear’ were also described using the correct use of image, size and color in slide design, so that it would be easier to be understood and easier to be applied in slide design.

The limitation to find characteristic emotionally involving (see Chapter 2.2) didn’t necessarily mean that affective domain would not be addressed in pedagogical design of this classroom; it would be a counter-proposition of integration of domains to support meaningful learning. Instead, the affective domain was addressed in form of role-playing (Kapp, 2012) as treasure hunter; where the students were invited to respond to the phenomena (Clark, 2015a) and giving active participation in the classroom, whether by discussing, giving ideas to analyze what is clear and unclear slide design, finding treasure map and presenting the slide design. The coins were used as incentive for those responds to phenomena, thus all of these activities were meant to encourage their participation.
The psychomotor domain was undoubtedly addressed; some demonstration (Kapp, 2012) on how color, size and image contributed to unclear and clear slide design were presented. Students were also practicing (Kapp, 2012) making unclear and clear slide design; not just listening on ‘how to’ do it. Before practicing, the learner was put in set (Clark, 2015b), being mentally ready (in this study, “mentally” is translated to “cognitively”) by given the conceptual matter of the topic; and being emotionally ready by some stimulations such as coins, role playing as treasure hunter and doing scavenger hunt for treasure maps (See Chapter 4.3). The psychomotor domain is also addressed in level of guided response, as learners had performed action—creating unclear and clear slide design—after some demonstration of how the concept works. Perhaps, this is the reason why experiential indicator were third most frequently identified from the participants; because students not only had chance to experience making the clear and unclear slide, but also chance to experience a clear and unclear slide design presentation.

These three domains (cognitive, affective and psychomotor), had been addressed and integrated, with some limitations, in the classroom, as Novak suggested (Bretz, 2001; Novak, 1993), to help fostering meaningful learning. In addition, all activities during the lesson described in Chapter 4.3 were addressing specific domains using effective teaching methods proposed in Chapter 2.3.2. Methods to address cognitive (specifically, rules-based and conceptual knowledge), affective, and psychomotor were all implemented in the classroom. Another reason is that concept maps, which is important for knowledge construction (see Chapter 2.1.1) were implemented in the classroom as well.

6.2 RQ2. What process characteristics of meaningful learning emerge in that lesson?

From the results, it seemed that most meaningful learning characteristics has occurred in the classroom; the ones appearing most would be from sub-categories of critical, reflective, and self-directed (able to self-evaluate learning). This is in alignment with what Ausubel and Novak claimed, that for meaningful learning requires relevant existing knowledge structure (Ausubel et al., 1978; Novak & Cañas, 2008; Novak 2011). When learners reflect, they are referring to the existing knowledge in their cognitive structure. It could also be inferred that as learners were able to self-evaluate themselves, they were willing to learning meaningfully—the next pre-requisites of meaningful learning (see Chapter 2.1), supported by the pedagogical design to conceptually clarify the class topic (See Chapter 4.3.5). Therefore, it is normal to
see constructive characteristic, especially able to deepen understanding, to also appear more frequently than the other characteristics.

As proposed above, experiential characteristic might be a result of the psychomotor activities in the classroom; the reason was because the indicator proposed in TML model, especially “I was able to apply my own practical experiences during the class” suggested that experience was more practical than simply mental. In contrary, the active characteristic does not suggest that everything learner do should be physical to be active; there is indicator of actively evaluating own learning.

This method of determining frequencies of something, according to number of participants mentioning the specific matter, is in alignment with what was stated by Saldaña (2010, p. 68). However, this proposition of frequency based on number participants mentioning the matter, was not to be seen as sole, absolute measure of what frequency happened during classroom: multi-representational was the only characteristics unidentified in any of the transcription; despite the target of learning was addressed in multiple forms: Google Slide, presentation and printed treasure maps. This case is the same with cooperative, conversational and collaborative: despite everyone was working as a group, only 9 out of 14 showed the indicator of cooperative, conversational and collaborative characteristics. Putting aside the indirect nature of the questions, other possible reason was the possibility of somebody who is not comfortable learning in a group; whose leaning won’t be optimized when learning together. Saldaña (p.69) thus proposed several advanced statistical methods such as hierarchical clustering and multidimensional scaling to identify associations, co-occurrence, distance, and proximity between such data.

Furthermore, this study had not considered the number of references of a characteristic in one source. The data had shown that it was possible once source identified the same characteristic repeatedly during interview. Therefore, it was a challenge to simply conclude that the number of source identifying absolutely and directly showing the frequency, or degree of intense of each characteristic. It was tempting to see this result in that way, however this limitation doesn’t allow Author to simply conclude “the more source from whom it was identified, the more intense the experience is”. More discussion about this can be found in Chapter 6.3.

On the other issue, it was found that many of the learners didn’t learn from classroom where there was only lecture—which was in alignment with Novak’s suggestion to integrate learning domains (Bretz, 2001). A classroom with just lecture to listen, without any other activities
to be done by learners (apart from, probably, writing notes and practicing exam questions), do not support this learning integration; 1) the students were not made aware with the possibility of different learning activity and 2) they were only expected to listen to the lecture. This case, however, were not put into inter-rater reliability and were not included in Hakkarainen’s (2011) framework. Moreover, this case is highly ambiguous; a clarification of whether the learners were really not learning because of the lecturing technique, or because of low motivation to learn, is needed. In addition, the question that was used to find this issue didn’t specify time frame and were totally open; and if it was relatively long time in the past, there is a possibility that the memories were not reliable as an information source.

6.3 Indirect interview questions toward the matter: possible issues

Elaborating further, it was stated on Chapter 4.5.2 the questions asked in the interview were indirectly addressing the process characteristics, although it was contextualized to the slide design classroom. This fact could lead to several discussions.

First, the number of participants indicated process characteristics (N), even though not absolute, might be showing the degree of the process characteristics’ experience under the lesson design. It might also illustrate how intense certain process characteristic was emerging in the classroom, based on how many students indicated it. However, it didn’t indicate how intense was the process characteristic in the personal level—which was what the previous studies (Hakkarainen, 2011; Hakkarainen et al., 2007) were finding out, using a set 5-likert scale questionnaire ranging from 5-strongly agree to 1-strongly disagree. It was also not indicating whether the process characteristics emerged throughout the classroom or within specific moments, instead, it merely stated the process characteristic was present during the classroom.

Second, the indirect nature of the interview questions led to 2 different views; it was either 1) interview transcripts were not indicating the process characteristics because the questions were indirectly addressing the matter, or 2) the process characteristics were actually there, because even it was indicated even when using indirect approach. The first view, however, arguably rebutted by the facts that the questions were specifically addressing the classroom itself and the events happened during that time, including what students had experienced; whether it was their learning experience or their difficult experience. As process characteristics are highly related to the event or experience (instead of learning outcome) the indirect
questions were providing open, but specific guidelines for participant to answer just within the context of situation they experienced in the classroom.

Going deeper on the purposes of the questions; initially, the questions were simply meant to look for indicator of meaningful learning by comparing pre- and post- concept maps with interview transcripts; and if possible, the circumstances that made them learn meaningfully. Questions about motivation were related to intention to learn, even though might just be rote and not meaningfully. Question about music was related to emotional state, which might hinder or enhance motivation. However, this kind of notion was less trustworthy as there were no specific framework to declare them, when it was done using these questions; hence the shift towards assessment of meaningful learning process characteristics. These discussions about interview questions led to one iteration suggestion as part of Design-Based Research: to use interview question as a further evidence of meaningful learning process characteristics, apart from the questionnaire.

6.4 Limitations and challenges

Some limitations of this study were 1) the nature of coding framework being taken from a questionnaire statement, as mentioned earlier in this chapter; could lead into 2 different interpretation, and probably the study result would be more rigorous, had the questionnaire were also used as part of data collection for cross-checking the interpretation. 2) The number of participants; which even though coming from quite many different countries, their number were clearly not sufficient for generalization (N= 14). 3) The characteristic emotionally involving was not used in this study due to the time and resource limitations.

4) Time and resource limitations also caused the integration of learning domain in this study was done without rigorous research basis; the classroom did address three of all domains throughout the activities, but as stated in Chapter 6.1, the extent of the learning domain integration was done in a very specified way, and thus could be as a basis for future analysis. 5) The percentage of cases used in inter-rater reliability was less than 10% of the whole data (1 participant out of 14) and only checking 1 meaningful learning characteristic out of 14. Joyce (2013) stated that only 20% of the cases are coded by the peer; while “Check Inter-rater Reliability” (n.d.) suggested 25%.
6) Perhaps the most unsatisfying part of this study is the fact that the inter-rater reliability has not shown strong, rigorous confidence on the interpretation yet; most of them were either moderately, poorly agree or even totally disagree to the Author’s interpretation, even though there are excellent agreements ($\kappa > 0.75$) on few indicators. The average Cohen’s Kappa for all meaningful learning characteristics in Participant 02’s interview is 0.31 and the average Cohen’s Kappa for Critical Thinking across all participants is 0.38. According to Landis & Koch (1977) both of these values are only considered fair; while it is poor according to “Run a Coding Comparison query” (n.d.).

There are some possible reasons for this; one, the peer coder was not being involved directly in the beginning of the project; the inter-rater reliability was rather done after Author had finished the coding and peer did not have any knowledge about the data, or how to interpret them, before data was shared. This causes the agreement about what extent the data should be coded were less rigorous if peer was involved from the beginning. (Silverman, 2013) noted one of his experience doing inter-rater reliability for months, involving a lot of redefining the coding categories to reach better agreement. This peer coding seemed to involve the peer from the beginning, because they “…independently coded samples of transcripts, comparing our coding to see if we overlapped…After some months in which we often found we had to revise our definitions of coding categories…we finally achieved a respectable Kappa level” (Silverman, 2013, p.272). Some example of cases in Gisev, Bell, & Chen (2013) were also suggesting that peer coding should be done by all coders from the beginning.

Two, peer coding was only done in one-time process, which gives less chance to review some parts, especially parts that was actually needed to be coded but hadn’t been coded yet. For example, these two transcriptions below were supposedly included as they are all evidence of critical thinking, but peer was only coding a part of it (showed in underline).

Transcription 1

I: Okay. Can I say you are mostly, like, reviewing what you know?

P: No, not mostly. Not mostly reviewing. Adding up—

I: Adding up?

P: Yeah. Adding—adding for my knowledge—

I: Okay.
P: And then applying them to the slides.

Applying is also the definition of critical thinking in this study, moreover, the answer “no, not mostly…adding up--” had also shown evaluation and synthesis of participant’s own learning.

_Transcription 2_

As I did it yesterday, so about the structure, uh, that, uh, I usually is to put more topics in the same slide, so okay, it’s convenient to put--to have [laughing] that slides but now I understand—it’s easier also to understand, to follow the discussion, of course, to have different slides. And uh, I didn’t care about--before, uh, to put like text in images like, every, um, every part, I just say, it’s okay. But now I understood that you should put better and organized structure and about the background, the issue to me to be distracting, but I didn’t know that I could put like, GIF for background.

Same case: the non-underlined part had shown the evaluation and synthesis of the learning, which is indicator of critical thinking. Besides the real different understanding issue, matters such those misses did contribute to the inter-rater reliability, not to mention that those were only 2 found examples—it was unknown how many misses were there in the data analysis. In addition, the portion of data coded in peer were less than 20% of total data; only 1 out of 14 participant transcriptions was coded to all meaningful learning characteristics indicator, and only 1 meaningful learning characteristic peer-coded to all participants.

The establishment and proceeding of the classroom were not without challenges either; for example, a miscalculation of number of students attending the class lead to way of submitting coins in Chapter 4.3.3, Figure AE. This notion had its limitation, i.e. some students were playing with the coins, stealing them from the other groups’ boxes. Even though some participants found this funny and lessen the tension in the classroom, had coins were implemented as part of assessment, it would be more challenging to assess fairly and correctly without more control over this notion. Some technical issues were raised due to this miscalculation as well, i.e. type of shapes, which determines number of groups, need to be increased on the spot; amount of coins would need to be increased as well, to make sure everyone would get a coin. Also, since number of students coming to the class was increasing, the time needed for collaboration was increased too – hence the extension of initial lesson time from 105 minutes to 140 minutes.

Some other minor, technical situations was the fact students initially were not aware they need to fill up a consent form before the class would start, resulting in 20-minutes wait of the
unknown. An instruction to go to link of consent form was there, but there was neither instruction nor notification that consent form needed to be filled before the class started. The situation got under control after Author realized the number of students filling the form were still less than the ones attending after 15 minutes; where it was immediately announced that the link presented in projector had to be opened in browser and filled before the class start. Apparently, this was the right call, as one of the interviewee admitted some upsetting moment because everyone just sitting there waiting. Also, the proceeding of coin giving was unclear for some students; they understood that they can only give coin once, instead of (maximum) 6 times, 1 coin each time, to all 6 presentations. The goal here was to provide healthy competition; where everyone appreciates the effort of others accordingly; instead of tackling down each other to get highest points. In context of higher education, it might not be such a big deal, but in case of studying this research in K-12 schools might be different.

6.5 Ethical Issues

Before the class begun, a link to fill a consent form was sent to all students who were coming to the classroom. Student were asked if they would give permission to Author to a) use artefacts such as concept maps, slide design and points, which would be produced in the classroom, as thesis data b) use students’ blog post as thesis data. There was also a field for providing their blog address, should they be willing to give permission. Then students were also asked if they were willing to be interviewed as part of data collection, the way they would like to be interviewed (with video recording or audio only) and their time availability within the next 4 days, to enhance the reliability of their memory about the classroom. It was stated that all published data would only be the analysis; their personal information would not be published, and their names would be anonymous. During peer coding, all participants’ names were anonymized and number was used instead (Participant 01, Participant 02..). No audio or video of the interviews were given to peer coders. Also, all video and audio recorded during interview will be used only for educational purposes.

The reason participants were chosen was stated in the consent form, which were the fact that they were speaking English and they were higher education students. The benefits to be in the study were also described; which were the experience of dynamic, not-just-sit-down-and-listen classroom, learn to create visually clear slide design, which was important as presentation would be inevitable in their study courses, and probably in their future. In
addition, as previously stated in Chapter, the classroom was conducted under the course Learning Environment and Technology, the topic making clear slide design was in alignment with the course objective.
7 Conclusion and Future Research

According to Design-based research principles (Barab & Squire, 2009), this study was only the first design cycle. Outcome from this first design cycle was a pedagogical design framework that supported almost every part of meaningful learning process characteristics, according to Teaching and Meaningful Learning (TML) model (Hakkarainen et al., 2007; Hakkarainen & Vapalahti, 2011). The pedagogical design was developed considering the integration of cognitive, affective and psychomotor domain (Bretz, 2001; Novak, 1993) with purpose of supporting the occurrence of meaningful learning. In addition, several teaching methods to address each of the learning domain (Kapp, 2012) were implemented to enhance the effectiveness of the pedagogical design.

Most of meaningful learning characteristics were identified in this classroom design, with exclusion of, arguably, multi-representational. Characteristics that were identified by all participants were critical thinking, reflective and self-directed (self-evaluation) and the least identified (not unidentified) was goal-oriented. Even so, the number of source identifying of a characteristic cannot necessarily represent the real frequency or degree of intense; for example, everyone was working in a group, but not everyone identified cooperative, conversational and collaborative.

For the next design cycle of this study, several iterations from several points of view are proposed. From pedagogical point of view, it is important to 1) always let the participants know what was going to happen; to set learner expectations means the success of a facilitator: the case of consent form filling was good warning. 2) different ways to distribute learner into groups are welcome to be implemented; probably the ones with capability to be easily scaled within a short time. 3) in the situation where peer review would become necessary assessment system in the classroom, incorporating social media accounts, such as Facebook, Instagram or Google Plus could minimize the risk of ‘stolen coins’ due to the impossibility of taking out someone’s like or plus given. 4) to provide more explanations and justifications about the emergence of meaningful learning processes, the way of integrating learning domains could be examined further, the basis of integration could be established, and pedagogical activities could be designed in such way.

From the point of view of academic research methods, it is suggested to 1) involve peer to code data from beginning point of research. In this way, Author could provide the basis of
coding rules, and both Author and peer could check the progress of each other’s coding more intensively, which in the end will maximize the inter-rater reliability. One way to make it more systematically could be a coding round. Hruschka et al. (2004) used coding round to address inter-coder reliability issue: after codebook (that is, a set rules of coding) were drafted, the team would begin a process of coding, reliability assessment, codebook modification, and recoding. Then, a “lead” coder assembled the draft codebook and distributed a subset of uncoded data to the team. This subset of data was 20% of the total data per coding round. This constant check and iteration provided prominent system to reach good agreement between coders. 2) in situation where interview or qualitative study was not a viable option, giving questionnaire developed by Hakkarainen (that has been developed in 2007, 2009 and 2011) would be an efficient way to proceed. The questionnaire had already been given to relatively low number of participants of n = 7 or n = 11 (Hakkarainen, 2011; Hakkarainen & Vapalahti, 2011) However, as some statements such as critical and creative can potentially be interpreted differently, it is good idea to explain the statements towards the participants. 3) the method of breaking down concepts into smaller and more measurable concepts should be tested in different class topic. In this study, the classroom topic was related to visual communication design in learning environment; which needed to be tested with the audience. On this context, the key points on breaking the concept down were choosing the less subjective definitions or learning objectives. 4) given that coding framework had been established and pre-tested, and all definitions of the code and categories had been clarified, the next cycle of this study could use protocol coding (Saldaña, 2010, p.130-133) as the data analysis method, especially if the data sources are interviews and documents such as participants’ reflection.

This thesis provided one method to support meaningful learning, especially in higher education context. Apart from presentation and collaboration devices such as computer, projector and internet access, the activities and resources used in this study were relatively low cost; such as few sheets of papers and several printed materials. In addition, summary of pedagogical design, with its sequences, were described, and the tools used were specified altogether in Chapter 4.3, which was hoped to make this method more easily be replicated and re-tested in different context and learning topic. In a higher education context where cognitive demand and knowledge complexity are typically higher than basic education, this method showed little promise—more reliability testing, refinement and iteration needed—to ease those cognitive demands which ultimately, will lead to higher comprehension and better knowledge acquisition.
References


Kilic, M., & Çakmak, M. (2013). Concept Maps As a Tool for Meaningful Learning and


Appendix 1

Learning Environments and Technologies subject from University’s Weboodi
## Appendix 2

Inter-rater Reliability for Participant 02

<table>
<thead>
<tr>
<th>Process Characteristic</th>
<th>Indicator</th>
<th>Cohen’s Kappa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical</td>
<td>The studying developed my critical thinking</td>
<td>0.3478</td>
</tr>
<tr>
<td>Self-Directed</td>
<td>I was able to evaluate my own learning during the class</td>
<td>0.2943</td>
</tr>
<tr>
<td></td>
<td>I was able to influence the content and realization of our slide design</td>
<td>-0.0399</td>
</tr>
<tr>
<td></td>
<td>The students directed their own studying process in the class</td>
<td>0</td>
</tr>
<tr>
<td>Reflective</td>
<td>I was able to evaluate my own learning during the class</td>
<td>0.2943</td>
</tr>
<tr>
<td>Constructive</td>
<td>I was able to utilize my prior knowledge about the class topics</td>
<td>0.1213</td>
</tr>
<tr>
<td></td>
<td>The class deepened my understanding of what I had learned before</td>
<td>0.8139</td>
</tr>
<tr>
<td>Experiential</td>
<td>I was able to apply my own practical experiences during the class</td>
<td>0.265</td>
</tr>
<tr>
<td></td>
<td>I was able to utilize my own experiences as starting points for learning in the class</td>
<td>-0.0398</td>
</tr>
<tr>
<td>Creative</td>
<td>The class encouraged creative thinking</td>
<td>-0.0883</td>
</tr>
<tr>
<td>Individual</td>
<td>I was able to apply my own practical experiences during the class</td>
<td>0.265</td>
</tr>
<tr>
<td></td>
<td>Studying enabled the achievement of my personal goals</td>
<td>0.4032</td>
</tr>
<tr>
<td></td>
<td>It was possible for me to study according to my own personal style that suits me</td>
<td>0</td>
</tr>
<tr>
<td>Active</td>
<td>Student actively apply info</td>
<td>0.3907</td>
</tr>
<tr>
<td></td>
<td>Students actively evaluate info</td>
<td>0.7408</td>
</tr>
<tr>
<td></td>
<td>Student actively acquire info</td>
<td>1</td>
</tr>
<tr>
<td>Cooperative, Conversational, Collaborative</td>
<td>Case related, small group discussions on the discussion area helped me to learn</td>
<td>-0.0964</td>
</tr>
<tr>
<td></td>
<td>The students were committed to collaboration</td>
<td>0.7969</td>
</tr>
<tr>
<td></td>
<td>Cooperation with my partners was successful</td>
<td>0</td>
</tr>
<tr>
<td>Multiple-Perspective Oriented</td>
<td>The class helped student to understand different perspectives related to the topic</td>
<td>0.358</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>-------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Abstract</td>
<td>On the class practical examples were studied in a theoretical framework</td>
<td></td>
</tr>
<tr>
<td>Contextual</td>
<td>The class promoted the learning of skills and knowledge needed in working life.</td>
<td></td>
</tr>
<tr>
<td>Goal Oriented</td>
<td>The studying enabled the achievement of personal goal.</td>
<td></td>
</tr>
</tbody>
</table>
| Multi-Rep
Representational | The targets of learning were examined through several forms of presentation (text, diagrams, pictures, video, etc.) |
### Appendix 3

Inter-rater Reliability for Critical Thinking

<table>
<thead>
<tr>
<th>Participant</th>
<th>Cohen’s $p_a$</th>
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<tr>
<td>01</td>
<td>0.8199</td>
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<tr>
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<td>13</td>
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<td>14</td>
<td>0.3063</td>
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