



**UNIVERSITÉ
DE GENÈVE**

**FACULTÉ DE PSYCHOLOGIE
ET DES SCIENCES DE L'ÉDUCATION**

**POSTER OF A TAXONOMY OF ELEMENTS FOR LEARNING AND INSTRUCTIONAL
DESIGN**

**MÉMOIRE REALISÉ EN VUE DE L'OBTENTION DE LA MAÎTRISE UNIVERSITAIRE EN
SCIENCES ET TECHNOLOGIES DE L'APPRENTISSAGE ET DE LA FORMATION**

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ABSTRACT

The high number of elements available for designing education might prevent some of the actors taking part in it from profiting from all the options at their disposal. The clear presentation of all the elements becomes therefore highly important to ensure the use of those options. This research study focuses on the creation and evaluation of a poster to present a taxonomy of elements for Learning and Instructional Design, and on the identification of the advantages and limitations of the chosen visual representation. The creation of the poster includes the conception of a taxonomy and the design decisions made to ensure a clear display of the information. The evaluation part focuses on the perceptions that the potential users have of the poster, and their answers guide the design as an iterative process.

RESUME

Le nombre élevé d'éléments disponibles pour la conception pédagogique pourrait empêcher certains des acteurs qui y participent de profiter de toutes les options dont ils disposent. La présentation claire de tous ces éléments devient donc très importante pour assurer leur utilisation. Cette étude porte sur la création et l'évaluation d'un poster qui présente une taxonomie des éléments de la conception pédagogique (Learning and Instructional Design) et sur l'identification des avantages et des limites de ce type de représentation visuelle. La création du poster comprend la conception d'une taxonomie et les décisions sur le design prises pour assurer une présentation claire de l'information. La partie d'évaluation se concentre sur les perceptions que les utilisateurs potentiels ont du poster, et leurs réponses guident la conception en tant qu'un processus itératif.

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Introduction

Designing education is a rather complex task because there are many elements that play a role in it. One of the main challenges is to keep a general view of the field as the high number of elements available might prevent some of the actors taking part in it from profiting from all the options at their disposal. Therefore, the possibility of having a visual representation of all the elements involved, by means of a poster, becomes significant.

Posters serve multiple purposes: as means of presenting information over extended periods of time (which helps memorize or remember the information given), as summaries of a topic, or as decoration. However, for Ossa and Musser (2004) it is also important to realize their educational potential. This potential does not only refer to educational settings, but also to workplaces where Informal Learning, according to Marsick and Watkins (2001), usually takes place, and where posters can be used as tools.

The goal of this research study is to identify the advantages and limitations of using a poster to present the elements of Learning and Instructional Design. The choice of a poster to present the taxonomy aims at having an overall view of the field and at creating awareness of all the elements available. The large size of the poster allows to present the field of Learning and Instructional Design as a whole, and its lasting nature permits this presentation over a long period of time.

The research study focuses on the process of creating the taxonomy and the design of the poster, as well as on evaluating the perception of the potential users of this kind of visual representation. The taxonomy created corresponds to the hierarchic taxonomy type as presented by Patrick Lambe (2007) where only the main hierarchical levels are presented and the relationships between the elements are not introduced. In order to give some flexibility for the future work with the taxonomy, the choice of a mind map to present it was made, therefore, following the key characteristics of mind maps enumerated by Buzan (2006), all the structure radiates from the centre, it is colourful and there are icons accompanying the main elements.

The design of the poster considers the main guidelines for design defined by Norman (2013) with the purpose of presenting the two most important characteristics of good design: *discoverability* and *understanding*. Regarding the evaluation of the poster, a

usability test was used, following the steps to ensure usability described by Dumas and Redish (1999). Participants were also asked about their perceptions on different dimensions such as usefulness, attractiveness, readability and completeness of the taxonomy. The evaluation of these perceptions was conceived to obtain more information from the participants given that the poster presents a high amount of information and that the presentation is static. A high rate in the dimensions is considered as giving more strength to the advantages identified by the participants.

Chapter 1 presents the theoretical framework for the whole research study: the use of posters in education, the definition of informal learning, some types of knowledge maps, the definition of taxonomy and the guidelines for its creation, as well as the main concepts related to design. Chapter 2 presents the objectives of the research as well as the research question and sub questions.

Chapter 3 presents specifically the main concepts accounted for in the taxonomy (Learning and Instructional Design) and gives an example of an instructional design method and a learning design specification. Likewise, it presents the definition and classification of Teaching Models and the rationale for including them in the taxonomy.

Chapter 4 presents the methodology used for creating the poster and for its evaluation with the goal of identifying the advantages and limitations of this visual representation. The choice of a mind map is explained, the types of tests are defined, and the dimensions that are considered in the evaluation are described. Arguments for using the Lund Use questionnaire are also presented.

Chapter 5 presents the results of the different tests and shows how the results of the testing of each version led to changes or improvements in the taxonomy and the poster. Chapter 6 presents the conclusions regarding the research question based on the results of the different tests. Finally, in chapter 7, a discussion of future work is introduced.

The poster proposed at the end is based on the illustrations created by Daniel Schneider in 2010 of a learning (/pedagogy/technology) taxonomy, that in turn was based on the work of Conole and Fill (2005). The original taxonomy served the authors to conceive a toolkit with the objective of creating pedagogically effective learning activities.

The final poster can be used to present the field or to guide the tasks for the COMEL (communication médiatisée) class. It can also be used in teacher training or as a tool to guide the planning of lessons or activities.

As a student of the Master Maltt, I see the importance of having a complete view of all the elements that take part in the process of designing education. Sometimes, while carrying out the tasks for the different courses of the Master's program we can lose perspective of all the things that play a role in this field. I consider that the understanding of the field is of significant importance for current and future learning and instructional designers, and that a poster might be an effective means to achieving this understanding as it provides a quick and easy access to all the elements available for designing education. The multiple possible uses of the final poster make it an interesting tool, and proposing a taxonomy is an excellent way of reviewing the elements of Learning and Instructional Design.

1. Theoretical framework

The study carried out is a complex one as different concepts come together to be able to design and produce the final poster. In this chapter we find the main definitions that guide this research study. Initially, the use of posters in education is presented as well as the advantages and disadvantages of their use, according to the works of Ossa and Musser (2004), and MacIntosh-Murray (2007) among others.

Afterwards, a differentiation between diverse types of knowledge maps is made, and the concept of mind map is defined according to its creator, Tony Buzan (2006). Moreover, the theory about usability tests by Dumas and Redish (1999) is presented.

Furthermore, the concept of taxonomy is defined and its main types identified. For this section I followed the work of Heather Hedden (2010). Likewise, several aspects of design as defined by Donald Norman (2013) are considered for the creation of the poster.

1.1 Posters

According to the Oxford dictionary a poster is: “[...] a large printed picture (which may or may not be an advertisement) suitable for decorative display.” Some of the following authors present other uses for the posters.

In education posters have long been used to improve the learning environment. This idea might make us think about their decorative purpose, however, posters had a real educational purpose in the classroom. They presented information that needed to be memorized and they served as reminders of that information. The posters also provided constant exposition to the given information.

As suggested by Ossa and Musser (2004) it is also important to realize their educational potential. According to these authors, posters are visually stimulating resources that can be used as learning media.

In their article, “Students using posters as a means of communication and assessment,” Berry and Houston (1995), present the posters as a way to evaluate the learning process of students. In their example the students created the posters and later presented them to their peers. The authors used the posters as tools both to learn and evaluate math concepts.

Literature about the use of posters in educational settings mention examples from different fields.ⁱ Nowadays, we can see a wide use in the academic field to present the progression or the results of a research (MacIntosh-Murray, 2007).

Ossa and Musser (2004) mentioned three of the 4 main following uses of posters in educational environments:

- *Illustration of a concept or a thing*
- *Demonstration of a process*
- *Differentiation between similar things*
- Presentation of scientific data

As pointed out by MacIntosh-Murray (2007, p. 347) “complexity arises from the multiple roles that posters must fulfil, combined with formatting restrictions, the nature of audience interaction, and prestige issues.” Although this appreciation referred specifically to the scientific posters it can be applied to posters in general in the educational field.

Drawing from the different readings about the use of posters in educational contexts we observe several advantages:

- They are at immediate view of the students.
- There is learning by exposition to the information on the poster ([Informal Learning](#)).
- There is stimulation for learning (because of the use of images that accompany the text).
- They are rather inexpensive as they can be used for an extended period.
- They help with retention of the subject matter.
- They help solidify and synthesize new knowledge.

Nevertheless, the different authors have also identified some disadvantages of the posters:

- Only limited pieces of information can be delivered at the same time.

- There is no interaction (unless a presentation accompanies the poster).
- Information needs to be absorbed from a distance within a limited time.

Berry and Houston (1995) stated that it is important to think about how to present the information in the poster to be able to impact the readers (p. 23). Ossa and Musser (2004) mentioned among other characteristics that a good poster must stimulate interest in the topic and effectively illustrate a concept or skill.

In the section about the preparation of the poster, MacIntosh-Murray (2007), talks about the “underlying framework that provides the structure to the poster’s content and formatting.” The information that we want to present should have a backbone to support it and should be clear enough for the reader. Learning in this context relies on the clarity of the information presented plus a reflection process on the part of the teacher, tutor or facilitator.

However, in the case of the poster, for the learning to take place there is no need of a formal educational setting.

1.2 Informal Learning

It is possible that given the nature of the poster Informal Learning might be achieved by placing it in a visible area and by presenting clear and concise information. Although the goal of the poster created for this research study is simply to present the field of Learning and Instructional Design, the characteristics of this type of learning meet the characteristics of the poster.

Informal Learning can be defined as the learning achieved through the intentional presentation of information with no educational context defined. Marsick and Watkins (2001) mention the following as examples of Informal Learning: networking, self-directed learning, coaching, mentoring. They also mention that this type of learning is very common in the workplace.

Allison Rossett and Bob Hoffman (2007) stated that Informal Learning acquires its value mainly from two characteristics: immediacy and relevancy. The information is ready to be learned and it is important for the students. Some reasons to use informal learning might

include the small amount of time or money to take advantage of it, and that from the point of view of the institutions there is no need to hire instructors.

According to the authors the following are the characteristics and value of Informal Learning:

Informal learning tends to be authentic, typically happening beyond the control of the people who manage training programs, outside the limits of classrooms and environments established to deliver formal instruction at a distance.

The characteristic of being informal does not mean that it cannot be planned, it just means that the setting of the learning process is different. The idea of experiencing an object or place to learn from is highlighted by the authors. Although the role of the learning or instructional designer is not widely discussed by the authors, they mentioned that the results of their work should have two characteristics: clarity and visibility.

Highly related to Informal Learning is Incidental Learning that is the unplanned, undirected or additional learning that takes place within a formal or informal situation. Some examples of Incidental Learning, according to Marsick and Watkins (2001), are learning from mistakes, or the hidden agenda of an organization's culture or a teacher's class. This type of learning could be achieved through a poster in the case of "passers-by," —people who encounter the information displayed— and who might take away something new with them.

1.3 Knowledge Maps

Distinct types of knowledge maps have been used to represent the reality or the structure of a field. In the context of education concept maps and mind maps have become of widespread use.

1.3.1 Cartography of cognition

In 1990, Wandersee talked about the cartography of cognition. For him "To map is to construct a bounded graphic representation that corresponds to a perceived reality." In his article, he mentioned how the metaphor of the map was applicable to representing

scientific knowledge. Nowadays, this definition is used in the representation of knowledge visible through several types of maps.

1.3.1.1 Concept map

In 1984, Novak and Gowin defined the concept map as a representation of the “meaningful relationships between concepts in the form of propositions.” They affirmed that “in its simplest form, a concept map would be just two concepts connected by a linking word to form a proposition” (p. 15).

In the website of the software for the creation of concept maps CMapⁱⁱ, Cañas and Novak extended this definition: “[the concept maps] include concepts, usually enclosed in circles or boxes of some type, and relationships between concepts indicated by a connecting line linking two concepts. Words on the line, referred to as linking words or linking phrases, specify the relationship between the two concepts.”

The main characteristics of the concept maps are:

- They have a propositional structure.
- They have a hierarchical structure.
- They have a focus question.
- They present cross-links.
- They have a theoretical foundation.
- They mediate the representations of knowledge between humans.

1.3.1.2 System map

It is a “visual representation of a knowledge domain where proximity and connections between entities are used to express their taxonomic and real-world relationships” (Lambe, 2007).

These maps can be conceptual or descriptive. These maps are “analogue of a real-world arrangement” (p. 42). Some examples of system maps are a map of the arteries in the body or the London Underground map.

1.3.1.3 Mind map

The concept of mind map originated in the late 1960's and was developed by Tony Buzan. He presented it as a natural way to represent the way the human brain organizes information. It is said to mirror the neural pathways in the brain to associate ideas and images. According to the author, the link between the images and the words allow the brain to stock more easily the information because it stimulates the two sides of the brain, what he calls synergetic thinking, and attires the senses. Although the concept of synergetic thinking has not been developed, this type of thinking describes the cooperation between the two sides of the brain to process the information.

Buzan (2006) stated that “because all the ideas on a Mind Map are linked to each other, it helps your brain to make great leaps of understanding and imagination by association.” (p. 64).

Mind maps have been largely used in education but they can be used in any field. The author presents mind maps as tools for communication, problem resolution, creation, teaching, time management or memorisation. In the initial version, the mind map was to be drawn around a concept, but in later versions Buzan has exhorted the people to use an image as the central element of the mind map.

In the book *The Ultimate Book of Mind Maps*, Tony Buzan (2006) mentions the common aspects of all mind maps:

- They all use colour.
- They all have a natural structure that radiates from the centre.
- They all use curved lines, symbols, words, and images.

Buzan affirms that only blank unlined paper, coloured pens and pencils, your brain and your imagination are necessary to create a mind map. Nonetheless, currently there are different software that allow people to create mind maps electronically and that also provide the users with images.

In a comparison between different qualitative visualization methods, Eppler (2006) identified the following advantages and disadvantages of the mind maps in an educational setting:

Advantages:

- Easy to learn and apply
- Encourages creativity and self-expression
- Provides a concise hierarchic overview
- Easy to extend and further content

Disadvantages

- Idiosyncratic, hard to read for others
- Represents mostly hierarchic relationships
- Can be inconsistent
- Can become overly complex (loss of big picture)

1.4 Taxonomy

The interest of proposing a taxonomy is to present the field of Learning and Instructional Design, and to provide the different actors that take part in it with a tool that might expedite their work. They can use it as a reference to the field as well as a guide for different and more complex information searches.

In the foreword of the book *The Accidental Taxonomist*, Patrick Lambe remind us that in our technology-driven world “Taxonomist and taxonomies have [...] become major instruments for analyzing content, purposes and needs, and designing taxonomies to help people find content whatever their need.”

Definition

According to the Oxford English Dictionary a taxonomy is, at its simplest definition, a classification of concepts or “a particular system of classification.” This basic definition is

how it is understood by most people nowadays. However, it was initially used in biology to classify the living organisms and understand the relationships between them.

Another widespread use of taxonomies is in the field of library science, where the information needs to be consistently organised to assure its retrieval. Taxonomies are also used in applications such as document indexing and retrieval, or navigation labels and categories in website information architecture as mentioned by Hedden (2010).

In the web site of the Accidental Taxonomistⁱⁱⁱ, Hedden states that a taxonomy is the base of the terminology work that later becomes more specific. In terminology, the taxonomy is represented as a domain tree that delimits the field that will be studied and places a high amount of importance to the hierarchical relationships and the associative relationships. According to Sager (1990) “a theory of terminology is [...] primarily concerned with a referential system which relates knowledge structures to lexical structure and defines the constituent elements of each type of structure” (p.14).

Diverse types of taxonomies are widely used in the field of knowledge management. They are used for example in organisations to manage their internal information environment and to be able to perform tasks such as “knowledge-building, identifying novel knowledge relationships, sense making, managing complexity, diagnosis and decision making, [...]” (Lambe, 2007).

In education, taxonomies have been used to assess the educational objectives such as Bloom’s taxonomy or to assess the quality of learning by observing the outcomes, as the SOLO taxonomy^{iv}.

An example of a taxonomy is the one developed by Finelli et al. (2015) which was intended to establish a standardized terminology and organizational system for the field of Engineering Education Research. Their objective was to map out the field as well as to agree upon the terms to present the latest researches. They talked about the challenge it presented given that it is a rapidly evolving and diverse field. This challenge is extended to the whole field of education.

Heather Hedden (2010) mentioned three types of taxonomies according to their use: indexing support, retrieval support, and organisation and navigation support. However, she is quick to mention that there can certainly be combinations of the different types:

- The goal of the indexing support type is to “ensure consistency” among the users of the taxonomy. It is used for example in the creation of documents for technical fields as it helps all the users use the same terms for the same concepts.
- The retrieval support type serves end-user retrieval where the users can “take advantage of broader and narrower term relationships or hierarchies to broaden or narrow their search.” The retrieval type is often used in search engines and large commercial directories.
- The organisation and navigation support type is “often applied in website information architecture, intranet content organisation or corporate content management systems” (p.21). The main difference with the retrieval type is that it does not help to find specific information but rather guides the way around. As an example, we can think of the navigational menu on a website.

Hedden also mentioned three types of hierarchical relationships found in the taxonomies:

- Generic-specific: “narrower term is a (kind of) broader term” (p. 113).
- Instance: “narrower term is a specific instance of broader term” (p. 114).
- Whole-part: “narrower term is a constituent part of (the) broader term” (p.115).

There are taxonomies in which a term may have more than one broader term. In this case Hedden talks about *polyhierarchies* (a term also used by Lambe), that might be found within each of the three types of hierarchical relationships mentioned above.

According to Hedden (2010) the following are the taxonomist skills (p. 51):

- Understand the relationships between the terms in the sense of broader/narrower and equivalence.
- Take into account the feedback from users and potential users.

- Determine the hierarchical relationships.
- Ensure that the terms are created in a consistent style.
- Research the meaning and usage of terms to make the proper term choices.
- Use of specific subject matter knowledge.
- Use of accuracy and consistency for creating the terms: spelling, capitalization.
- Understanding of user needs and expectations.

These skills show that to work in a taxonomy is necessary to go back and forth between the theory, the terminology and the feedback from the users.

Patrick Lambe (2007) presents seven forms that taxonomies can take. Each of these representations works differently with the attributes of classification, semantic expressiveness and mapping of a domain:

1. Lists. The most basic form.
2. Trees. Represent the transition from general to specific or from whole to part.
3. Hierarchies. A very specific kind of tree structure.
4. Polyhierarchies. To be used when items belong in more than one class.
5. Matrices. Extremely useful for sense-making as well as for new knowledge creation or discovery.
6. Facets. Basic taxonomies comprising only one of the fundamental dimensions in which content can be analysed.
7. System maps. The visual representation in the most important characteristic.

For the purpose of clearly presenting the field of Learning and Instructional Design a hierarchic taxonomy is used and a maximum of four hierarchical levels are presented.

1.5 Design

Design plays a significant role in the process of creating the poster because we want the final tool to present a rather complete taxonomy but to be at the same time comprehensible, readable, organised, attractive, useful and easy to use.

Donald Norman, in the book *The Design of Everyday Things* (2013), says that “Good design is actually a lot harder to notice than poor design, in part because good design fits our needs so well that the design is invisible, serving us without drawing attention to itself” (xi preface).

The design goal is then to be able to clearly present the large amount of information of the taxonomy. The use of a mind map is therefore a design solution as it allows a more relaxed presentation of the information in a way that it remains useful for all the people taking part in Learning and Instructional Design as they can choose the way use it, and that avoids distracting people with its presentation.

According to Norman (2013) the two most important characteristics of good design are discoverability and understanding. *Discoverability* deals with the possibility of figuring the possible actions to be performed with a product and *understanding* deals with how the product is supposed to be used.

To ensure *discoverability* the “relevant components must be visible, and they must communicate the right message.” (Norman, 2013, p. 3). To ensure *understanding*, I would say, one needs to make sure that the information presented is clear at all levels.

The seven fundamental principles of design according to Norman are:

1. Discoverability. It is possible to determine what actions are possible and the current state of the device.
2. Feedback. There is full and continuous information about the results of actions and the current state of the product or service. After an action has been executed, it is easy to determine the new state.

3. Conceptual model. The design projects all the information needed to create a good conceptual model of the system, leading to understanding and a feeling of control. The conceptual model enhances both discoverability and evaluation of results.
4. Affordances. The proper affordances exist to make the desired actions possible.
*Affordances have to do with the relationship between a physical object and a person. It is the relationship between the properties of an object and the capabilities of the agent that determine just how the object could possibly be used. They determine what actions are possible.
5. Signifiers. Effective use of signifiers ensures discoverability and that the feedback is well communicated and intelligible. *The signifiers communicate where the action should take place. They can be deliberate and intentional, and they can be accidental and unintentional.
6. Mappings. The relationship between controls and their actions follows the principles of good mapping, enhanced as much as possible through spatial layout and temporal contiguity. *Mapping is the relationship between the elements of two set of things.
7. Constraints. Providing physical, logical, semantic, and cultural constraints guides actions and eases interpretation.

1.5.1 Interaction Design

Another important aspect that we must consider in design is the user: “Because things are designed to be used by people, and without a deep understanding of people, the designs are apt to be faulty, difficult to use, difficult to understand” (Norman, 2013, p. 44).

When we focus on how people interact with an object (or product) we talk about Interaction design: “The goal is to enhance people’s understanding of what can be done, what is happening, and what has just occurred. Interaction design draws upon principles of psychology, design, art, and emotion to ensure a positive, enjoyable experience” (Norman, 2013, p. 5).

1.5.2 Emotional Design

Nowadays, emotional design is considered a very important aspect on design especially in marketing. According to Norman (2013) "The emotional system is a powerful information processing system that works in tandem with cognition. Cognition attempts to make sense of the world: emotions assign its value" (p. 47).

Norman proposed an approximate model of human cognition and behaviour by considering three levels of processing information (p. 50):

- **Visceral.** The most basic level of processing. This system allows us to respond quickly and subconsciously. "The visceral level responds to the immediate present and produces an affective state, relatively unaffected by context or history"
- **Behavioural.** It is the home of learned skills, triggered by situations that match appropriate patterns. The actions and analyses are largely subconscious.
- **Reflective.** It is the home of the conscious cognition. It is where reasoning and conscious decision-making takes place.

The visceral response is about immediate perception and relates to style. At the behavioural level, every action is associated with an expectation. Finally, "[t]he highest levels of emotions of emotions come from the reflective level, for it is here that causes are assigned and where predictions for the future take place" (p. 53).

Norman states that design must take place at all levels. However, reflection is the most important of the three as it is this reflection that makes users decide whether to use and/or recommend a product or not.

The design of the poster is therefore of paramount importance as it will make a difference in the users' perception and in their willingness to use it.

The characteristics highlighted above show that the idea of presenting a taxonomy in a large mind map might be an attracting way to present a field as it emphasizes the top levels and thanks to the combination of text and images it might hold the attention of people long enough for them to acquire new information or to be reminded of the elements of the field.

1.6 Poster Design

The American graphic designer Milton Glaser^v stated in the *Graphis Poster 97*^{vi} (19) that the earliest rule about posters is that they are “made for people on the run” and should therefore “be simple in form, reductive in content, and easily understood.”

According to Wittich and Schuller (1973) quoted by MacIntosh-Murray (2007): “[it should be] a visual combination of bold design, color and message intended to catch and hold the attention of the passerby long enough to implant a significant idea in the mind.”

Additionally, MacIntosh-Murray (2007) mentions that the content is displayed as a “visual unit” (her own quotation marks).

2. Research study

In the previous chapter I discussed the theories that provide the framework for this research study. In this section, the objectives as well as the research question and sub questions are introduced. The research question and sub questions guide directly the choice of dimensions to be evaluated and the design of the tests.

This research study can be considered a qualitative research as I try to collect information about the advantages and limitations of using a poster to present the field of Learning and Instructional Design. For this purpose, I analyse the data collected from three tests and I search patterns that allow me to describe the perceptions of the potential users of the poster.

2.1 Main objective

- To create and evaluate a poster presenting a taxonomy of the elements for Learning and Instructional Design.

2.1.1 Specific objectives

With the objective of creating the poster, I intend to gather the elements currently available for the field of Learning and Instructional Design in a taxonomy, and to present the taxonomy in a synthesized and clear way by means of a mind map in a poster size. In order to evaluate the perception of the poster three different tests are carried out.

2.2 Research question

The following question was proposed for this research study:

What are the advantages and limitations of a poster presenting the elements currently available for Learning and Instructional Design?

2.2.1 Research sub-questions

- Is a mind map a suitable visual representation to present a taxonomy of elements of Learning and Instructional Design?
- Is the poster perceived as a suitable tool to create a lesson plan?
- Do the users find the poster attractive (pleasing to the eye)?

- What key elements of a taxonomy of Learning and Instructional Design are users able to recall from the poster?

2.3 Delimitation of the research

This research study focuses on the creation and evaluation of the poster as means to present a taxonomy for the field of Learning and Instructional Design.

To create the poster, I identified the most suitable mind map software to present large amounts of information. I analysed previous taxonomies and mapped out the field of Learning and Instructional Design, and I followed some design guidelines to ensure a clear and visible result. To evaluate the poster I asked potential users about their perception of different dimensions such as comprehension, readability, organisation, attractiveness, usefulness, ease of use and satisfaction.

The research study does not focus on the evaluation of the real use of the poster and it evaluates very lightly the completeness of the taxonomy. However, propositions for both cases are presented in the section future work.

3. Taxonomy Design

This chapter presents specifically the main concepts included in the Taxonomy: Learning Design, Learning Designer, Instructional Design, Instructional Designer, an example of an instructional design method and of a learning design specification. It also presents the rationale for choosing the *Teaching Models* by Joyce et al. (2015) instead of a more conventional presentation of teaching theories. The other concepts presented in the Taxonomy were taken from the previous taxonomies.

The fields of Instructional and Learning Design are defined following the works of Reiser, Gagné, Koper, and Conole & Fill. These two fields, that in my opinion are complementary, are two separate ways of designing education or of looking at how it is designed.

Afterwards, a brief definition of instructional design models and learning design specifications is given, and a summarized description of the ADDIE model by Donald Clark is presented. At the end of the chapter, the *Teaching Models* by Joyce et al. are introduced.

3.1 Definition of Instructional Design (ID)

Throughout the years, different definitions of Instructional Design have emerged. Initially the field was presented as the interaction of humans with technological resources to present information that was to be learned by a group of students in a way that was efficient for both teachers and students.

Robert Reiser, in the book *Trends and Issues in Instructional Design and Technology* (2nd edition, 2007) talks about the different names used to call this field and the changes experienced in the definition depending on the point of view from it was observed. Among the possible names, we find: audiovisual instruction, instructional technology, educational technology, instructional systems design, instructional media, learning design.

Reiser explains how in the United States the early definition of the field viewed Instructional Technology as *media* and that from the 1960's thanks to the works of Finn (1960) and Gagné (1965), it also became viewed as a *process*.

Later, from 1977 on, the field was influenced by the advances of technology as well as by the different learning theories used as guiding principles such as the constructive and cognitive learning theories. The arrival of the Internet in 1994, enhanced the possibilities for learning in general, and for distance learning in particular.

More recent definitions such as the one proposed in 2006 by the Association for Educational Communications and Technology (AECT, <http://aect.site-ym.com>), include the concepts of ethical practice and improvement of performance.

Reiser and Dempsey (2007) presented a definition for the field that he called “Instructional Design and Technology” including key factors such as the extension of this field not only to educational institutions but to the workplace as well. Reiser explained that “Instructional Design and Technology” includes the Instructional Design part -as a systematic process- and the Instructional Technology part -as the use of media for instructional purposes:

The field of instructional design and technology (also known as instructional technology) encompasses the analysis of learning and performance problems, and the design, development, implementation, evaluation, and management of instructional and non instructional processes and resources intended to improve learning and performance in a variety of settings, particularly educational institutions and the work-place.

In this paper we will apply Reiser’s definition to the more general term *Instructional Design*, considered by most to focus on the systematic process, as it is well known that people working in the field often use technology to develop programs and materials.

The systematic process in the definition is presented through the actions of design, development, implementation and management of processes and resources. To this definition, I also add a description of the process provided by Gustafson and Branch (2007): “[It] is a complex process that is creative, active and iterative.”

Gustafson and Branch (2007) also proposed six characteristics of Instructional Design (ID):

- ID is learner centred.

- ID is goal oriented.
- ID focuses on meaningful performance.
- ID assumes outcomes can be measured in a reliable and valid way.
- ID is empirical, iterative, and self-correcting.
- ID typically is a team effort.

Gagné et al. (1992) affirmed that the interest of speaking of instruction in a general way is “to describe all of the events that may have a direct effect on the learning of a human being, not just those set in motion by an individual who is a teacher” (p. 3). Although the authors remind us of the importance of the teacher, they highlight how in the learning environments of today, teachers are not the only ones guiding the learning. The authors added that “the learners may be able to manage instructional events themselves” (p. 3).

In the book *Principles of Learning Design* Gagné et al. (1992) stated that “the purpose of designed instruction is to activate and support the learning of the individual student” (p. 4) in all types of educational contexts.

3.2 Definition of Instructional Designer

Following Reiser’s definition we will define *Instructional Designer* by what she or he does: their goals are to analyse learning and performance problems, and to design, develop, implement, evaluate, and manage instructional and non instructional processes and resources intended to improve learning and performance in a variety of settings.

Roderick Sims and Tiffany Koszalka in the paper “Competencies for the New-Age Instructional Designer” (2014), stated that the instructional designers must develop the essential competencies “for supporting the integration of hardware and software technologies (mobile devices, personal blogs, multiplayer environments) into collaborative instructional networks.” This definition highlights the importance of specific training for the people who work in the field. This training could be done through a combination of formal and informal learning that provides awareness of the size and complexity of the field.

3.3 Definition of Learning Design (LD)

According to Conole and Fill (2008), Learning Design “refers to the range of activities associated with creating a learning activity and crucially provides a means of describing learning activities.” The authors mentioned that LD is defined as an application of a pedagogical model for a specific learning objective, target group, and a specific context or knowledge domain (p. 5).

In the book *Learning Design*, Koper states that LD answers the following questions:

- What support do people need in order to learn?
- How can we assess and communicate the results of a learning process?
- How can we make learning and support as effective, efficient, attractive, and accessible as possible for everyone involved in the process?

Conole and Fill (2008) state that “Learning Design provides a means of representing learning activities so that they can be shared between tutors and designers.” For Conole, an important aspect of LD is to be able to obtain a design that describes “the essence of a learning activity that can then be reused in the development of a new learning activity” (p. 190).

In 2015, Conole proposed *The 7 C’s of Learning Design*. According to the author the idea was to “shift the focus away from content to activities and the ultimate learner experience” (p. 118). The 7 C’s allow the designers to visualize the process and therefore be able to share it and discuss it with other people.

The 7 C’s:

- **Conceptualize.** Create a vision for the course of module being designed and think about the nature of the learners.
- **Create.** Articulate what learning materials need to be created or repurpose Open Educational Resources (OER).
- **Communicate.** Methods that facilitate communication between learner and tutor, learner and peers, and learner and the broader community.

- Collaborate. Foster mechanisms to enable collaboration or group work.
- Consider. Reflection and demonstration to promote learning achievement.
- Combine. Reflection on the design process.
- Consolidate. Implementing the design in a real-life context and evaluating its effectiveness.

As we can see Learning Design focuses on the supports and the activities that are carried out to accomplish learning and aims at sharing the resources created for those activities.

3.4 Definition of Learning Designer

According to Koper (2010), the Learning Designers are all the people that “have a learning design to perform” (p. 4). Their main task is “to design a course that meets a set of learning objectives.”

One important aspect of this definition is that it is not only related to teachers. Koper enumerates the following people as learning designers: course developers, curriculum developers, coaches, mentors or learners who design their own learning plans.

The definitions of LD and ID may overlap, but mostly they complement each other. ID focuses on the systematic process to design the activities (or the lessons) and LD focuses on the activities themselves according to a set of learning objectives. Given that they complement each other, I decided to present the elements that are available for both types of design under the name Learning and Instructional Design.

3.5 Instructional Design Models

As the field of Instructional Design deals mostly with the process we could define the Instructional Design Models as main guidelines for carrying out the process of designing instruction.

3.5.1 ADDIE

A widely-known model in Instructional Design is the one presented by Donald Clark in 1995, and that has since been kept up to date. The model is often referred to as ADDIE, an acronym that represents the five phases of the Instructional Design System: Analysis,

Design, Development, Implementation and Evaluation. According to Clark “ADDIE may be defined as the systematic and iterative method for creating learning experience that develop[s] and enhance[s] skills and knowledge.” In his webpage <http://www.nwlink.com/~donclark/hrd.html> Clark explains each of these phases:

Analysis

“is the foundation of a learning or training process. The deliverables of this phase are the building blocks for all subsequent design and development activities.”

This analysis is done by thinking ahead about the goals and by defining the actions that will help achieve the goals. During the analysis phase, we need to think about the results (outcomes), the performance (concrete actions), the resources needed and the motivation (to learn and perform).

Design

“[t]his phase insures the systematic development of the learning process. It is driven by the products of the analysis phase and ends in a model or blueprint of the learning process for future development.”

In this phase we need to account for what the author calls the five key outputs: entry behaviours (what the students must know before entering the course), learning objectives, learning or performance steps (how to perform a task), a performance test (perform a task or an activity to standards) and a sequenced and structured learning process.

Development

“[t]his phase elaborates and builds on the Learning Objectives and Performance Steps that were produced in the design phase by fleshing out all the previous content that was created in the prior two phases, Analysis and Design, into a complete learning environment.”

There are six activities in the development phase:

- List learners' activities: these activities should be chosen to help the learners acquire the necessary skills and knowledge. This activity includes the creation of "performance aids" that can be use during the activities to help reduce the cognitive load.
- Choose a delivery system: it is the medium that will be used by the students and it should be the one that represents the "least interruptions on their jobs."
- Review existing material: it is view as a way to recycle pre-existent content to meet the performance needs.
- Develop instruction: it is the instruction material that will be used to provide the best learning environment.
- Synthesize: it is the combination of different activities and material to "foster performance." This process should be iterative as "ADDIE is dynamic, not linear."
- Validate instruction: it aims to ensure that the activities and material help students perform to the required standards.

Implementation

"The Implementation phase is where the learning, training, processes, Products, and services are actually delivered to the learners."

Evaluation

"is the systematic determination of merit, worth, and significance of a learning or training process by comparing criteria against a set of standards." The evaluation is carried out throughout the entire process to fix the potential problems and to make sure it is a dynamic process.

3.6 IMS Learning Design Specification

IMS Learning Design Specification is a pedagogical metalanguage. "The IMS Learning Design specification supports the use of a wide range of pedagogies in online learning.

Rather than attempting to capture the specifics of many pedagogies, it does this by providing a generic and flexible language. This language is designed to enable many different pedagogies to be expressed” (IMS Global Learning Consortium)^{vii}.

Conole (2008) stated that “This specification provides a means of formally representing (and thus reusing) learning sequences” (p. 191). The specification aims at integrating different electronic resources to make them shareable and reusable and in consequence saving time for teachers and institutions.

Although the specification has lost some of its initial force, it is still use in many institutions in countries such as the United States.

3.7 Teaching Models

Education is a complex field with different schools of thought but with a common aim: to provide students with new knowledge. How this aim is achieved is the main difference.

In this paper, I have chosen to follow Joyce et al. (2015) and the *Models of Teaching* they proposed. The models are based on “research to guide practice” and are centred on the idea that “teaching is not a one-dimensional operation. [...], teaching reaches toward different students and across disciplines, responsible for a panoply of standards that require corresponding sets of teaching strategies and ways of reaching students” (preface). The goal of the different models is the construction of optimal learning environments for the students.

The authors clearly state that *learning* is the reason for all the models. They add that the models also share the following common attributes: help students learn how to learn, help students take responsibility for learning and support their efforts, and help students reach toward new knowledge, skills and self-understanding. The different models have a constructivist orientation as they “seek to help students build knowledge, skills and values” (Joyce et al., 2015, p.7).

The authors decided to regroup the models of teaching into four initial large families (that one could called categories) oriented towards the student and the learning process: information-processing, social, personal and behavioural families. In the ninth edition of

the book, the authors state the advantage of using the ICT (Information and Communication Technology) resources in teaching.

Each of the models in the families would, for example, make a different use of the elements proposed in the taxonomy depending on the learning outcomes or the educational context (in-house training, blended, etc.).

The main outcomes of the basic information-processing family of models are the development of the capacities to learn, to collect and approach information confidently, and to help one another become a community of learners. This family has been divided into basic information-processing and special purpose information-processing.

The models of the basic information-processing family are:

- Inductive Thinking
- Scientific Inquiry
- Picture Word Inductive

The outcomes of the special purpose information-processing family of models are more specific than those presented before. Their goal is to teach concepts, to help memorize more effectively facts and core ideas, to make metaphoric comparisons as well as to teach basic inquiry skills. The models of this family are:

- Concept Attainment
- Synectics
- Mnemonics
- Advance Organizers
- Inquiry Training

The social family of models looks to expand what people can do together and to create democratic relationships to enhance the learning of the students through collaboration. The models of the social family are:

- Partners in Learning
- Group Investigation
- Role Playing

The personal family of models considers the interaction of the personality of the learner and the learning environment. The models of this family are:

- Nondirective Teaching
- Developing Positive Self-concepts

The behavioural family of models looks at the world of tasks, performances, and positive and aversive reactions. The models of the behavioural family are:

- Explicit Instruction
- Mastery Learning
- Direct Instruction

One of the advantages of looking at the models from the perspective of families is that it provides the option to combine different pedagogies to achieve learning. In Learning and Instructional Design, people tend to think of only one model to guide their teaching, however, a holistic approach should not be discarded.

4. Methodology

This chapter presents the methodology used for the design and evaluation of the poster *Taxonomy of Elements for Learning and Instructional Design*, and the steps followed to answer the research question that aims at identifying the advantages and limitations of this type of visual representation.

The process followed to produce the poster is described in the different sections below. In a summarized version, it consisted of a review of literature including the definition of taxonomy (presented in chapter 1), a definition of the type of research, a choice of map mapping software, an analysis of the previous taxonomies and visualisation techniques, the design of the poster, the design and implementation of the usability tests, the analysis of the test results and the improvements made to propose a final design of the poster.

Concerning the design of the taxonomy, I considered the previous taxonomies as well as the most important components of Learning and Instructional Design. Given that the field is a rather complex one, because of the number of elements that play a role, and that there are multiple relationships that can be made among the elements, I decided that I wanted to give the final users the option to integrate the different elements according to their point of view and not include relationships between the elements. To ensure clarity, I followed the basic rules of design and aimed to make the poster as simple as possible.

There were three testable versions of the poster that related directly to changes in the taxonomy and in the design. The three versions were named 0.3, 0.6 and 0.9. The result of this research study is version 1 (V1).

Likewise, to answer the research question and sub questions, three different tests (Test A, test B and test C) were carried out taking into consideration the theory about usability. The types of test chosen relate to the research questions as they evaluate the perception of the potential users. Each of the items in the tests (A, B and C) relates to the main research question or to the sub questions.

4.1 Type of Research

The definition of the type of research guides the choice of tests and the dimensions that will be evaluated. This research study can be considered a qualitative research. According to

Leedy and Ormrod (2014) qualitative research consists of making specific observations in order to draw inferences about larger general phenomena. The goal is to scrutinize the data collected to search for patterns as this kind of research is used in domains of high complexity.

Following the classification of research according to the finalities of research presented by Schneider (Study book, 2009), modified from Marshall & Rossmann (1995: 41), one can state that this research study belongs to the engineering category.^{viii}

The engineering category deals with how to build something, how well the artefact works and the effects it has. In this category the researcher builds something, tests its use and evaluates the effects on the users. This kind of research is widely used in technology and relates in part to what is done in this research study: two of the tests carried out for this research study deal with the perception the users have of the tool. Only one of the tests evaluated its use with a scenario and none of the tests evaluated its effects on a real context.

4.1.1 Usability

Usability is widely used in the technological field and it refers to the ease with which a tool, object, or interface is used. In his webpage, Jakob Nielsen^{ix} states that “Usability is a quality attribute that assesses how easy user interfaces are to use” but that it also “refers to methods for improving ease-of-use during the design process.”

Nielsen defines usability (of an interface) by 5 quality components: learnability, efficiency, memorability, errors and satisfaction. However, for this research study, of the five components proposed by Nielsen, only the *satisfaction* component is considered.

According to Dumas and Redish (1999) “usability means that the *people who use the product* can do so *quickly and easily* to accomplish *their own tasks*” (their own italics). For the authors this definition rests on the following:

- Usability means focusing on users.
- People use products to be productive.
- Users are busy people trying to accomplish tasks.

- Users decide when a product is easy to use.

To ensure usability Dumas and Redish (1999) mention some of the following steps: engineer it into the product through an iterative design and development process; involve users in the process; allow usability and user's need to drive design decisions, and test products for usability.

Usability Testing

An important part of the engineering research is the test of the artefact created. To obtain information about the artefacts the technique *usability testing* is commonly used. Usability testing allows us to obtain information about the perception the users have of the tool, product or interface.

There are five characteristics that all usability test share as stated by Dumas and Redish (1999):

- The primary goal is to improve the usability of a product.
- The participants represent real users.
- The participants do real tasks.
- What participants do and say is observed and recorded.
- The resulting data is analyzed to diagnose the real problems and to recommend changes to fix those problems.

To decide who participates in the usability testing Dumas and Redish (1999) propose the development of user profiles, a selection of subgroups for a test, to define and quantify the characteristics for each subgroup, and to decide how many people to include in a test.

User profiles

In order to develop the user profiles, the authors suggest thinking about the relevant characteristics the users share as well as those that make a difference among them. We also need to decide which factors matter most as it would help us defining the profile, for example the user's years of experience in the field. In this step of the

process we should think as well of the potential users and the characteristics they might share.

The second step is the selection of subgroups. Here we look at the specific characteristics the users share or a combination of specific characteristics, this way we can define and quantify the characteristics for each subgroup.

Finally, in regard to the definition of the number of participants the authors affirm that it depends on the number of subgroups we need to satisfy our goals and concerns, the time and money available and the importance of being able to get statistical significance for the results.

Scenario

Dumas and Redish (1999) say that we should provide the participants with the goal and with all the information they will need to complete the tasks.

A good scenario should be short, written in the user's words, unambiguous, give participants enough information to do the tasks, and be directly linked to tasks and concerns. The authors remind us that we should not give the participants the steps as in real life it is the users that need to figure out the steps to use the artefact.

Measure usability

To measure usability, we can have performance and subjective measures. The performance measures count the observable actions or behaviours and the subjective measures collect people's perceptions, opinions and judgements.

In general terms, the performance measures are quantitative: "you can count how much time people take, how many errors they make, how many times they repeat the same error" (Dumas and Redish, 1999, p. 184).

Subjective measures can be quantitative or qualitative. We can use a scale to rate a product, for example, and even though the judgement is subjective we obtain a quantitative response.

To measure usability different models and questionnaires have been proposed. After reviewing the characteristics of the poster and the dimensions to be evaluated I considered the Lund questionnaire as the best suited for the task.

4.1.1.1 Lund USE questionnaire

Arnold Lund created the USE questionnaire to give the proper importance to the subjective reactions to a product or application when evaluating usability. The USE questionnaire is rather short and “could be used to measure the most important dimensions of usability for users, and to measure those dimensions across domains.” It can also be used for several kinds of products.

The final questionnaire evaluates four dimensions: *usefulness*, *satisfaction*, *ease of learning*, and *ease of use*. The questionnaire evaluates the dimensions with a seven-point Likert rating scale. The users rate their agreement with the statements, ranging from 7 (strongly agree) to 1 (strongly disagree).

4.1.1.2 Why not use the TAM model?

The *Technology Acceptance Model* (TAM), defined by Fred Davis in 1989, aims at predicting the acceptance of an information system. It has been widely used in educational technology as it focuses on the behavioural intention of the user. The TAM model evaluates the user’s *opinions* in terms of *perceived usefulness* and *perceived ease of use*. For the author, both variables are important “as determinants of user behaviour” which is influenced by their acceptance of the system.

Fred Davis (1989) provided the following definitions:

- Perceived usefulness: “the degree to which a person believes that using a particular system would enhance his or her performance” (p. 320).
- Perceived ease of use: “the degree to which a person believes that using a particular system would be free of effort” (p. 320).

Two studies were carried out to validate the two specific variables or as he called them theoretical constructs, perceived usefulness and perceived ease of use, considered “fundamental determinants of user acceptance” (p. 319). Davis reported as one of the main

findings for both studies that “*usefulness* was significantly more strongly linked to usage than was *ease to use*” (my italics) (p. 333). However, in this research study we evaluate usage with only one of the tests.

What should be highlighted from this theory is the definition of perception. Users evaluate based on their perception, which is completely subjective. The results are therefore to be considered carefully according to the participants of the tests.

The TAM model includes *ease of learning* as “one substratum of the ease of use” (Davis, p. 325) and given that the poster is not a system that we need to learn how to use I decided to use Lund’s scale that separates *ease of learning* from the other dimensions and it allows me leave it aside for the tests of the poster.

4.2 Reasons for choosing a mind map to present the taxonomy

When talking about the taxonomy work in knowledge management, Patrick Blame stated that “the taxonomies we develop [...] need to reflect the working worlds of the organisations they are created for - and because those working worlds continue to change and evolve, so must our taxonomies.”

Keeping in mind, that the field of Learning and Instructional Design is always changing and evolving, the mind map seemed to be the most flexible structure to display this information. The mind map allows its users to use different approaches to the content as there is no linearity and it can be modified at all times to include more elements for all the branches. The mind map allows iterative work on the taxonomy and gives place to creativity as there is no given sequencing in the use of the elements.

“A mind map employs colour coding to discriminate between categories” (Lambe, p. 44). This feature is very useful for our context as the poster presents a large amount of information.

4.3 Mind mapping software

Nowadays, different mind mapping software are available. Three software were tested to identify the best suited to present large amounts of information. Each of the software was

used to design only one of the branches of the taxonomy. The software tested were Freeplane, Mindmeister and Inspiration.

Freeplane

This software is presented as a free mind mapping and knowledge management software. It is free and open source. It runs in any operating system that has a current version of Java installed and it has a wiki that contains all the information related to the software as well as tutorials and forums. Freeplane allows the user to add videos, to comment the mind maps and to add icons. The resulting maps can be easily integrated to internet pages. The mind maps can be exported to the following files: *.html, *.tek, *.jpg, *.odt, *.xml and as a flash animation.

Mindmeister

This is a free software for the “basic plan” that allows the user to create three mind maps for individual use but that cannot be saved. However, a paying version allows to save the maps, allows several people to modify them, and permits the creation of an unlimited number of maps. For the “basic plan” the mind maps can be exported to the following files: *.png, *.pdf, and *.docx.

Inspiration

It is presented as a visual learning App. This software allows the user to create concept maps, mind maps, outlines, brainstorming webs and graphic organisers. It contains a library of images and symbols, headers and footnotes can be added and we can also insert videos and sounds.

The mind maps can be exported to the following files: *.pdf, *.ppt, *.docx, *.html, *.png, *.jpg, and *.jpeg.

The paying software Inspiration 9IE was chosen giving the number of features it presents. One of the most important features is that it allows the user to switch from a “mind map version” to a “concept map” to “outline” very easily. The outline version corresponds to a more conventional taxonomy display in which all the terms are listed and their place in the hierarchical organisation is indicated by their

distance to the left margin in what is considered to be a full term hierarchy format (Hedden, 2010, p. 262).

The final taxonomy resulting from this research study is presented in the poster and also as an outline at the end of this paper.

4.4 Analysis of previous taxonomies

To propose a taxonomy of Learning and Instructional Design, I reviewed the previous taxonomies proposed by Conole and Fill, and by Schneider in order to identify the most important components of the field. The previous taxonomies were defined with other concepts at heart yet presented many of the essential elements.

Analysis of the taxonomy by Conole and Fill

The taxonomy created by Conole and Fill placed the Learning Activity (LA) at the centre and it consisted of *three* main branches: context, learning and teaching approaches, and tasks. The classification of the learning and teaching approaches presented by Conole and Fill was based on a review by Mayes and de Freitas (2004)^x.

Analysis of the taxonomy proposed by Daniel Schneider

The initial “learning taxonomy” was presented by Schneider in the site http://edutechwiki.unige.ch/en/Conole_and_Fill_learning_taxonomy. For this taxonomy Schneider relied on different publications by Conole and Fill, the DialogPlus website and his own experience.

His taxonomy also placed the Learning Activity (LA) at the centre and it consisted of *seven* main branches: roles, outputs, learning outcomes, resources, tools, tasks and context. In this taxonomy there was a different order given to the elements, and several of them were separated into independent ones or, as in the case of the *learning and teaching approaches*, they became a subdivision of another branch.

Regarding the visualisation of the taxonomy, Schneider explored five different layouts generated by algorithms of the graphviz package. The resulting images of the four first layouts can be seen in the edutechwiki webpage^{xi}. Some of these

visualisations are not very clear, mostly when the whole taxonomy is presented at once. After reviewing the computer generated images it was decided that a “manual” solution was needed and therefore a mind map software was chosen.

Definition of the Taxonomy of Learning and Instructional Design

Lambe (2007, p. 8) describes a taxonomy as a kind of knowledge map in the sense that:

[...] any user of the taxonomy should immediately have a grasp of the overall structure of the knowledge domain covered by the taxonomy and be able to accurately anticipate what resources he or she might find where.

To provide the overall structure of the field, and to account for the learning in educational institutions, the one that takes place in organisations as in-house training, as well as to account for the technical and the pedagogical aspects involved, I decided to define the field as Learning and Instructional Design.

To start delimitating the taxonomy, I decided to place Learning and Instructional Design at the centre, and identified the main hierarchy and the basic relationships among the branches. Afterwards, after I separated the elements presented by Schneider.

The second main decision made was to present all the elements only one time in the whole taxonomy to have a regular hierarchy (as opposed to a [polyhierarchy](#)) because I wanted a clear view of the field without double terms that belonged to different branches. To this end, I identified the elements that should remain, those that in my opinion should be eliminated, and those that were repeated in different branches such as *draw* that appeared three times in Schneider’s taxonomy. In his taxonomy it was classified as a *psychomotor outcome*, as a *knowledge outcome* and as a *productive task*. For the first version of the taxonomy it was only considered as a *psychomotor outcome*.

To take into consideration the effects of using images and words to help representation of concepts and memorization (what the creator of the mind maps calls synergetic thinking), eleven icons were added to the taxonomy, one for each of the main branches of the mind map. The icons were chosen among the images proposed in the Inspiration software.

The use of the different elements proposed in the Taxonomy is an individual choice (or a collective one in the case of schools or companies) and those choices depend on the pedagogical model that people would want to implement. In the taxonomy we find a branch that presents the classification of *Models of Teaching* defined by Joyce et al. (2015). This classification is the result of the testing of different pedagogical models.

Considering that the taxonomy created before this research study was proposed by an expert with 25 years of experience in the field, most of the narrower terms in the branches were kept exactly the same for the first two versions of the taxonomy.

4.5 Versions of the poster

The design of the poster was done as an iterative process to ensure usability as presented by Dumas and Redish (1991). Three different versions were designed, tested and improved based on the results of the tests. All the improvements took into account the comments of the experts and of the other participants as well as the rate given to each dimension.

4.5.1 Pre-test version of the poster

This version was created using a simple layout, white lettering and a brown background in the software Canva. A *.png file of the mind map was uploaded into the software and added to the layout.

Canva is an online software application that helps design several documents such as posters, brochures, cards, postcards, etc., with a drag-and-drop feature. The user chooses a design type (social media, presentation, blog, car, etc.), a layout, elements (shapes, icons, chart, etc.), the text type and font, a background and any own *.png files to personalize their creations. The resulting designs can be shared or kept private and they can be downloaded as *.jpg, *.png or *.pdf. This software was used for the pre-test version to give the poster a “commercial feeling.”

However, after the pre-test, the decision to do the whole design of the poster with the Inspiration software was taken to avoid having to go back and forth between software, and to facilitate further changes or improvements in the design of the poster.

4.5.2 Version 0.3

Poster version 0.3

This version was created using the Inspiration software. It had a white background and black lettering.

The poster consisted of:

- Title: Taxonomy of elements for Learning and Instructional Design
- Subtitle: Ingredients for lesson plans and learning activities
- Mind map of the taxonomy
- Name of the designer of the poster, of the initial author and of the authors on whose work the whole taxonomy was based.

Taxonomy 0.3

The branches that presented subdivisions were divided and arranged differently to place Learning and Instructional Design at the heart of the taxonomy, which consisted of *eleven* main branches: learning outcomes, evaluation|assessment, context, tools, pedagogical models, skills, quality assessment, roles, tasks, resources and learning outputs.

The main change in this taxonomy is that the classification of the pedagogical models did no longer follow Mayer et de Freitas (2004) but the classification into families developed by Joyce et al. (as presented in the first edition).

For this version of the taxonomy the branch called “instructional design models,” that had been added by Schneider, was not considered.

4.5.3 Version 0.6

Poster 0.6

This version was created using the Inspiration software. It had a white background and black lettering.

Given that the subtitle took place that could be used to expand the mind map, the subtitle was erased.

The poster consisted of:

- Title: Taxonomy of elements for Learning and Instructional Design
- Mind map of the taxonomy
- Name of the designer of the poster, of the initial author and of the authors on whose work the whole taxonomy was based.

Taxonomy 0.6

For the second version, a reduced version of the branch called “instructional design models” added by Schneider was included.

The taxonomy consisted of *twelve* main branches: learning outcomes, evaluation|assessment, context, tools, pedagogical models, skills, quality assessment, roles, tasks, resources, learning outputs, and instructional design.

4.5.4 Version 0.9

Poster 0.9

This version was created using the Inspiration software. It had a white background and black lettering.

The poster consisted of:

- Title: Taxonomy of elements for Learning and Instructional Design
- Mind map of the taxonomy
- Name of the designer of the poster, of the initial author and of the authors on whose work the whole taxonomy was based.
- It also included the references for the authors followed for the classification of the *outcomes* and of the *models of teaching*.

Taxonomy 0.9

To decide on the third version of the taxonomy, I examined closely the results of the tests with the experts as well as their comments.

A discussion with the research study director also took place to ensure that the elements in the different branches belonged to the same category. Given that there were elements that could be placed into different categories the branches *roles*, *tasks* and *tools* were simplified and no longer had a subdivision between students, teachers and learning designers.

Taking into account the suggestion of the first expert about reviewing the classification of the outcomes, I decided to present the outcomes according to the classification illustrated in Don Clark's webpage about Bloom's taxonomy: <http://www.nwlink.com/~donclark/hrd/bloom.html>.

For this version of the taxonomy the branch *Interactions* was added to account for the different types of interaction in education.

The branch *context* changed to *educational context* to take into account the observations of the expert. The branch *pedagogical models* changed to *Models of Teaching* to use the same terms as the authors of the book. The branch *skills* changed to *competences* to account for those abilities that can be developed. The branch *instructional design* changed to *educational modelling* to include standards and to avoid double terms in the taxonomy.

This taxonomy consisted of *thirteen* main branches: learning outcomes, assessment, educational context, tools, models of teaching, competences, quality assessment, roles, tasks, resources, learning outputs, educational modelling and interactions.

4.6. Tests

To obtain the largest amount of information possible about the poster, three different tests were designed. The questionnaires as well as the scenario, were initially written in English but after considering that the language could become a limitation when carrying out the tasks or when evaluating the poster, the decision to translate them into French was made. The tests of the different versions aimed at including iteration in the process of design.

Dimensions Evaluated

The three tests evaluated the following dimensions:

- Comprehension: people understand what the poster is about.
- Readability: people can easily read all the elements present in the poster.
- Organisation: people consider that the text and the icons are placed in an organised manner.
- Attractiveness: the poster is pleasing to the eye.
- Completeness of the taxonomy: people consider that the taxonomy includes all the important elements of Learning and Instructional Design.
- Usefulness: people consider that the poster will serve a purpose in their profession.
- Ease of use: people can easily use the information provided in the poster.
- Satisfaction: people are satisfied with the overall design of the poster.

The dimensions *readability* and *organization* aimed at answering the sub question about the mind map being a suitable visual representation to present the taxonomy. The dimensions *comprehension*, *completeness of the taxonomy*, *usefulness*, *ease of use* and *satisfaction* aimed at providing an answer to the sub question about the poster being a suitable tool to create a lesson plan.

The dimension of *attractiveness* (pleasing to the eye) aimed at integrating the role of aesthetics in the evaluation of the poster: “The total experience of a product covers much more than its usability: aesthetics, pleasure, and fun play critically important roles.”

(Norman, xiii preface).

In test B, two open questions were asked about the aspects of the poster that the participants liked and dislike to incorporate the aspects discussed in emotional design.

A simple question to evaluate the recollection of the main branches was asked in the test C to provide an answer to the sub question about the elements that the potential users were able to recall from observing the poster.

It is important to mention that *none* of the tests evaluated all the attributes. The attributes were chosen and evaluated keeping in mind the participants and the sort of information we wanted to obtain from them.

The questionnaires for the three tests were reviewed and approved by the supervisor of the research study.

4.6.1. Test design

Following the theory by Dumas and Redish on usability testing (1999) these steps were taken: I focused on the people who would be the final users of the poster, I engineered it into the iterative design process, and I let users decide if it was easy to use.

To choose the participants I developed two profiles: experts and regular users. Experts are people who already have professional experience with Learning and Instructional Design. Regular users are the students of the Master Maltt, who have who might have zero or some experience in Learning and Instructional Design, and current teachers.

Even though usability testing is mostly used in the field of computer-human interaction its goal and characteristics are applicable to the poster created. The evaluation of usability was made through only one of the tests (test B). The other two tests evaluated the perception of some aspects that might be considered dimensions of usability.

4.6.1.1 Pre-test

It was made to evaluate the basic layout of the poster with a design expert. The file was to be printed in A4 size. There was no questionnaire accompanying the “poster”. The basic questions were about the colours, and the placement of the text and icons in the page.

4.6.1.2 Test A

It was created for the experts. It was proposed to people who have experience in Learning and Instructional Design, and who might have worked with learning taxonomies. Among the experts there were three current MALTt teachers.

Test A is a questionnaire that focuses on the following dimensions: *usefulness, ease of use, readability, organisation, attractiveness, and completeness of the taxonomy*. These

dimensions were evaluated with a seven-point Likert rating scale ranging from 7 (strongly agree) to 1 (strongly disagree).

To inquiry more about the users' perceptions of the poster, three open questions were asked:

- whether they considered the poster to be a suitable tool for the learning and instructional designers and why,
- what they considered to be the advantages of the poster as a tool for the learning and instructional designers, and
- what they considered to be the limits of the poster as a tool for the learning and instructional designers.

This test is the only one to evaluate the *completeness of the taxonomy*. The observations of the experts were accounted for in the different versions of the taxonomy.

4.6.1.3 Test B

It was designed as a formal test that evaluated usability: students filled a questionnaire after having resolved several tasks described in a scenario using the poster as a tool for Learning and Instructional Design.

The students were given *eight* tasks to create a lesson plan. The tasks followed roughly the [ADDIE model](#). Afterwards, they evaluated the poster using my own version of the [USE](#) questionnaire.

For this scenario the participants were to create a lesson plan to teach basic vocabulary of English action verbs to basic level students of an online course. The [tasks were conceived](#) to request simple terms presented in the taxonomy: the participants were requested to name the context, the outcomes, the roles of the people taking part in the lesson, the tools for the lesson, to name the outputs and the resources available for the students, to decide on three activities and to choose an evaluation method.

The reduced version of the USE questionnaire evaluated *usefulness* (through 5 items), *ease of use* (through 5 items) and *satisfaction* (through 4 items). I added a comments section in

case the participants decided to mention something specific about the taxonomy or the poster. I did not take into account the dimension *ease of learning* present in the original USE questionnaire.

4.6.1.4 Test C

It was designed as a semi-formal test to evaluate the following dimensions: *comprehension*, *readability*, *attractiveness*, and *usefulness*. These dimensions were evaluated with a seven-point Likert rating scale ranging from 7 (strongly agree) to 1 (strongly disagree).

For test C, the poster was displayed in a hallway and the participants were asked to fill the questionnaire.

To evaluate the recall of the information presented in the poster, there was an open question that requested participants to name the branches they were able to recall.

To inquiry more about the *attractiveness* of the poster (pleasing to the eye) two open questions were asked:

- what the participants liked the most about the posters, and
- what they liked the least about the poster.

The main goal of the tests is to identify the advantages and limitations of the poster. Moreover, the evaluation of the different dimensions is intended to obtain more information about the perceptions of the participants. In general, we can say that a high rate of the dimensions can be view as a positive outcome of the design, as it would mean that the poster is comprehensible, readable, organised, attractive, useful, and easy to use.

5. Results

This chapter presents the results of the tests carried out for each of the versions of the poster. The modifications that resulted from each test are also presented. The interest of presenting the results in this manner is to make manifest the iterative design process and to clearly state the changes in the poster as well in the taxonomy that are directly linked to the perception of the poster expressed by the users.

The tests of the first version took place at the end of November and through December 2016. The second version of the poster was tested in February 2017. The third version was tested in early April 2017.

The following table presents the number of participants for each type of test and for each version of the poster.

Table 1 Number of participants per test

| Poster version | Type of test | | |
|----------------|---|--|---|
| | Number of participants Test A (experts) | Number of participants Test B (formal testing) | Number of participants Test C (semi-formal testing) |
| Version 0.3 | 1 | 3 | 0 |
| Version 0.6 | 2 | 2 | 13 |
| Version 0.9 | 1 | 1 | 1 |

5.1 Pre-test

A small version of the poster (size A4) was printed to be presented to an expert. This initial poster had a [brown background and white lettering](#). Although the electronic version seemed clear enough, the printed version presented several problems that the expert pointed out:

- The contrast between the colours of the branches and the background was not always optimal: some colours seemed to disappear.
- The small version could not tell us if the size of the font was correct.

- Because two different software were used for the construction of the “poster” the image of the taxonomy was treated as a *.png which seemed to give it a lighter background than the rest of the poster.

From my point of view, the small size did not allow the expert to achieve the “poster experience”: being able to see everything quickly and from far away. However, the initial comments were very helpful for the design process that followed.

Taking into consideration the comments of the design expert, it was decided that given the amount of information presented and the number of branches it was better to keep a white background to avoid a surcharge of colours.

5.2 Results test version 0.3

The first version was printed in A1 size with a white background and black lettering. For this version of the poster there was one participant for test A and three participants for test B.

5.2.1 Results Test A

The expert had 7 years of experience in the field of Learning and Instructional Design.

She gave a 7 rate (strongly agree) to the *usefulness* and the *organisation* of the poster because it presented an overview of the design process and because it presented the information clearly. The expert gave a 6 rate (agree) to the dimensions of *ease of use* and *attractiveness* because she would have preferred an electronic version and there was too much text. She gave a 5 rate (slightly agree) to *readability* as the font was considered small.

Regarding the dimension *completeness of the taxonomy* the expert gave a 4 rate (neutral) and made several comments that were considered for the second version of the taxonomy.

The expert considered the poster to be a suitable tool to accompany tasks in the learning and instructional design process, but proposes looking for a more dynamic type of presentation, in the form of a card game for example. The advantages highlighted were that the poster can be used as a checklist and that it is a source of ideas. The limit of the poster mentioned is that it lacked concrete examples.

5.2.2 Results Test B

The participants for this test were recruited in the COMEL (communication médiatisée) class of Master Maltt. For this test there were three participants. The participants are students of the first year of the master's and only one of them had a background in educational studies.

The following table shows the rates given to each dimension by participant:

Table 2 Version 0.3, Test B, rates by participant

| Dimension | Rates by participant | | |
|--------------|----------------------|----|----|
| | P1 | P2 | P3 |
| Usefulness | 6 | 5 | 4 |
| Ease of use | 6 | 4 | 4 |
| Satisfaction | 5 | 5 | 4 |

As we can see there is no agreement among the participants regarding the *usefulness*. Two of them mentioned that they had had trouble understanding the whole context and one of them mentioned that the concrete application of Learning and Instructional Design was not clear for him.

Regarding the *ease of use* two of the participants gave it a “neutral” rate, that might be due to not knowing the basis of the field. It is hard to say if something is easy to use or not when we are not sure what we can do with it.

The dimension of *satisfaction* is clearly related to the two dimensions mentioned above. We can infer that we cannot feel satisfied of an artefact if we are not sure about its purpose.

A possible explanation for the difficulties experienced by the participants is the lack of educational studies that hinders the participants from understanding the links between the different branches.

5.2.3 Modifications made to version 0.3

After test A with one of the experts and three tests B, the layout was changed. The subheading was erased to gain more space and the font size as well as the size of the icons was increased.

5.3 Results test version 0.6

The second version was printed in A1 size with a white background and black lettering.

For this version of the poster there were two participants for test A, two participants for test B and thirteen participants for test C.

5.3.1 Results Test A

The participants are current teachers of the Master MALTT. For this test there were two participants.

The following table shows the rates given to each dimension by participant:

Table 3 Version 0.6, Test A, rates by participant

| Dimension | Rate | |
|------------------------------|------|----|
| | P1 | P2 |
| Usefulness | 6 | 6 |
| Ease of use | 5 | 6 |
| Readability | 7 | 7 |
| Organisation | 7 | 6 |
| Attractiveness | 7 | 5 |
| Completeness of the taxonomy | 6 | 5 |

Both participants rated with 6 (agree) the *usefulness* of the poster. They mentioned reasons such as: it allows to reflect upon the person's own representations in terms of teaching models, it helps remember the diversity of choices and variables that play a part in the design, and that the branches are like "entries" to each dimension that invite us to learn more about the models, the tools, etc.

In relation to *ease of use*, one of the experts clearly stated that it was hard to evaluate this aspect since he had not used it in a real context. The other expert expressed his disagreement with the mind map as representation of the field because we do not see the relationship between the elements, but clearly mentioned that the difficulty of use was not due to the poster.

Apropos of *readability*, both experts strongly agreed that the size of the poster was appropriate and that the type of font was adequate.

Concerning *organization*, the experts mentioned that there was a correct use of the space for the different elements of the poster.

Regarding *attractiveness*, one of the experts rated with 7 (strongly agree) affirming that the colours and the font made it “pleasing to the eye”. The other expert, who rated with 5 (slightly agree), considered that there might be too much information and some of the list of elements were too long, which made the poster look a bit overloaded.

With respect to the *completeness of the taxonomy*, the experts highlighted that some of the items in the lists did not belong to the same category, for example: SCORM could not be categorized under languages and tools because it is not a tool. It was also suggested that some categories could be divided even more, but there were no specific examples.

For the two experts, the poster was perceived as a suitable tool for learning and instructional designers that could be presented during the first stages of their training. One of the experts suggested that it would be helpful to have more information about each branch.

The advantages highlighted by the experts about the poster as a tool for learning and instructional designers were: it forges awareness of the different elements of Learning and Instructional Design and of the multiple possibilities within each branch, and that it is an entry to concepts and methods.

The limits of the poster mentioned were: it does not provide deep knowledge of the field, there are no propositions as to how use the poster to ensure coherence between the different choices, and that the taxonomy should be open to discussion.

5.3.2 Results Test B

The participants for this test are students of second year of the Master Maltt. For this test there were two participants, both have had experiences designing a lesson or a course, whether as a professional experience or as part of one of the courses of Maltt.

The following table shows the rates given to each dimension by participant:

Table 4 Version 0.6, Test B, rates by participant

| Dimension | Rates by participant | |
|--------------|----------------------|----|
| | P1 | P2 |
| Usefulness | 7 | 6 |
| Ease of use | 6 | 6 |
| Satisfaction | 6 | 6 |

The participant with the education background rated 7 (strongly agree) the *usefulness* of the poster and the other participant rated it with 6 (agree) as for him the poster does not completely make the tasks of learning and instructional design easier to get done.

Both participants rated with 6 (agree) the *ease of use* of the poster as well as the *satisfaction* but did not give any reasons for their choice.

One of the participants mentioned that the different branches help to be aware of the number of choices for each variable taking part in the creation of a general lesson plan. She added that the poster helps to create a lesson plan because it guides the person to reflect about the essential elements of Learning and Instructional Design.

5.3.3 Results test C

The participants for this test were recruited in the seminar of Master MALTT (séminaire mémoire). The participants are in the final stage of the master and are preparing their dissertations. The test took place in the hallway where the poster was hung. The participants took a long look at the poster to get familiarized with it and answered a questionnaire. There were thirteen participants for this test.

The following table shows the rates given to each dimension by participant:

Table 5 Version 0.6, Test C, rates by participant

| Dimension | Rates by participant | | | | | | | | | | | | |
|----------------|----------------------|----|----|----|----|----|----|----|----|-----|-----|-----|-----|
| | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P11 | P12 | P13 |
| Comprehension | 3 | 2 | 2 | 6 | 4 | 5 | 6 | 7 | 3 | 2 | 6 | 5 | 5 |
| Readability | 2 | 2 | 2 | 1 | 2 | 5 | 4 | 3 | 4 | 2 | 5 | 6 | 4 |
| Attractiveness | 5 | 4 | 3 | 2 | 4 | 5 | 4 | 3 | 4 | 2 | 6 | 6 | 5 |
| Usefulness | 6 | 3 | 4 | 4 | 4 | 7 | 6 | 2 | 4 | 2 | 5 | 4 | 6 |

As we can see in the table the variance of the answers is very high. However, for the dimensions of *readability* almost half of the participants agreed on the font being too small to make the poster properly readable, and for the dimension of *usefulness* five participants were neutral and they mentioned not be sure on how the poster would be use in their profession.

The high variance is hard to explain. I propose two possible explanations and even a combination of the two explanations:

- The problems with the *readability* affected the other dimensions, which created a variance (and a decrease) in the rate of the other dimensions since *readability* is one of the main characteristics of the posters, and/or
- The significant differences in knowledge and experience in education of the participants prevented some of them from understanding the purpose of the poster but allowed others to mentally make the links between the branches of the taxonomy.

Some of the participants mentioned that what they liked most about the poster was the completeness of the taxonomy presented, the clarity of the main branches, that it summarizes the field, the colours and the main concept in the middle (the mind map visual representation), the granularity of the taxonomy, the use of the space, that there were icons, and the organisation of the information.

They also mentioned that the following were the things that they liked the least: the small font, the long lists, that there is no depth, that there is no discrimination between what is important and what is not, that there was too much text, the fact that it is in English, and that it is a printed format and therefore there is no interactivity.

The variance in the responses of test C for version 0.6 of the poster might also be explained by the fact that several people were working at the same with the poster. All the other tests were carried with only one participant at a time.

5.3.4 Modifications made to version 0.6

In order to solve the problem of readability, the font was increased for all the elements except for the one in the middle that was already using the largest size. The size of the icons was also increased.

To ensure coherence, the only link (between skills and roles) was erased.

The taxonomy was revised with the director of the dissertation and modified accordingly.

The names of the authors for *Models of Teaching* and *Outcomes* were added at the end of the poster to give the corresponding credit to the authors.

5.4 Results test version 0.9

The third version was printed in A0 size with a white background and black lettering. For this version of the poster there was one participant for test A, one participant for test B, and one participant for test C.

5.4.1 Results Test A

The expert that participated in this test has 5 years of experience in the field and currently organizes workshops for university teachers and university teacher assistants.

The expert rated with 7 (strongly agree) the *usefulness* and the *ease of use* of the poster. As a teacher trainer, she said she can use it to help teachers create their lesson plans and that the division in levels of the taxonomy allows people to use it easily.

The dimension of *readability* was rated with 5 (slightly agree) because she considers that the font is too small to read it from far away even though if it is clear when standing next to it.

The dimension of *organization* was rated with 7 (strongly agree) as all the elements are correctly placed and there is the name of the authors of the theories at the end. She also highlighted that there was a good use of the space and that the colours gave it a nice finish.

Regarding the *completeness of the taxonomy* and the *attractiveness*, the dimensions were rated with 6 (agree) and the expert suggested to add the characteristics of the students such as genre, mix courses and the competence in a language for the bilingual contexts.

The expert agreed that the poster is a suitable tool for Learning and Instructional Design because it allows the user to think about everything in a systematic way. The advantage of the poster as a tool, as highlighted by the expert, is that it goes through all the elements one by one. The limit of the poster mentioned by the expert is that it needs a guiding document that tells the user how to use and how to put together the different elements.

5.4.2 Results Test B

The participant is a teacher with 10 years of experience and who has participated in online training.

The participant rated with 7 (strongly agree) the *usefulness* of the poster. She mentioned that the poster presents the complexity of the field as there are many variables that take part in it at the same time, but that it allows each user to mix those elements as they choose. She rated with 6 (agree) the *ease of use* as it would need some sort of instruction manual to guide its use. Finally, she rated with 6 (agree) the *satisfaction* as she would like to have some sort of interaction with it. However, she highlights that the poster is an excellent source of ideas.

5.4.3 Results test C

The participant is a student of the Master Maltt with experience in teaching. She rated the *comprehension* of the poster with 6 (agree) and stated that everything was understandable except for the branch “Models of Teaching”. She stated that the definition of *family* would be necessary for its full comprehension.

Regarding the *readability*, she rated it with 7 (strongly agree). For her, the colours and the font were correctly chosen and the space was well used.

The participant rated with 7 (strongly agree) the *attractiveness* of the poster. She mentioned that the colours and the icons attract attention.

The dimension *usefulness* was rated with 7 (strongly agree). The participant stated that the poster is a tool that helps plan different types of instruction because it presents all the elements needed to implement the instruction.

What the participant liked most about the poster was the clarity of the terms presented and that each branch is detailed. What she liked the least was that there is a lot of information to go through and for the poster to be well used, one would need to do an in-depth reading.

5.4.4 Modifications made to version 0.9

After considering the results from the three test the following made changes were made:

To ensure *readability*, the size of all the elements was increased.

The branch *models of teaching* and *outcomes* were modified to present correctly the theory of the authors.

All the important words in the title were capitalized, and the year of publication to the theories was added.

5.5 Results on Usability

There were six participants for the usability test, three of them had a background in education studies.

The participants were to create a lesson plan to teach basic vocabulary of English action verbs to basic level students of an online course. The participants were expected to write the name of the elements as they appeared on the poster and they did not need to explain their choices.

The following were the tasks proposed to create the lesson plan:

- T1: name the type of environment

- T2: set the outcomes for the lesson
- T3: name the roles of the people taking part in the lesson
- T4: choose the tools to use for the lesson
- T5: specify the outputs
- T6: name the resources that will be available for the students
- T7: decide on 3 tasks to do with the class
- T8: choose an assessment technique for the whole lesson

The following are the success rates for each task and the problems encountered by the participants:

Table 6 Usability success rate and problems encountered

| Task | Success rate % | Problems experienced |
|--|-----------------------|--|
| T1 | 66.8 | Two participants named Instructional Design as the context of the lesson. |
| T2 | 66.8 | One of the participants talked about describing a procedure but did not mention any outcomes. Another participant talked about goals in vocabulary but not in terms of the lesson. |
| T3 | 100 | -- |
| T4 | 100 | -- |
| T5 | 100 | -- |
| T6 | 83.4 | One of the participants mentioned that there would be resources to read and to listen to, but did not provide any examples. |
| T7 | 100 | -- |
| T8 | 100 | -- |
| Total usability rate for eight tasks 89.6% | | |

The problems detailed above were experienced by the participants with no background in education studies. Therefore, we could say that the usability of the poster as a tool for creating lesson plans is related to previous knowledge of the field.

The participants with previous knowledge of the field provided not only the elements as found in the poster, but some of them also gave reasons for their choices.

The following are the comments by participant for each of the versions:

Table 7 Comments by participant on the usability test

| Participant | Poster version | Comment |
|--------------------|-----------------------|---|
| P1 | 0.3 | “I had a difficult time at the beginning to identify the outcomes of the lesson and that blocked me for a while, that’s why I don’t give the maximum rate to the items.” |
| P2 | 0.3 | “For me, some of the categories were very much alike. It might be due to my lack of knowledge of the field.” |
| P3 | 0.3 | “The topic of the field is rather large and I didn’t get to understand the precise application of Learning and Instructional Design. My answers might have been influenced by a lack of knowledge of the English language.” |
| P4 | 0.6 | “The level of detail helps find a way and the presence of many choices allows to explore the possible variants of a regular lesson plan. The poster aids planning the lesson because it helps to ask yourself important questions.” |
| P5 | 0.6 | -No comments- |
| P6 | 0.9 | “The poster presents the complexity of the field and is a good source of ideas. Maybe there could be an instructions manual to guide its use.” |

The results of the usability test show potential for the use of the poster in real life contexts.

5.6 Recollection of branches

The question requesting the participants to write down the elements they recalled was only part of test C. A total of 14 participants answered this question for the three versions.

The following table presents the branches recalled by all the participants of test C for all versions of the poster.

Table 8 Number of participants that recalled an element

| Term | Number of participants |
|-----------------------|-------------------------------|
| Tools | 7 |
| Roles | 6 |
| Outcomes | 6 |
| Assessment | 4 |
| Skills | 3 |
| Outputs | 2 |
| Context | 2 |
| *Instructional design | 1 |
| *Social family | 1 |

Of the 12 branches of the taxonomy only 7 were mentioned by at least one person. One could think that given the large amount of information the recollection of all the branches is very difficult, and it is important to mention that for test C the participants only had about 5 minutes to get familiarized with the poster. This subject would need more testing to identify what makes some branches easier to recall than others and to evaluate the help of the icons in the process of recalling the terms.

5.6 Version 1.0

This is the final version of the taxonomy and the poster. This version accounts for all the changes in the previous versions, and the modifications that took place relied on the comments given by the last three participants and on their perceptions of the different dimensions evaluated.

During the whole design process the perceptions about readability were specially considered as visibility is one of the main characteristics of the posters. Concerning the

taxonomy, the perception of the experts regarding its completeness guided the whole development process.

Taxonomy

After further revision of the classification of the outcomes, the branch was modified to present all the items accurately. For the classification of the learning outcomes, I decided to follow the review of Bloom's taxonomy made by Krathwohl et al. (2001) of the Cognitive process dimension and the Knowledge dimension^{xii}, and the taxonomy of the Psychomotor domain as proposed by Harrow in 1972.

The branch *models of teaching* was completed to include the subdivision of the information-processing family presented in the ninth edition of the book.

This final taxonomy consisted of *thirteen* main branches and 331 elements in total. The main branches are: learning outcomes, assessment, educational context, tools, models of teaching, competences, quality assessment, roles, tasks, resources, learning outputs, educational modelling and interactions.

The following are the main subdivisions of the *final* taxonomy:

1. Learning outcomes: affective, psychomotor, and cognitive.
2. Assessment: assessment tools, type, and technique.
3. Educational context: no subdivisions.
4. Tools: hardware, software types, integration tools, writing and drawing, media, communication, information management.
5. Models of Teaching: information-processing family, social family, personal family, and behavioural family.
6. Competences: preredquired and developable.
7. Quality assessment: of the process and of the outcomes.
8. Roles: no subdivisions.
9. Tasks: task technique and task type.

10. Resources: no subdivisions.

11. Learning outputs: no subdivisions.

12. Educational modelling: models and languages, educational software and standards.

13. Interactions: no subdivisions.

Poster

This version was created using the Inspiration software. It has a white background and black lettering.

The poster consisted of:

- Title: Taxonomy of Elements for Learning and Instructional Design.
- Mind map of the taxonomy.
- Name of the designer of the poster and of the initial authors.
- Name of the authors and year of publication of the works on which the whole taxonomy was based.

6. Conclusions

The results of the tests present the perceptions that the participants had of the poster. It is important to mention that their perceptions guided the development process as the design was improved based on the results collected. The opinions of the experts were very important for presenting a complete taxonomy and for deciding whether the poster was a suitable tool for the creation of lesson plans.

The different tests carried out pointed to the accomplishments and limitations of the poster designed. Concerning the main research question, I was able to identify the following advantages of using a poster for presenting the elements currently available for Learning and Instructional Design:

- It forges awareness of the different elements of Learning and Instructional Design and of the multiple possibilities within each branch.
- It is an entry to concepts and methods.
- It guides the reflection about the essential elements of Learning and Instructional Design.
- It presents all the elements one by one.
- It can be used as a checklist.
- It is a source of ideas.

Likewise, the tests allowed me to identify the following limitations of using a poster presenting the elements currently available for Learning and Instructional Design:

- It does not provide deep knowledge of the field.
- There are no propositions as to how use the poster to ensure coherence between the different choices.
- It needs a guiding document that tells the user how to use and how to put together the different elements.
- There is no interactivity.

- It lacked concrete examples.
- There is a high amount of text which makes the information less visible.

Concerning the use of a mind map to present the taxonomy we can say that it is a suitable tool because the taxonomy might be modified at any time. However, some of the users are accustomed to more traditional visual representations of a taxonomy (as a tree structure) and therefore have difficulties understanding the field as the relationships between the different elements are not specified. The lack of relationships is mostly troubling for the novice users or people with no background in education.

Based on the results of the usability test, we can say that the poster is an appropriate tool for creating lesson plans, with a usability rate of 89.6%. Regarding tests A and C, we can say that the poster is perceived as an appropriate tool (mostly by participants with some experience) for creating lesson plans because it provides an overall idea of the field, helps remember the diversity of choices and variables that play a part in Learning and Instructional Design, it allows users to mix the elements as they choose, and because it helps plan different types of instruction. Nonetheless, several participants stated the need of a guide, manual or accompanying document to ensure coherence in the choice of elements.

The characteristics that make the poster attractive are the use of colours and the icons. However, what takes away the attractiveness is the large amount of information. The amount of text in the poster makes it less visible and clear from a distance, which is one of the basic characteristics of a poster.

Regarding the recall of the branches the results showed that there was not much recall of elements, and I propose two possible explanations: the amount of time to work with the poster was too limited and there might have been interference from the English Language. I consider that this is a subject that would need more testing.

As presented in the theoretical framework the complexity of designing a poster is that it must fulfil many roles and there are formatting restrictions. Too much information and no interaction might scare users away. However, if the information is attractive and readable they might be interested in getting familiarized with the information.

Finally, we can say that [discoverability](#), as a characteristic of good design presented by Norman (2013,) and perception of [usefulness](#) are hard to achieve if the users are not familiar with the field.

As a final word, I can say that based on the answers of the participants and on the comments of the experts, the poster is an interesting tool to be used in formal and informal learning even in a period of time that demands interactivity from almost everything. In formal learning the poster could be used as a learning object where a clear objective is set and there are guidelines for its use. In informal learning, we could just hang the poster in a visible place and people would learn by exposition to it as there is no need for a formal setting.

7. Future work

The complexity of the field and the number of different concepts that intervene in the design of the taxonomy and the poster provide multiple possibilities of research.

The following are some propositions of future work regarding the poster:

- There can be an improvement on the icons. They can be designed specifically for this taxonomy.
- A French version can be created.
- It could be tested as a learning object in a teacher's training program. It would need to be accompanied by a scenario and a set of instructions to achieve a specific objective.
- It can be tested in use, for example in the master Maltt, for the activities that use LAMS or Compendium to see if it can be used as a generator of ideas.
- It can be used as a cognitive tool for Informal Learning.
- Each branch can be presented individually in a poster along with the definitions of all the concepts presented.

Concerning the taxonomy, the following can be done to improve the taxonomy:

- Consider other ways to present the taxonomy to account for the complexity of the field, such as a matrix representation to “accommodate alternative points of view very effectively,” or a polyhierarchical representation as some “items belong in more than one class” (Lambe, 2007).
- Present it in an electronic version and make it available for online consultation, with date of the latest editing and an email contact to add or remove elements.
- A more classic version of the taxonomy can be created by using taxonomy creation software that will allow an easier update.
- A branch that accounts for feedback and another one for the characteristics of the learners could be added.

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Annexes

Annexe 1. Original USE questionnaire by Arnold Lund

Original USE questionnaire

Usefulness

- It helps me be more effective.
- It helps me be more productive.
- It is useful.
- It gives me more control over the activities in my life.
- It makes the things I want to accomplish easier to get done.
- It saves me time when I use it.
- It meets my needs.
- It does everything I would expect it to do.

Ease of Use

- It is easy to use.
- It is simple to use.
- It is user friendly.
- It requires the fewest steps possible to accomplish what I want to do with it.
- It is flexible.
- Using it is effortless.
- I can use it without written instructions.
- I don't notice any inconsistencies as I use it.
- Both occasional and regular users would like it.
- I can recover from mistakes quickly and easily.
- I can use it successfully every time.

Ease of Learning

- I learned to use it quickly.
- I easily remember how to use it.
- It is easy to learn to use it.
- I quickly became skillful with it.

Satisfaction

- I am satisfied with it.
- I would recommend it to a friend.
- It is fun to use.
- It works the way I want it to work.
- It is wonderful.
- I feel I need to have it.

- It is pleasant to use

Measuring usability with the USE questionnaire (PDF Download Available). Available from:

https://www.researchgate.net/publication/230786746_Measuring_usability_with_the_USE_questionnaire [accessed Jan 27, 2017].

Annexe 2. Questionnaire Test A in English

Questionnaire Test A

Please rate the following statements to evaluate the poster:

I. The poster is useful for my profession.

| | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| 7 | 6 | 5 | 4 | 3 | 2 | | 1 |
| Strongly | | | | | | | Strongly |
| Agree | | | | | | | disagree |

Further comments:

II. The poster is easy to use.

| | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| 7 | 6 | 5 | 4 | 3 | 2 | | 1 |
| Strongly | | | | | | | Strongly |
| Agree | | | | | | | disagree |

Further comments:

III. The poster is easy to read.

| | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| 7 | 6 | 5 | 4 | 3 | 2 | | 1 |
| Strongly | | | | | | | Strongly |
| Agree | | | | | | | disagree |

Further comments:

IV. The poster is well-organized.

| | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
| Strongly | | | | | | | Strongly |
| Agree | | | | | | | disagree |

Further comments:

V. The poster is attractive (pleasing to the eye).

| | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
| Strongly | | | | | | | Strongly |
| Agree | | | | | | | disagree |

Further comments:

VI. The taxonomy presented in the poster is complete.

| | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
| Strongly | | | | | | | Strongly |
| Agree | | | | | | | disagree |

Further comments:

VII. Do you think the poster is an appropriate tool to complete tasks in the instructional design process?

Yes

No

Further comments:

VIII. Please list the advantages of the poster as a tool for instructional designers.

IX. Please list the limits of the poster as a tool for instructional designers.

Annexe 3. Scenario and Questionnaire Test B in English

Scenario Test B

Time: 10-15 mins

Goal: to create a lesson plan to teach basic vocabulary of actions in French to basic level students taking an online course.

Tasks:

A. Name the type of environment:

B. Set the outcomes for the lesson:

C. Name the roles of the people taking part in the lesson:

D. Choose the tools to use for the lesson:

E. Specify the outputs:

F. Name the resources that will be available for the students:

G. Decide on 3 tasks to do with the class:

H. Choose an assessment technique for the whole lesson:

Questionnaire Test B

Age: _____ Do you have a background in Education? Yes No

Please rate the following statements according to your own experience with the poster:

| Item | USE (Usefulness, Satisfaction and Ease) | | | | | | | |
|------|--|-------------------|----------|--------------------|---------|-----------------|-------|----------------|
| | Usefulness | Strongly disagree | Disagree | Partially disagree | Neutral | Partially agree | Agree | Strongly agree |
| 11 | It helps me be effective. | | | | | | | |
| 12 | It helps me be productive. | | | | | | | |
| 13 | It gives me control over the instructional design activities in my profession. | | | | | | | |
| 14 | It makes the things I want to accomplish easier to get done. | | | | | | | |
| 15 | It saves me time when I use it. | | | | | | | |
| | | | | | | | | |
| | Ease of use | Strongly disagree | Disagree | Partially disagree | Neutral | Partially agree | Agree | Strongly agree |
| 16 | It is easy to use. | | | | | | | |
| 17 | It is simple to use. | | | | | | | |

| | | | | | | | | |
|---------------------|--|-------------------|----------|--------------------|---------|-----------|-------|----------------|
| 18 | It requires the fewest steps possible to accomplish what I want to do with it. | | | | | | | |
| 19 | It is flexible | | | | | | | |
| 110 | I don't notice any inconsistencies as I use it. | | | | | | | |
| 111 | Both occasional and regular users would like it. | | | | | | | |
| Satisfaction | | | | | | | | |
| | | Strongly disagree | Disagree | Partially disagree | Neutral | Partially | Agree | Strongly agree |
| 112 | I am satisfied with it. | | | | | | | |
| 113 | I would recommend it to a colleague. | | | | | | | |
| 114 | It is fun to use. | | | | | | | |
| 115 | It works the way I want it to work. | | | | | | | |

Annexe 4. Questionnaire Test C in English

Questionnaire Test C

Please rate the following statements to evaluate the poster:

I. The poster is easy to understand.

| | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| 7 | 6 | 5 | 4 | 3 | 2 | | 1 |
| Strongly | | | | | | | Strongly |
| Agree | | | | | | | disagree |

Further comments:

II. The poster is easy to read.

| | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| 7 | 6 | 5 | 4 | 3 | 2 | | 1 |
| Strongly | | | | | | | Strongly |
| Agree | | | | | | | disagree |

Further comments:

III. The poster is attractive (pleasing to the eye).

| | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| 7 | 6 | 5 | 4 | 3 | 2 | | 1 |
| Strongly | | | | | | | Strongly |
| Agree | | | | | | | disagree |

Further comments:

IV. The poster will be useful for my profession.

| | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
| Strongly | | | | | | | Strongly |
| Agree | | | | | | | disagree |

Further comments:

IV. Please list the noeuds you remember.

V. Please write what you liked the most about the poster.

VI. Please write what you liked the least about the poster.

Annexe 5. Questionnaire Test A in French

Questionnaire Test A en français

Nombre d'années d'expérience dans le design pédagogique: _____

Je vous remercie de remplir ce questionnaire pour évaluer le poster. S'il vous plaît évaluez chaque énoncé.

I. Le poster est utile pour ma profession.

| | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| 7 | 6 | 5 | 4 | 3 | 2 | | 1 |
| Tout à fait d'accord | | | | | | | Pas du tout d'accord |

Pourquoi?

II. Le poster est facile à utiliser.

| | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| 7 | 6 | 5 | 4 | 3 | 2 | | 1 |
| Tout à fait d'accord | | | | | | | Pas du tout d'accord |

Pourquoi?

III. Le poster est facile à lire.

| | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| 7 | 6 | 5 | 4 | 3 | 2 | | 1 |
| Tout à fait d'accord | | | | | | | Pas du tout d'accord |

Pourquoi?

IV. Le poster est bien organisé.

| | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| 7 | 6 | 5 | 4 | 3 | 2 | | 1 |
| Tout à fait d'accord | | | | | | | Pas du tout d'accord |

Pourquoi?

V. Le poster est plaisant à voir.

| | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| 7 | 6 | 5 | 4 | 3 | 2 | | 1 |
| Tout à fait d'accord | | | | | | | Pas du tout d'accord |

Pourquoi?

VI. La taxonomie présentée dans le poster est complète.

| | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| 7 | 6 | 5 | 4 | 3 | 2 | | 1 |
| Tout à fait d'accord | | | | | | | Pas du tout d'accord |

Pourquoi?

VII. Pensez-vous que le poster est un outil approprié pour les concepteurs pédagogiques?

Oui

Non

Pourquoi?

VIII. Veuillez énumérer les avantages du poster comme outil pour les concepteurs pédagogiques.

IX. Veuillez énumérer les limites du poster comme outil pour les concepteurs pédagogiques.

Annexe 6. Questionnaire Test B in French

Scénario Test B en en français

Bonjour,

Le but de cet exercice est de tester l'utilité du poster à travers d'une suite de tâches à effectuer. Vos connaissances ne seront pas testées.

Temps : 10-15 minutes.

Objectif : création d'un scénario pédagogique pour enseigner le vocabulaire basique des actions en français à des étudiants de niveau débutant dans un cours en ligne.

Tâches :

A. Nommez le contexte du cours :

B. Décidez quels sont les objectifs (outcomes) de la leçon :

C. Quels sont les rôles des personnes qui participent au cours ?

D. Choisissez les outils pour la leçon :

E. Quels seront les productions (outputs) de la part des étudiants ?

F. Quels sont les ressources disponibles pour les étudiants ?

G. Listez les tâches pour les étudiants :

H. Quelle sera votre technique d'évaluation pour cette leçon ?

Questionnaire Test B

Age : _____ Avez-vous effectué des études en Science de l'Éducation? Oui Non

S'il vous plaît évaluez chaque énoncé d'après votre expérience pour la construction d'un scénario pédagogique.

| USE (Usefulness, Satisfaction and Ease) | | | | | | | |
|--|------------------------------|---|---|---|---|---|------------------------------|
| Usefulness | 7 Tout à fait d'accord | 6 | 5 | 4 | 3 | 2 | 1 Pas du tout d'accord |
| • Le poster m'aide à être efficace. | | | | | | | |
| • Le poster m'aide à être productif. | | | | | | | |
| • Le poster me donne une sensation de contrôle sur les activités de conception pédagogique dans ma profession. | | | | | | | |
| • Le poster facilite la réalisation des tâches. | | | | | | | |
| • Le poster m'aide à économiser du temps. | | | | | | | |
| | | | | | | | |

| Ease of use | 7 Tout à fait d'accord | 6 | 5 | 4 | 3 | 2 | 1 Pas du tout d'accord |
|--|------------------------------|---|---|---|---|---|------------------------------|
| <ul style="list-style-type: none"> Le poster est facile à utiliser. | | | | | | | |
| <ul style="list-style-type: none"> Le poster requiert un nombre minimum d'étapes pour accomplir les tâches. | | | | | | | |
| <ul style="list-style-type: none"> Le poster m'aide à être flexible. | | | | | | | |
| <ul style="list-style-type: none"> Je n'ai pas identifié des incohérences quand je l'utilise. | | | | | | | |
| <ul style="list-style-type: none"> Les utilisateurs réguliers ainsi que les utilisateurs occasionnels vont aimer cet outil. | | | | | | | |
| | | | | | | | |
| Satisfaction | 7 Tout à fait d'accord | 6 | 5 | 4 | 3 | 2 | 1 Pas du tout d'accord |
| <ul style="list-style-type: none"> Je suis satisfait du poster, | | | | | | | |
| <ul style="list-style-type: none"> Je le recommanderais à mes collègues | | | | | | | |
| <ul style="list-style-type: none"> Il est amusant à utiliser. | | | | | | | |
| <ul style="list-style-type: none"> Le poster fonctionne de la façon dont je veux qu'il fonctionne. | | | | | | | |

Commentaires :

Annexe 7. Questionnaire Test C in French

Questionnaire Test C en français

Je vous remercie de remplir ce questionnaire pour évaluer le poster. S'il vous plaît, donnez une note à chaque phrase.

I. Le poster est facile à comprendre.

| | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| Tout à fait d'accord | | | | | | Pas du tout d'accord | |

Pourquoi?

II. Le poster est facile à lire.

| | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| Tout à fait d'accord | | | | | | Pas du tout d'accord | |

Pourquoi?

III. Le poster est plaisant à voir.

| | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | |

Tout à fait
d'accord

Pas du tout
d'accord

Pourquoi?

IV. Le poster sera utile dans ma profession.

| | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| Tout à fait d'accord | | | | | | Pas du tout d'accord | |

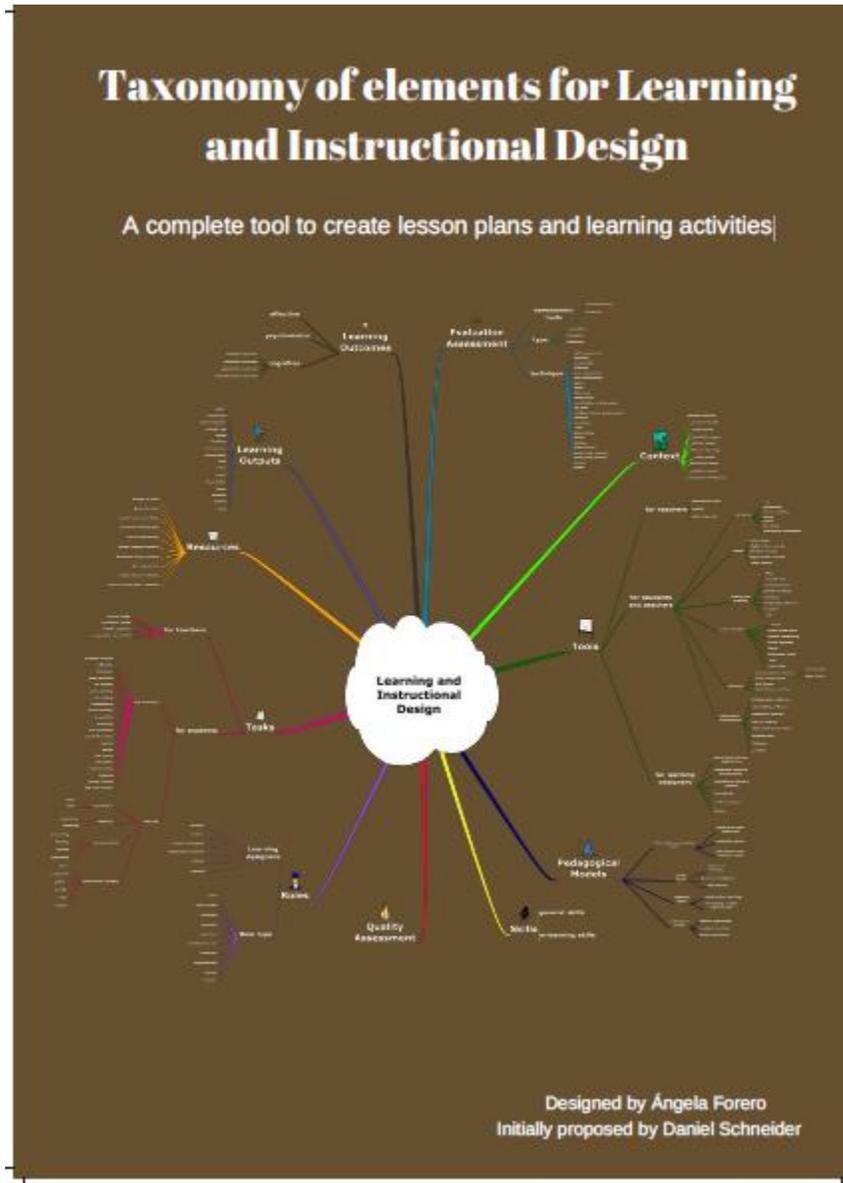
Pourquoi?

IV. Écrivez les noeuds (taxonomiques) dont vous vous rappelez.

V. Écrivez ce que vous avez le plus aimé du poster.

VI. Écrivez ce que vous avez le moins aimé du poster.

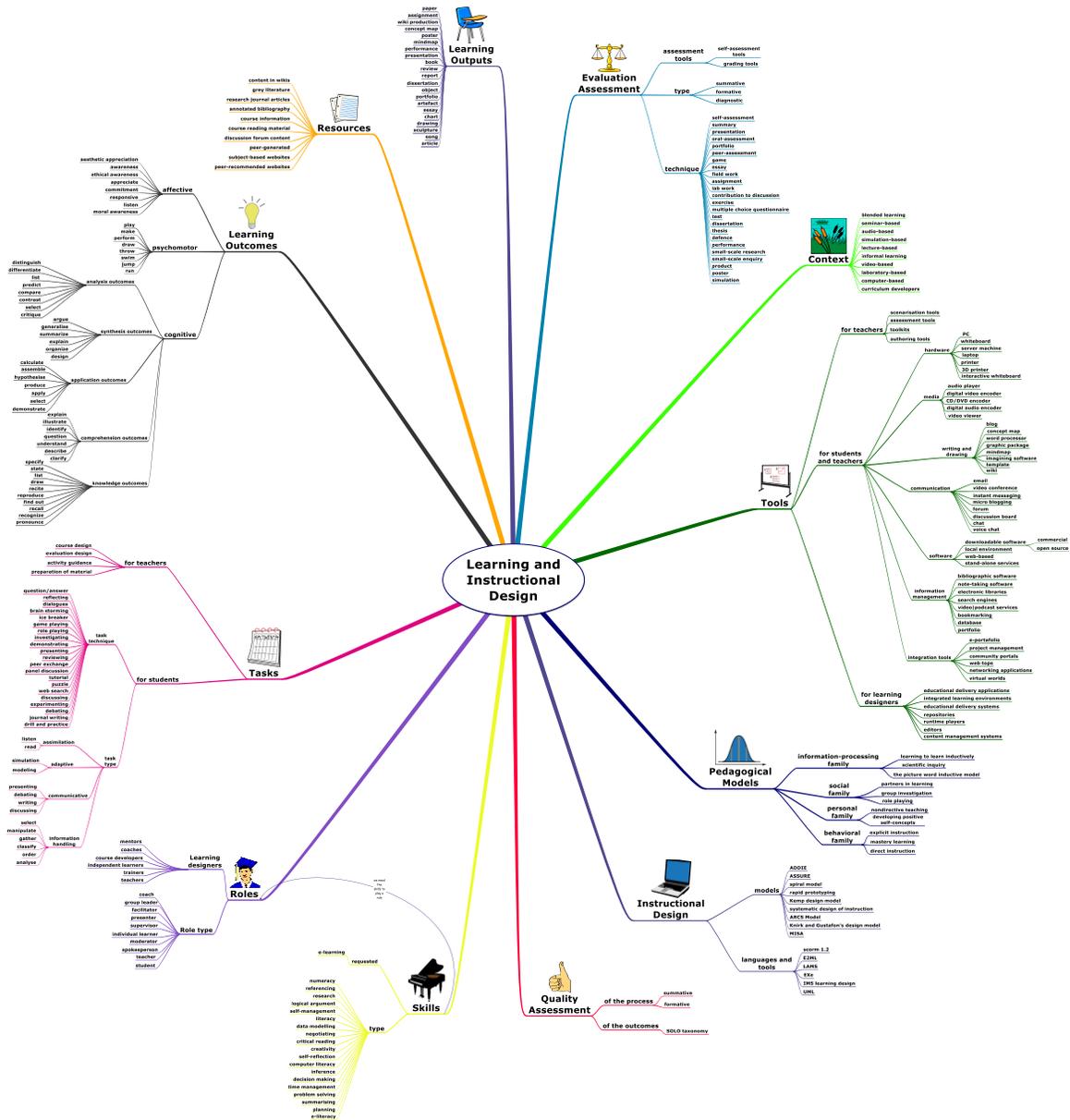
Annexe 8. Pre-test version



Annexe 9. Version 0.3

TAXONOMY OF ELEMENTS FOR LEARNING AND INSTRUCTIONAL DESIGN

Ingredients for lesson plans and learning activities

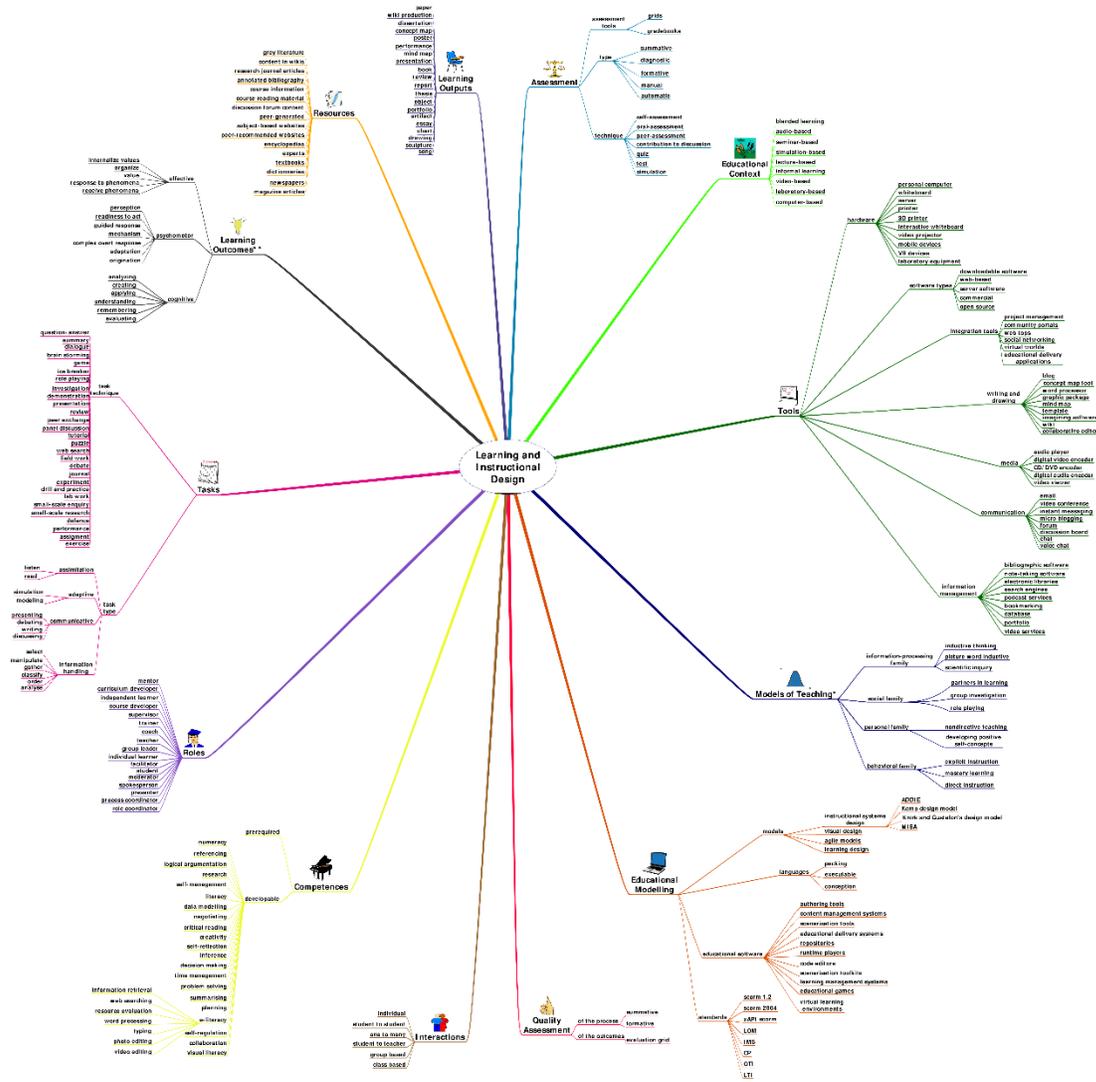


Designed by Ángela Forero, University of Geneva 2016

Initially proposed by Daniel Schneider based on the work by Conolle and Fill

Annexe 11. Version 0.9

Taxonomy of elements for Learning and Instructional Design



1. Models of Teaching by Joyce, B., Weil, M. and Calhoun, E.
 2. Learning Outcomes by Krawford et al.

Designed by Ángela Ferrero.
 Initially proposed by Daniel Schneider based on the work by Gráinne Conole and Karen Hill.
 University of Geneva, 2017

Annexe 12. Final Taxonomy

Learning and Instructional Design

- I. Quality Assessment
 - A. of the process
 - 1. summative
 - 2. formative
 - B. of the outcomes
 - 1. evaluation grid
- II. Resources
 - A. content in wikis
 - B. grey literature
 - C. research journal articles
 - D. annotated bibliography
 - E. course information
 - F. course reading material
 - G. discussion forum content
 - H. subject-based websites
 - I. peer-generated
 - J. peer-recommended websites
 - K. magazine articles
 - L. newspapers
 - M. encyclopedias
 - N. experts
 - O. textbooks
 - P. dictionaries
- III. Tools

- A. hardware
 - 1. whiteboard
 - 2. server
 - 3. printer
 - 4. 3D printer
 - 5. interactive whiteboard
 - 6. personal computer
 - 7. video projector
 - 8. mobile devices
 - 9. VR devices
 - 10. laboratory equipment

- B. media
 - 1. audio player
 - 2. digital video encoder
 - 3. CD/DVD encoder
 - 4. digital audio encoder
 - 5. video viewer

- C. writing and drawing
 - 1. concept map tool
 - 2. template
 - 3. blog
 - 4. word processor
 - 5. mind map
 - 6. imagining software
 - 7. wiki
 - 8. collaborative editor

- D. communication
 - 1. email
 - 2. video conference
 - 3. instant messaging
 - 4. micro blogging
 - 5. voice chat
 - 6. chat
 - 7. discussion board
 - 8. forum

- E. software types
 - 1. server software
 - 2. downloadable software
 - 3. web-based
 - 4. commercial
 - 5. open source

- F. information management
 - 1. bibliographic software
 - 2. note-taking software
 - 3. electronic libraries
 - 4. search engines
 - 5. podcast services
 - 6. bookmarking
 - 7. database
 - 8. portfolio
 - 9. video services

- G. integration tools

1. project management
2. community portals
3. web tops
4. social networking
5. virtual worlds
6. educational delivery applications

IV. Assessment

A. technique

1. self-assessment
2. oral-assessment
3. peer-assessment
4. contribution to discussion
5. quiz
6. simulation
7. test

B. assessment tools

1. grids
2. grade books

C. type

1. summative
2. formative
3. diagnostic
4. manual
5. automatic

V. Competences

A. prerequired

- B. developable
 - 1. numeracy
 - 2. referencing
 - 3. research
 - 4. logical argumentation
 - 5. self-management
 - 6. literacy
 - 7. data modelling
 - 8. negotiating
 - 9. critical reading
 - 10. creativity
 - 11. self-reflection
 - 12. inference
 - 13. decision making
 - 14. time management
 - 15. problem solving
 - 16. summarising
 - 17. planning
 - 18. e-literacy
 - a. information retrieval
 - b. web searching
 - c. resource evaluation
 - d. word processing
 - e. typing
 - f. photo editing
 - g. video editing

19. self-regulation

20. collaboration

21. visual literacy

VI. Models of Teaching

A. personal family

1. nondirective teaching

2. developing positive self-concepts

B. social family

1. partners in learning

2. group investigation

3. role playing

C. information-processing family

1. basic information processing

a. inductive thinking

b. picture word inductive

c. scientific inquiry

2. special information processing

a. concept attainment

b. synectics

c. mnemonics

d. advance organizers

e. inquiry training

D. behavioral family

1. explicit instruction

2. mastery learning

3. direct instruction

VII. Learning Outcomes

A. affective

1. characterization
2. organization
3. valuing
4. responding
5. receiving

B. psychomotor

1. reflex movements
2. fundamental movements
3. perceptual abilities
4. physical abilities
5. skilled movements
6. non-discursive communication

C. cognitive

1. remember
2. understand
3. apply
4. analyze
5. evaluate
6. create

D. knowledge

1. factual
2. conceptual
3. procedural
4. metacognitive

VIII. Tasks

A. task technique

1. question/answer
2. dialogue
3. brain storming
4. ice breaker
5. game
6. role playing
7. investigation
8. demonstration
9. presentation
10. review
11. peer exchange
12. field work
13. experiment
14. debate
15. panel discussion
16. tutorial
17. puzzle
18. web search
19. journal
20. drill and practice
21. summary
22. lab work
23. small-scale research
24. small-scale enquiry

- 25. defence
- 26. performance
- 27. assignment
- 28. exercise

B. task type

- 1. information handling
 - a. select
 - b. manipulate
 - c. gather
 - d. classify
 - e. order
 - f. analyse
- 2. assimilation
 - a. listen
 - b. read
- 3. adaptive
 - a. simulation
 - b. modeling
- 4. communicative
 - a. presenting
 - b. debating
 - c. writing
 - d. discussing

IX. Roles

- A. mentor
- B. curriculum developer

- C. course developer
- D. independent learner
- E. trainer
- F. teacher
- G. coach
- H. group leader
- I. facilitator
- J. supervisor
- K. individual learner
- L. moderator
- M. spokesperson
- N. student
- O. presenter
- P. process coordinator
- Q. role coordinator
- X. Educational Context
 - A. blended learning
 - B. seminar-based
 - C. simulation-based
 - D. laboratory-based
 - E. audio-based
 - F. lecture-based
 - G. video-based
 - H. informal learning
 - I. computer-based
 - J. self-directed learning

K. in-house training

XI. Learning Outputs

A. dissertation

B. wiki production

C. concept map

D. mind map

E. poster

F. presentation

G. performance

H. thesis

I. review

J. essay

K. book

L. portfolio

M. report

N. paper

O. artifact

P. object

Q. chart

R. drawing

S. sculpture

T. song

XII. Educational Modelling

A. models

1. instructional systems design

a. ADDIE

- b. Kemp design model
 - c. Knirk and Gustafon's design model
 - d. MISA
 - 2. visual design
 - 3. agile models
 - 4. learning design
- B. languages
 - 1. packing
 - 2. executable
 - 3. conception
- C. standards
 - 1. scorm 1.2
 - 2. scorm 2004
 - 3. xAPI scorm
 - 4. LOM
 - 5. IMS
 - 6. CP
 - 7. QTI
 - 8. LTI
- D. educational software
 - 1. authoring tools
 - 2. scenarisation toolkits
 - 3. code editors
 - 4. runtime players
 - 5. repositories
 - 6. educational delivery systems

7. scenarisation tools
8. content management systems
9. learning management systems
10. virtual learning environments
11. educational games

XIII. Interactions

- A. individual
- B. one to many
- C. student to student
- D. student to teacher
- E. group based
- F. class based

Context notes

ⁱ Examples of use of posters in education: health (S. A. McCann, R. Solomon and S. Jantzi 1999), math (Denson, 1992; Berry, J. and Houston, K., 1995), biology (Price and Donkin, 1993), psychology (Baird, 1991), sociology (Lowry, 1992), teacher education programs (J. Ossa and L. R. Musser 2004).

ⁱⁱ Cmap software: <http://cmap.ihmc.us/docs/conceptmap.php>.

ⁱⁱⁱ The Accidental Taxonomist webpage: <http://accidental-taxonomist.blogspot.ch/2015/11/taxonomies-and-terminologies.html> .

^{iv} The SOLO taxonomy “deals with the content of the learner’s response to what is being assessed. Its holistic approach means that it can be used to assess performance in the affective and psychomotor, as well as cognitive, domains.” (Ahoniemi et al. 2007).

^v This is Milton Glaser’ webpage <https://www.miltonglaser.com/>.

^{vi} The Graphis Poster is an Annual publication that presents the best submitted work in graphic design. https://en.wikipedia.org/wiki/Graphis_Inc.

^{vii} IMS Global Learning Consortium: entity in charge of maintaining the specification. <http://www.imsglobal.org/learningdesign/index.html>.

^{viii} According to D.K. Schneider research can be classified in five types: exploratory, explanatory, descriptive|comprehensive, predictive and engineering.

^{ix} Jakob Nielsen <https://www.nngroup.com/articles/usability-101-introduction-to-usability/>.

^x Mayes, T. and de Freitas, S. (2004). Review of e-learning theories, frameworks and models. *JISC e-Learning Models Desk Study*. London.

^{xi} Initial DKS taxonomy: http://edutechwiki.unige.ch/en/Conole_and_Fill_learning_taxonomy.

^{xii} Cognitive process dimension categories:

- Remember. Retrieve relevant knowledge from long-term memory.
- Understand. Construct meaning from instructional messages, including oral, written and graphic communication.
- Apply. Carry out or use a procedure in a given situation.
- Analyze. Break material into constituent parts and determine how parts relate to one another and to an overall structure or purpose.
- Evaluate. Make judgements based on criteria and standards.

-
- Create. Put elements together to form a coherent or functional whole; reorganize elements into a new pattern or structure.

Knowledge dimension categories:

- Factual. The basic elements students must know to be acquainted with a discipline or solve problems in it.
- Conceptual. The interrelationships among the basic elements within a larger structure that enable them to function together.
- Procedural. How to do something, methods of inquiry, and criteria for using skills, algorithms, techniques and methods.
- Metacognitive. Knowledge of cognition in general as well as awareness and knowledge of one's own cognition.

Concerning the affective domain, I followed the initial work by Krathwohl, Bloom and Masia (1964) Handbook II. The categories of this domain are:

- Receiving. Refers to the learner's sensitivity to the existence of stimuli – awareness, willingness to receive, or selected attention
- Responding. Refers to the learners' active attention to stimuli.
- Valuing. Refers to the worth or value a student attaches to a particular object, phenomenon, or behavior.
- Organization. Refers to bringing together different values, resolving conflicts between them, and beginning the building of an internally consistent value system
- Characterization. Refers to the learner's highest of internalization and relates to behavior that reflects a generalized set of values, and a characterization or a philosophy about life.

Concerning the psychomotor domain, I followed the work by Harrow (1972) Handbook III. The categories of this domain are:

- Reflex movements. Involuntary reactions.
- Fundamental movements. Inherent movement patterns which are formed by combining of reflex movements and are the basis for complex skilled movements.
- Perceptual abilities. Response to stimuli.
- Physical abilities. Require endurance, strength, vigor, and agility which produces a sound, efficiently functioning body.
- Skilled movements. Advanced learned movements.
- Non-discursive communication. Use effective body language, such as gestures and facial expressions