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visual thinking. Bases of thermography,
thermo-graphic electromedical equipment and
its application in health

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Abstract

Finding ways that facilitate the learning of students, so that this is more effectively is one of the teachers' goal.

The use of traditional teaching methods, of complex concepts and their relationship with reality suppose, in numerous occasions, difficulties in learning. For this reason, we propose an experience in which university students in the area of electronic technology and the health area, specifically the degrees in Industrial Electronics Engineering and Physiotherapy, previously trained in the use of the visual thinking tool and with specific knowledge in the concepts of radiation and its types, infrared radiation, its use in health in both treatment and diagnosis, thermoregulation and thermography can transversally share a teaching scenario with students of professional training in the technology areas and health in particular to the Superior Technicians in Clinical Electromedicine, with which we would complete the circle among the technicians who apply the medical diagnostic tools those who design them and those who maintain them.

Keywords: *Visual thinking, teaching transversality, non-ionizing radiation, infrared radiation, temperature, thermography.*

Introduction

The latest research on learning styles has confirmed that the brain of human beings is eminently visual. The ability of abstraction and planning are directly related to the ability to visualize, so people who use the visual representation system are more easily and quickly to acquire large amounts of information and establish relationships between different ideas and concepts (Constant & Amores 2017).

Since the man is man has made visual representations, to express ideas, tell stories, face and solve problems. The cave paintings of the Paleolithic are an example. Currently, this practice of thinking with images of our ancestors is considered an innate habitual practice found in our DNA. Also, the learning model of Bandler and Grinder (1988) called VAK (visual-auditory-kinesthetic) is based on the neurolinguistic criterion that considers that the system of input and representation of information is largely determined by the senses (Grinder & Bandler 1998). The use of these representation systems is unequal, some are enhanced and others are underutilized.

The capacity for abstraction and planning are directly related to the ability to visualize, so people who use the visual representation system are more easily and quickly to acquire large amounts of information and establish relationships between different ideas and concepts (Velásquez 2006).

Howard Gardner (1993) in his theory of "Multiple Intelligences" describes eight types of intelligence, which includes the visual-spatial which is responsible for developing skills in the recognition and development of visual images, allowing mental models to be formed by the analysis of the space that surrounds us, as well as the creation of spaces and images (Gardner 2010).

Continuing with this line of argument visual thinking or visual thinking (in English) is something innate to the human condition. The visual thought, although it was named by Rudolf Arnheim's in 1969 is a concept in vogue and revolutionized by Dan Roam after the publication of the book in 2010 "Your world in a napkin".

Visual Thinking means "take advantage of the innate ability to discover ideas that would otherwise be invisible, develop them quickly and intuitively and then share them with other people so they can understand them immediately. There is no better way to confirm that we really know something than by drawing it" (Roam 2010).

The visual thought is considered as a tool that consists in overturning and manipulating ideas through simple and easily recognizable drawings, creating connections between them by means of mental maps, in order to understand them better, define objectors, identify problems, discover solutions, simulate processes and generate new ideas.

The European Higher Education Area (EHEA) proposes significant changes in the teaching-learning processes on the one hand in the learning approaches that university students use during their academic training and on the other hand in the methodological approaches and teaching strategies that university teachers use (Argos et al., 2013).

Learning approaches integrate both the motivation that the student has to perform a task and the strategies that will be used to achieve it. It is something complex, dynamic and continuous that affects deep processes of knowledge (metacognition) and the use, in practice, of the strategies necessary to achieve learning objectives (Tocci 2013).

In this context, teachers often observe how students have learning difficulties, with traditional teaching methods, complex concepts and their relationships with reality. For this reason, we propose an experience in which university students in the area of electronic technology and the health area, specifically the degrees in Engineering in Industrial Electronics and Physical Therapy, previously trained in the use of the visual thinking tool and with specific knowledge in the concepts of radiation and its types, infrared radiation, its use in health both in treatment and in diagnosis, thermoregulation and thermography can transversally share a teaching scenario with students of professional training in the areas of technology and health in particular to the Superior Technicians in Clinical Electromedicine, with which we would complete the circle among the technicians who apply the medical diagnostic tools those who design them and those who maintain them.

This type of training experiences acquired between equals produces greater effectiveness in the results and generates greater adhesion in the teaching scenario and a posteriori in the work scenarios.

In order to complete the experience, a multidisciplinary group has been set up, but it is unrelated to the different areas of knowledge involved (health professionals who combine university teaching, faculty who teach at the university and in professional training, etc.), being common to all of them with their nuances the knowledge, competences, abilities and learning results.

The proposed experience has the following objectives:

1. University scope:
 - Make the university students aware of the benefits of the visual thinking tool:
 - improve the capacity for understanding and synthesis.
 - facilitates to express ideas when words are not enough.
 - triggers shared processes of thought, dialogue, design and action.
 - Train university students in specific concepts about radiation, infrared, thermoregulation and thermography and its application in health.
 - Motivate self-learning e-learning.

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- Share the teaching scenario among the university students previously trained to train, through visual thinking, the Professional students in the specific detailed concepts.
2. Professional Training Area:
- Encourage the activity and participation of students, using active and contextualized methodologies that facilitate the participation and involvement of the student as well as the use of communication strategies based on the role to be developed in the experience.
 - Encourage teaching-learning habits and professional procedures.
 - Create a climate in the classroom of collaboration and positive communication.
 - Encourage self-taught learning by focusing attention on practical issues.
 - Provide several levels of learning depending on the student's starting degree.
 - Reserve moments for reflection and recapitulation of the aspects that have been developed through activities (visual thinking) of synthesis.

Related Jobs

Teachers of the Professional Training Center *Misericordia* in which the experience will be held has received, in recent years, courses on new teaching tools that facilitate learning, among which we must highlight those related to Visual thinking:

- Visual thinking. The drawing as a learning tool. Training Plan for Teachers Integrated Public Professional Training Center *Misericordia*.
- Visual thinking. Center for Training and Innovation and Specific Resources for Professional Training of the Valencian Community.

Some teachers are using this tool occasionally and claim that the results are satisfactory and that students show great acceptance of the use of it.

Methodology

Visual thinking or "Visual Thinking" is a creative methodology of reflection and action that is used to process information through the use of drawings, images, connectors, graphics, words and numbers in a simple way. It is structured in four steps or phases:

1. *VISUAL MAPPING* Search and collect the most relevant information on the subject that you want to work.
2. *VISUAL EXPLORE*. Select the data that interests us and start to pose grouping patterns using six questions: What ?, Who ?, When ?, Where ?, Why? and how?. In this way we are able to visualize the most relevant data.

3. *VISUAL BUILDING*. Interpretation and transformation of words into images, that is, constructing them visually. Depending on the data there will be different ways of visualizing it.
4. *VISUAL TESTING*. Communicate clearly and concisely what you want to express, supporting a story linking data and drawings.

The most outstanding benefits of this schematization technique are, on the one hand, paying more attention to identify what is important and relating ideas and on the other it allows us to remember better, since conceptual and visual memory are used.

The contextualized methodology foreseen to be used in this proposal contains the following steps (figures 1, 2 and 3):

- A. University students:
 1. Attracting university students to participate in the experience.
 2. Conducting an initial training seminar for volunteer university students to participate in the experience, which will consist of two parts:
 3. Session in which it will be held to presentation of the proposal, objectives, methodology to be followed and knowledge to be achieved. And theoretical-practical explanation of visual thinking.
 4. Session of exposition of the specific knowledge to acquire to transform with visual thinking and share in the university teaching scenario-professional training.
 5. Motivation for self-learning e-learning about the tool. Study outside the classroom of the theoretical-practical contents to be transmitted (flipped classroom).
 6. Realization of the teaching material using the visual thinking tool.
- B. Carry out the transversal experience in university teaching-professional training.
- C. Experience evaluation: A self-administered questionnaire based on questions with answers with a Likert scale will be used:
 1. Evaluation of the knowledge acquired.
 2. Assessment of the degree of acceptance, degree of satisfaction with the experience lived and the difficulties encountered.

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Figure 1. Steps to follow with university students

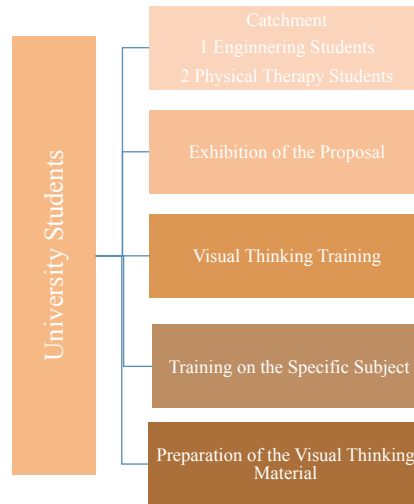
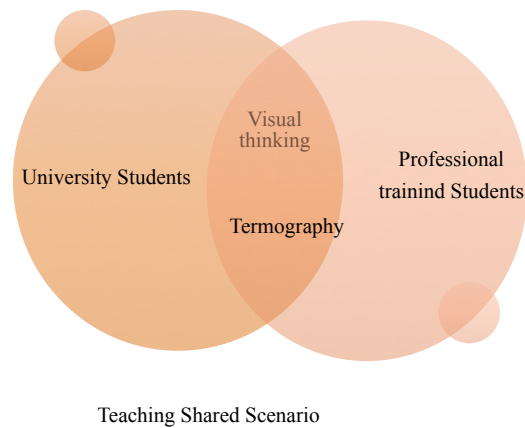


Figure 2. Transversal teaching experience University-Professional training.



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Results

Being a proposal, we can talk about expected results and that are closely related to the contribution of the implementation of this teaching tool and the cross teaching experience sharing scenarios. For all these reasons, we expect the following results (tables 1 and 2):

1. Acceptance of the experience by the students.
 - University students.
 - Professional Training students.
2. Satisfaction of the experience.
3. Participation of Professional Training students.
4. Acquisition of visual thinking knowledge.
5. Knowledge about the use of thermography in health and its theoretical bases, based on the contextualized skills and competencies of each degree.

Table 1. Expected results on acceptance and satisfaction.

| | Acceptance Teaching Experience | Satisfaction Students |
|-----------------------------------|-----------------------------------|--------------------------|
| University Students | 100% | 100% |
| | Good-Very Good | Moderate-High |
| Professional Training Students | 80% | 75% |
| | Good-Very Good | Moderate-High |

Table 2. Expected results on adquired knowledges.

| | Adquired Knowledges | |
|-----------------------------------|------------------------|---------------------------|
| | Visual thinking | Thermography in Health |
| University Students | 100% | 100% |
| | Adequate-Very Adequate | Adequate-Very Adequate |
| Professional Training Students | 90% | 75% |
| | Adequate-Very Adequate | Adequate-Very Adequate |

Conclusions

This type of learning-teaching activities are of interest because they motivate students and provide them with a continuous added value that will allow them to discover and strengthen skills that will be of great help in their learning processes incorporating this new approach.

Sharing teaching scenarios University-Professional Training is interesting for the implementation of competencies.

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