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“SIX THINKING CARDS”: A GAME FOCUSED ON DEVELOPING ARGUMENTATIVE SKILLS IN THE CHEMISTRY CLASSROOM

DE ALMEIDA, Luciana Pereira^{1*}; DE OLIVEIRA, Victória Beatriz dos Santos¹; PASSINATO,
Cristiana de Barcellos¹

¹ Universidade Federal do Rio de Janeiro, Instituto de Química, Setor de Acessibilidade

* Correspondence author
e-mail: luciana.almeida@ufrj.br

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ABSTRACT

Considering the increasing need to develop the argumentation and communication skills of the students, teaching practice has to consider how to do this concerning individual needs and preferences. Meaningful Learning proposes that education should consider the already acquired knowledge of the students in the process of building new learning. Therefore, when applied to the learning process, argumentation is a way to express acquired knowledge to other participants of this process. The Six Thinking Cards game permits students to explore their thinking in focused stages that are represented by the colors proposed in the Six Thinking Hats strategy by Edward De Bono, thus creating an environment where students have time and space to study and think about scientific concepts in a thoroughway. It is expected that the game also helps students develop soft skills that are considered essential for 21st century learning, such as empathy, communication, problem-solving, and teamwork. The game also adds Libras (Brazilian Sign Language) and Braille (tactile writing system) elements for accessibility purposes towards the objective of building an inclusive classroom. This game should be able to be applied in the chemistry classroom once Covid-19 hard restrictions and quarantine are over and in-person studies are permitted, allowing the authors to do qualitative and quantitative research of this proposal's reach and relevance for beyond of the projection of this proposal. Interviews with both teachers and students are to understand better how students' metacognitive skills improve as they engage in cooperative learning and express their ideas.

Keywords: *Meaningful Learning, cognition, focused thinking, Six Thinking Hats, argumentation.*

1. INTRODUCTION

The North-American psychiatrist who focused his studies on educational psychology, David Ausubel, theorized the importance of meaningful learning to the cognitive process. Conscious thought plays an important role in teaching and learning and should be at the forefront of didactic planning (Ausubel, 1976). According to Moreira (2006), the Meaningful Learning Theory is “the process through which new information acquires meaning by interaction (not association) with preexistent relevant aspects in the cognitive structure”. That means that learning should consider the meaningful knowledge that students have already acquired and use it as a motivation strategy. Considering students' previous thoughts, opinions, hypotheses, and even feelings is essential for significant long-term learning.

The study also considers the effects of “mechanical learning” where students merely memorize required knowledge for a short period, as in for an exam, and discard it as soon as it isn't “needed” anymore. At first glance, learning seems effective, as students can reproduce steps learned in problem-solving to excellence and show a good amount of critical thinking skills in explaining theories during a test. However, the problem lies in long-term learning and association skills, seeing that students only memorize steps and explanations, don't reflect on cognition, and don't create personal mental structures to accommodate learning deliberately and critically.

Thinking about the increasing search for strategies that help to develop critical thinking, meaningful learning, and expression skills, the work proposed in this paper focuses on the importance of understanding chemical concepts in a real way: both in a broad sense and in a

concentrated way. To do that, we propose a game called “Six Thinking Cards” based on Edward de Bono’s book and strategy, “Six Thinking Hats”.

The “Six Thinking Hats” method is a metacognitive strategy that organizes learning in stages of focused thought (De Bono, 1985). According to De Bono, it’s a “great technique to categorize opinion and fact” in the process of creating critical thinking. This technique is used in companies to increase productivity and solve creative divergence (Kivunja, 2015 and Lewis, 2004) and, more recently, has been used in education to promote lateral thinking and explore a problem, or concept, through different perspectives, as described by the NSW Department of Education.

De Bono proposed an approach that allows exploring various aspects of the same problem. According to him, the brain can function as a self-educating and self-organizing system, capable of effective information processing through a few basic operations, and processes in which the colors of the hats correlate to the concepts addressed. The author believes that creativity is a type of horizontal thinking that is difficult to cultivate because it violates traditional habits of logical thinking where the essence must be corrected at every step when it strays away from logical and straightforward analysis. In the “horizontal” thinking described by him, though, this direct view is not the only important process. Other aspects such as creativity, emotion, and judgment are considered just as meaningful for learning as facts, methodology, and data.

In education, this technique has been used to develop data comprehension, problem-solving and emotional response regulation skills (Lystopad, 2017), going hand in hand with Ausubel’s Meaningful Learning Theory and promoting global development of student’s skills and competencies in a way that always considers them at the center of their cognitive process. The work proposed in the present paper also considers inclusion as a key to didactic planning, seeing that the game is built with both Libras (Brazilian Sign Language) and Braille (tactile writing system) elements.

2. MATERIALS AND METHODS

The game is called “Six Thinking Cards” and it uses the idea behind the color scheme proposed by De Bono to organize learning in focused stages. The cards will all have a common back with the name of the game (Figure 1) and a

front containing a color and a chemical concept (Figure 2). The color and chemical concept indicated in the card will point to the focused stage of thought that the students should express.

The cards will contain a tactile writing

Figure 1. Common back of all cards based on the card created based on Six Thinking Hats by De Bono

of the card created based on Six Thinking Hats by De Bono

system so students with low sight and blind can read the cards without being told what is written in there. Seeing that colors represent the different stages of thought, there was a need for a tactile representation for them. This need was addressed by the method *see color* (Marchi, 2019). This method is a combination of tactile dashes and dots that represent colors without the need of writing their names in braille and subjecting the students to a word that might not have a concrete meaning.

Thus, the *see color* method creates a symbol for each card that will be recognizable by each student that uses braille.

The cards will also contain the image of the Libras sign for the scientific concept allowing participants that use that language to instantly understand the concept instead of using a Libras-Portuguese translator.

According to the color-associated mechanism proposed by De Bono, the colors will be organized as seen in table 1.

Table 1. Color association

Color	Meaning
Blue	Process
Yellow	Positivity
Red	Emotion
Black	Caution
Green	Creativity
White	Fact

Reference: De Bono's Six Thinking Hats color scheme

The game will start with the students mixing up all the cards. Then, the first student will pull out a card, read its scientific concept and color and have some time to prepare their arguments. Once they feel confident, they start their arguments which should reflect the stage of focused thought represented by the color of the card.

The other ones taking part in the game should understand which the argumentation used by the student is expressing concept and color. The objective of the game is going over all six stages of focused thought for a same concept.

3. RESULTS AND DISCUSSION:

In the development phase, this work proposes to help students improve their communicative skills through selective argumentation. Seeing that each color represents a stage of thought, it is expected that as students gain confidence and familiarity with the game, their arguments in each specific type of thought get better and more sophisticated.

According to De Bono, this type of selective thought, and subsequent argumentation, allows people to use it to develop a thorough understanding of a concept. Thus, students engaging in this type of activity should develop great argumentation and communicative skills. Another skill that this game aims to develop is emotional response control. When students are asked to direct their thinking to emotions, as in the red card, they are working on their ability to reflect upon their personal experiences and feelings associated and also on other people's emotional response to it, improving their intrapersonal and interpersonal response. Seeing that empathy, the

ability to relate and try to understand others, and communication, being able to express one's ideas, are soft skills so essential in the 21st century, this game cares in helping the students develop themselves to their full potential.

Considering that the school environment needs to work on students' real-lives challenges, like the ability of communication and teamwork, this game offers a cooperative atmosphere in which students learn to work with others to achieve a common goal. This game also doesn't apply the pressure of competition on its participants, seeing that competition can act against the purpose of making the participants comfortable to think and voice their argumentations.

All things considered, the game aims to act as a tool for active learning that is sensitive to the environment and needs of each individual student as they build their knowledge by means of argumentation and exposure of opinion.

4. CONCLUSIONS

In conclusion, this game can improve students' argumentative skills and it can be applied in inclusive classrooms. With the help of the game, students are also encouraged to engage in cooperative learning environment developing 21st century essential soft skills such as communication and problem-solving.

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