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CONCEPT MAPPING FOR STUDENTS WITH VISUAL IMPAIRMENT: PRACTICES AND CHALLENGES

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ABSTRACT

Concept Mapping is a pedagogical tool for organizing and representing knowledge. It is a tool for representing the conceptual structure of a subject/discipline in a two dimensional graphical representation. The graphical nature of concept mapping marginalized the students with visual impairment to use this kind of mapping. The loss of vision and an inadequate spatial concept may create the biggest challenges for educators to convey visual images to them. On the other hand, with the reasonable accommodation, this tool allows students with visual impairment to give a new integration or meaning of the content of the text by tactile map exploration. The present paper deals with the challenges faced by students with visual impairment in practicing Concept mapping strategy and also highlight its reasonable accommodations.

Key Words: Concept Mapping & Students with Visual Impairment.

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INTRODUCTION

Vision is the dominant sense giving us information about the environment. No interaction with the environment is possible without gathering, storing retrieving and organizing information. The loss of vision tends to restrict the development of the perceptions or ideas concepts like position, location and direction. In other words, it is mainly through the visual modality human beings receive accurate and gestalt impression of the environment, assisting them in orientating towards the environment (Sen, 1998). Piaget, a great empiricist, has widely acknowledged the importance of the senses for the mental presentation of the objects in the mind of a child which, in turn, work as a building block for the higher order of mental abilities. Vision is important in the formation and refinement of the concepts. A concept can be defined as "An idea or mental image that allows for things which share common properties to be grouped together or categorized." (Oden, 1987 as cited in Canas, *et.al*, 2016 p.129).

Actually, vision appears to influence the psychological/cognitive process like: perception, recognition, meaningful association and problem solving, which ultimately influence the cognitive abilities, because these process works as building blocks for the development of cognitive abilities (Sanchez & Flores 2010). It means sighted can learn many things by seeing what is happening around him/her so their learning is natural whereas students with visual impairment rely on sequential observation i.e. only part of an object can be seen or felt at a time and the entire image built-up out of the components. Therefore, learning is an important aspect of our educational system. Bruner in his theory of discovery learning also believes that the educational theories should address the question of how to learn better and more. An important aspect of teaching goal is to help students to understand the main concepts rather than just memorizing and isolate facts (Tversky, 2001). These are the important elements of the cognition that help to simply and summarize information (Median, 2000; Hahn & Ramscar, 2001; Klausmeier, 2004). It also assists the process of remembering, making it more efficient. When students to group work on objects to form concepts, they can remember the concept, then retrieve the concepts characteristic. Thus, concepts help students to simplify and summarize information, as well as improve the efficiency of their memory, communication and use of the time. These learning strategies include recognizing important information, note taking, summarizing, and meaningful learning (Pressley, 1982; Weinstein, 1998).

One of the strategies based on Ausubel's theory of meaningful learning in the classroom (Ausubel *et al*., 1978 as cited in Kharatmal, M & Nagarjuna, G. 2006, p.01) is concept mapping. Based on the learning psychology of David Ausubel, Prof. Joseph D. Novak at Cornell University presented a concept map as an instructional technique in the 1980s (Coffey *et al*., 2003).

The Concept Map

The concept map method that was developed by Novak and his group (Novak & Cañas, 2006) is based on the Ausubel meaningful learning theory which assured that new knowledge is constructed by the connections to the prior knowledge (Ausubel, 1960). Applying concepts maps is one of the effective ways for relating the new subjects to the existing cognitive structure (Irvine, 1995). Concept mapping is a graphical tool for organizing and representing knowledge in

networks of concept and linking statements about a problem or subject (Novak & Cañas, 2006). In fact, concept map is a graphical representation in which nodes (concepts) and connecting lines (linking words) are arranged in a dendritic form at various hierarchical levels. It allows identifying once the most relevant concepts within the context, make relationships among them, to organize them hierarchically and generating a graphical representation of the associated mental schemes to this context (Novak & Gowin, 1984). The fundamental aim in concept maps is to create meaningful propositions.

The concept maps can be drawn by using paper, pencil, and blackboard and computer software. One of the big advantages of using the concept mapping in teaching and learning is that it provides visual images of the concept which can be focused very easily. They can be easily revised any time when necessary. The concept mappings are user friendly for the sighted students as well as students with special needs like Hearing Impairment (Castillo *et al*., 2008; Nikolaraizi & Theofanous, 2012) Intellectual Disability (Brown, 2007; Chen *et al*., 2014) and Learning Disability (Sturm *et al*., 2002; Lami, 2008). On the other hand, due to its graphical nature of concept mapping, they are not accessible for the students with visual impairment.

Challenges in constructing Concept Mapping by Students with Visual Impairment

'*Sarven Dhrivanam Nayanam Pradhana'* this is a sloka in Sanskrit which means that amongst all of the organs of our body the eyes are the most important sense organ to gain knowledge. Vision plays a critical role in gaining knowledge and in the development of various ideas notions thoughts concepts.

Concept map, as imagined by Novak, is a *spatial* representation of concepts and of the relations which join these concepts some with others, in an organized and hierarchized way (Algrain, 2016. The construction of a concept map depends on the *number of propositions*, *levels of hierarchy*, *cross links* and examples. The valid relationship of a concept critically depends on the kind of *linking words or phrases* used (Pereira *et al*., 2014). These *linking words* contain the *spatial inclusion* concepts like located inside, occurs near, packed in, surrounded by, wound around, enclosed by, exit through, extends through, separated by, encloses, situated between, project into, aligned, enclose within etc. These extracted linking words are relevant to mapping the *Cell Structure and Function* (Khartmal&Nagarjuna, 2016). Vision plays an important role in comprehending the spatial structure of an environment and such individual (Thinus-Blanc & Gaunet, 1997) with blindness seen to face difficulties in the acquisition of concepts relevant to spatial relationship (Warren, 1994). In the study by Hartlage (1969), it was found that young congenitally blind children are not as good at dealing with *spatial concepts* as they are with *nonspatial concept*s. This poor performance may be a result of *inadequate spatial concepts or poor motor* control. Maps are differing from other drawings in that they not only serve to present information (such as a list of elements) but also spatial configuration. In addition, due to its graphic nature, it cannot be utilized by students with visual impairment. The loss of vision and an inadequate spatial concept may create the biggest challenges for educators to convey visual images to the students with visual impairment.

Concept mapping is both easy and hard (Canas *et al*., 2016). Two concepts

connected by a linking phrase form a proposition and by adding concepts and propositions and we construct the concept map. The most recent research, (Buhmann and Kingsbury 2015 as cited Marriott &Torres 2016, p.100) proposed 6 classifications according to the Concept Maps layout for assessment of its morphology. This classification indicates 6 different types: (i) broad; (ii) deep; (iii) imbalanced; (iv) connected; (v) interconnected; and (vi) normal

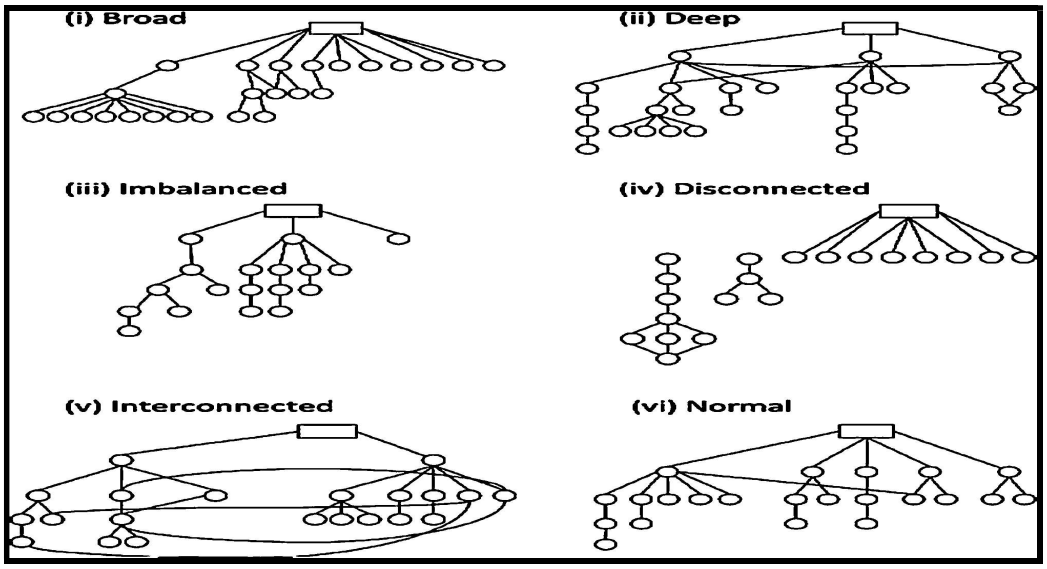

Figure 1. Concept map global morphologies suggested by Buhmann and Kingsbury 2015 as cited Marriott &Torres 2016

In many circumstances, there is no way for the students or educators (novices) to know what the *right size* for the concept map (Canas et al., 2016). They mostly tend to add many concepts as they can think of the map. This may represent the structural complexity of the map. An excessively detailed map becomes cluttered and unreadable, and results in a perceptual overload for the reader (Jacobson, 1996). *As (Landau*, 1983 as cited in–Warren 1994, p.138*) aptly put it, where relevant experience is lacking, word meaning cannot be learned*." Unfortunately, a blind user is severely limited in using these kinds of Concept Mapping.

According to (Sanchez & Flores, 2010) the meaningful evaluation of concept mapping requires the integration of five skills *Like Association, Classification*, *Categorization, Sorting and Summarizing* and found that the difference was produced by the blind childs' lack of clarity as far as spatial positioning within the map he was creating. Visually impaired children tend to put hierarchically aligned concepts in a *very linear* and sequential manner (vertical organization), making the task of constructing the map and its conceptual representation quite difficult. In the construction of a map by a sighted child, in general there is better spatial distribution, which provides uniformity between previous concepts and new ones to be inserted.

Reasonable Accommodations in Constructing Concept Mapping for Students with Visual Impairment:

According to United Nations Convention on the Right of Persons with Disabilities (UNCRPD) *Reasonable accommodation sheds clear light on the necessary and appropriate modification and adjustment not imposing a disproportionate or undue burden, where needed in a particular case, to ensure to person with disabilities the enjoyment or exercise on an equal basis with others of all human rights and fundamental freedom (*as cited Inclusion of people with disabilities in Vocational training: Practical guide, 2013, p.11). Reasonable accommodations are those adaptation that are designed specifically for an individual and *what* he or she requires in a specific learning work or other situation. This can support a student without taking so much time and effort that they interfere with teachers' responsibility to other students. In addition, that accommodation may be helpful for other students in the class without legally identified special needs. It is primarily focused on the assumption that they carefully analyzing students learning needs and the specific demands of the class environment teachers can reasonably accommodate most students with special needs in the classrooms.

Thus, a reasonable accommodation offers the appropriate techniques or teaching strategies to maximize students' success without taking a disproportionate or undue burden on amount of teacher time and effort or diminishing the education of non-disabled students in the class. Reasonable accommodation strategy is basically based on the following two key ways (Khan, 2012).

1. Students' performance in school is the result of an interaction between the students and the instructional environment. In other word, students do have problems but sometimes the task or the setting causes or magnifies the problem.

2. By carefully analyzing students learning needs and the specific demands of classroom environment, teachers/ special educators can reasonably accommodate most students with special needs in their classroom.

Although, students with visual impairment have the wide range of cognitive abilities as other students, they typically have had fewer opportunities to acquire information learned through vision. students with visual impairment often experience learning difficulties simply because they cannot easily use vision to process information. To overcome the obstacles, necessary accommodation is required in the way:

- **Raised-line Concept Map with Braille Legend**

When we create a concept maps for visually impaired students, the visual modalities may be changed into the other modalities. Braille may be used to display textual information (Tatham, 1991) that can be consider as a Raised-line of concept map. In Raised line map we use tactile elements in the form of symbols and texture which help the students with visual impairment for the acquisition of spatial knowledge and comprehend the concept mapping. Changing the image/ visual text into braille is completely justifiable because adequately conveyed information in the form of raised line of concept map allow the students to build meaning to explicitly integrate knowledge by having a tactual resource at hand. Touch is segmented and sequential,

which places great demands on memory (Hatwell, 2003). Information given in the map has to be integrated from hand movements and cutaneous sensations from fingertips. When we create a raised line of concept map the followings things should be taken into consideration:

- Braille text takes a lot of space (Tatham, 1991) therefore; few numbers of concepts should be presented on the map.
- Text should be written in uncontracted braille.
- An excessive detailed map becomes cluttered and unreadable for the reader (Jacobson, 1996). In order to avoid overloading in map, a legend can be used to display Braille text.

Thus with the reasonable accommodation, this tool allows students with visual impairment to give a new integration or meaning of the content of the text by tactile map exploration.

- **Right Size of Concept Map**

User learning to concept map often face the problem of when is it that concept map is complete. The students, mostly novices in the subject area, tend to add as many concepts as they can think of the map. Since they tend to include many irrelevant concepts and form the large map but in concept mapping, *larger is not always better* (Canas *et al*., 2016). Thus, it would be interesting to design a *small concept map* for students with visual impairment. Even though there are different size-ranges for the different purposes of concept maps, there are a few criteria that all concept maps should have to be of the right size (Canas *et al*., 2016):

i The concept map should answer the focus question.

ii The concept map should be as concise as possible while fulfilling its objective; smaller is better

iii All concepts and propositions should be relevant to the topic of the concept map and to answering the focus question

- **Raised line Concept map with audio output (Audio-Tactile Map):**

In this type of map, there is the replacement of *braille text by audio output*. This audio-tactile concept map can be assume superior to tactile paper map with braille legend because of improved accessibility for the students with *low braille reading skills*. Long- term studies have demonstrated that use of *audio* is a viable way for stimulating users with Visual disability (Sanchez, 2008). A general thinking about visually impaired persons is that only a small part of the visually impaired population has been trained to read braille and especially for the late blind people, *Braille represents a great challenge*.

Besides this, now a days i phone and iPad provide the possibility to access Map information with the default *Voice over Screen Reader*. The output is based on the auditory feedback only, without any tactile cues (Brock, *et al*., 2015).

Some researches revealed that the cognitive deficits associated with blind learned is more related to a lack of stimulation than to lack of vision, which is why rehabilitation is based on audible stimulus is a viable alternative (Sanchez & Sanez,2006). This occurs mainly because stimulation is a fundamental process in learning, helping the learner to be active and interested in the learning process. Therefore, for teaching and learning to all students in the

classroom we ought to shift our focus *from deficits to strength*.

CONCLUSIONS AND FUTURE RESEARCH

Concept mapping is a strategy for teaching and learning. These concepts maps are user friendly for the sighted children as well as students with special needs like hearing impairments, intellectual disability, and learning disability. However, due to its graphic nature it is not easily accessible for the Students with Visual Impairment. But these concept mapping as a learning tool can be used by the children with special need when adopted according to the needs of the children. To provide an equal opportunity of education, there must be some accommodation in the learning environment and in the curriculum material.

The researcher is at the beginning of the research work on concept mapping and on the basis of related literature reviewed, the researcher found that concepts maps are helpful in the retention of the concepts to a large extent and clear the misconceptions among students. So, its utilitarian values cannot be neglected by educators and teachers. Therefore, much additional research is needed for better understanding of the concept mapping for students with visual impairment. It demands new technologies, such as touch screens, multi-touch devices, interactive map, development of educational software and instructional module on the concept mapping which is specially tailored for students with visually impairment.

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