How to Cite:

Arora, B., & Giri, J. N. (2022). Dual coding theory and its application in healthcare facility. *International Journal of Health Sciences*, 6(S2), 5021–5025. https://doi.org/10.53730/ijhs.v6nS2.6261

Dual coding theory and its application in healthcare facility

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> Abstract --- The gap between verbal and non-verbal learning has always been a task for trainers and finding new ways for the same. Dual Coding Theory as a theory has been quite popular for past several years but still has not yet made its place in the daily education concepts. This paper focuses on application of the concept of Dual Coding Theory in which visuals were integrated into the content delivery and pre & post session evaluation using questionnaire having visuals to bring down the cognitive load on the mind of learners when being introduced to a new concept. Learners were healthcare workers and administrative staff who belonged to diversified departments. Content delivery was on Radiation Safety in Healthcare Facility to which they could be directly or indirectly encountering during their course of working. Attendees were appreciative of the visual dynamic components (Hand Drawn Images on Digital/Physical White Boards) for ease of understanding, interactive delivery and real time evaluation tools.

Keywords---radiation safety, dual coding theory, visuals, healthcare.

Introduction

Healthcare education on a specific topic like Radiation safety across diversified employees (clinicians, nurses, paramedics) during induction or retraining is a big challenge. Stock videos or PowerPoint presentations are commonly used for this purpose. As the stock presentations are usually monotonous in nature and were found uninteresting by the participants. To resolve this problem an approach based on Dual Coding Theory (DCT) was envisaged.

International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2022.

Manuscript submitted: 27 Feb 2022, Manuscript revised: 18 March 2022, Accepted for publication: 09 April 2022 5021

Drawing Based Teaching (DBT) Interventions

Dual Coding Theory (DCT) underlining principle is that text supported by visuals has significant potential in understanding of a concept compared to dependence on textual content. A focused group activity based on DBT was developed to better engage the participants in the learning process and meet diverse range of their basic learning. Prior to initiating the DBT approach, a visual library of hand drawn drawings was developed which included basic human figures in different postures related to healthcare workers and patients in and around there environment.

Similarly another set of drawings were prepared on the principles of Radiation Generation, Interaction with human and Radiation Safety of the personnel including patients. Participants of the session were also encouraged to make drawings for their active participation and envisioning the scenarios where Radiation Application would be possible. Starting of this activity in the beginning of session itself brought their attention to the topic of the session. While faculty used digital/physical white boards/flipchart for DBT purpose, Participants mostly had notebook and pen for their visual note taking.

Significance

In Healthcare, it's important for the faculty members to simplify a complex subject like Radiation Safety so that disperse learners can understand the concept of Radiation Safety while handling the patients and equipment both diligently without causing any harm to self, patients and public at large. A new updated DBT was introduced based on the information provided by the regulatory authority on Radiation Safety so that all the aspects of the lesson are covered. DBT format consisted introduction to Radiation Spectrum, here attendees were encouraged to draw waves of different frequency and there relation with energy. Second part of the lesson included drawing eyes, ears, nose, tongue and a hand representing five sensory organs which help us in Radiation Detection. Third part of the lesson included simple drawings of sun, building, fruit like banana, stick figure of a human being which are main source of the ionizing radiation to which we all are exposed and is known as background radiation. As these drawings were drawn on real time basis as an activity based learning, one could feel the enthusiasm of the learners because lesson was unfolding as a mystery being solved step by step. As they say 'Drawing is fun' then 'Learning by drawing is double fun'.

DBT whether practiced on a physical white board or digital white board is always an engaging activity and this activity when done on digital platform like JamBoard, Miro or Mural become more interesting as submission or response of the attendees can be incorporated on a real time basis. Extending on this topic, a great opportunity is observed for developing DBTs for healthcare learners. Hand drawn drawing notes are used in several other disciplines like architecture, designing, change management, product/process development (Design Thinking). Visual Facilitators have an experience of adding visuals into the already existing textual education. Educators can have seminars with the facilitators which can help them in modifying the same Textual Format of Radiation Safety or any other

5022

health topic and even other disciplines to a better and more understanding version.

Dual Coding Theory

DCT was proposed by Paivio in the year 1971, it gave a concept to give equal importance to verbal and non-verbal inputs to the brain [1]. While Clark and Paivio presented DCT as a framework of for cognitive psychology [2]. Further in future Paivio went to produce another comprehensive text to this theory which was entitled as Mental Representations. When discussed in detail 'Mental Representations' discusses the concept of two brains, one based completely on the image part while the second one based completely out of the language part. While they can be viewed independently, they can also be viewed together as there is great interconnectivity between these two. Cueing these two together emerges the concept of dual coding. While the image part focuses only on the Visual Spatial Intelligence of an individual, the textual part focuses only on the linguistic intelligence of the individual.

In one of his experiments, Paivio did an experiment where the subjects were viewed pairs of objects (eg. Tomatoes) of different roundness and were asked to describe the quality of roundness [3]. The objects paired were displayed sequentially as word-word, picture-picture and word-picture pairings. It was observed that participants were able to identify picture-picture fastest when compared to word-word comparison which was the slowest and word-picture which was intermediate.

DCT suggests that the use of visualization enhances learning and recall, as pictures and words are stored and processed at different sites of the brain. While DBTs are heavily grounded in the concept of DCT it is important to bring this knowledge in action [4][5]. Learners during their initial attempts may find their drawings 'not up to the mark' as individuals try to be judgmental on any drawing put forward. However, this fact need to be grounded to the learners that drawings here are for learning purpose and not for the beauty purpose. Once this fact is acknowledged and embedded then the whole focus shifts towards the understanding of the concept. Slowly tangible opportunities starts surfacing where a drawing is able to convey the information in one go which cannot be contained in thousands of words. Telling a lesson through drawing can be used to advantage as a teaching tool [6].

Hypothesis

It was observed that DBT amplifies cognition when compared to written/lecture information.

Study Method

To check out the effectiveness of the DBT based knowledge dissemination to the learners; two quizzes were created and conducted which consisted of the same set of questions. While the one quiz was based on conventional textual format and the other was designed keeping drawings/pictures as the primary source of communication. The quizzes designed were as follow in Fig. 1 and Fig. 2:

Training Question Paper

Na	me:	Department:	
Ph	one	No E-mail:	
TLI	D No	D	
1	What is the principal reason for wearing a dosimeter (chest or wrist)		
-	a	It signifies that the worker is authorized to work with radiation	
	h	The results from a TID hadge comprise a permanent record of an individual's occupational	
		radiation exposure history	
	C.	The use of the badge replaces the need for surveys in the lab	
	d.	The dosimeter will absorb the radiation and reduce the individuals exposure	
2.	If you lose your film badge, you should:		
	a.	notify the Radiation Safety Office immediately to obtain a replacement	
	b.	borrow someone else's badge	
	с.	do without one until next month's badge arrives	
	d.	estimate your exposure with a survey meter	
3.	Which of the following is more sensitive to radiation		
	a.	Unborn child	
	b.	Child	
	с.	Adolescent	
	d.	Adult	
4.	The radiation dose may be reduced by		
	a.	Wearing a dosimeter badge	
	b.	Moving farther away from the source	
	с.	Wearing an alarming dosimeter	
	d.	Using a shorter head nose	
5.	W	What is maximum dose limit established by AERB for a year	
	a.	10mSv	
	1.1	20-5-5	

b. 20mSv
c. 50mSv
d. 100mSv

Fig. 1 Textual Radiation Safety

Radiation Safety Training Question Paper



Fig. 2 Visual radiation Safety Quiz

Conclusions

As this DBT method is a Work in Progress hence, lacks elements of randomized controlled trial. Outcomes presented are rudimentary and preliminary in nature. However, on the basis of outcome of previous studies where it has already been established that even if learners are doodling, their recall and retention is more. In this context, we report our findings.

To date, more than 700 learners have been exposed to the DBT Method of lesson delivery. Findings at the end of the lesson are as follows:

- a. The lesson was most interesting
- b. It broke the monotony of PowerPoint Presentation
- c. It was interactive in nature
- d. It helped in understanding the concept
- e. An image of the drawing could be archived on learners phone for reference and recall
- f. The quiz at the end of the session helped in assessing the impact of DBT

As this study is preliminary in nature hence, the outcomes have been reported in descriptive way. An in depth study incorporating inferential statistics across disperse learner groups may be presented to establish DBT role in cognitive learning.

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