



Review Article

Effective learner engagement strategies in visual presentations

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ABSTRACT

An efficient teacher needs to communicate effectively with the audience, which in turn largely depends on an engaging presentation. The goal of any presentation is to inform, entertain, persuade or inspire and academic presentations primarily provide information, as in a classroom lecture or in a conference research paper. The department of medical education at our institute has been conducting the 'National course on educational sciences for teachers of health professionals' since last four decades. Since 2015, newer learner engagement strategies (LES) were incorporated into the program. We analysed the feedback data from participants with an aim to understand the impact of implementation of LES in the course. Literature was further explored to identify other LES in practice. We collected data of five national courses conducted during 2018 to 2020 at our Institute. The in-campus national faculty development course, which is spread over 6 days, consists of about 42 sessions involving nearly 28 presentations. One hundred thirty-five (n=135) participants from all over India had participated in this course during the period under review. Newer strategies must be used to engage new generation of learners during presentations. The best way to engage learners is by having an interactive presentation with a structured narrative that holds their attention and allows them to participate in the presentation process. Medical teachers should make themselves familiar with digital tools which help in interactive teaching. Further prospective research studies need to be carried out to understand outcomes and improve strategies of learner engagement.

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1. Introduction

An efficient teacher needs to communicate effectively with the audience, which in turn largely depends on an engaging presentation. Presentations are a mode of communication of the presenter with the audience. While the goal of any presentation is to inform, entertain, persuade or inspire, the purpose of academic presentations is primarily to provide information in a classroom lecture or in a conference research paper. In some situations, academic presentations help persuade audience to change practice and adopt new strategies. Either way, presentations must be engaging so that the audience take along with them a clear message in their mind. This becomes more pertinent in the present

era of decreasing attention spans of learners and surge in online mode of presentation delivery. This manuscript aims to instruct readers on principles of Learner Engagement Strategies (LES) during multimedia presentation and share our institutional experience in adopting these principles.

2. Materials and Methods

The department of medical education at our institution has been conducting the 'National course on educational sciences for teachers of health professionals' a flagship faculty development programme over the last four decades following the adult teaching learning principles. Starting from 2015 this national faculty development programme was revamped to incorporate the principles of learner engagement keeping in mind the advancements in

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educational technology. A variety of digital tools other than PowerPoint were introduced for interactive teaching, learning and assessment. A structured feedback proforma made with Google Forms was used to collect participants' feedback. Feedback for each session was collected at the end of each day during the course from participants and improvements based on these anonymous feedbacks are incorporated into subsequent sessions. We analysed the feedback data from participants obtained from March 2018 to March 2020 with an aim to understand the impact of implementation of LES in the national faculty development course. Furthermore, we explored English language literature in Embase and Medline databases in last 2 decades with the search terms 'learner engagement strategy', 'Multimedia principles AND learner engagement' and, 'educational techniques AND learner engagement' to identify other LES in practice.

3. Results

We collated data of five national courses conducted during 2018 to 2020 at JIPMER. The in-campus national faculty development course is spread over 6 days and each course consists of about 42 sessions involving nearly 28 presentations. While each presentation is unique and relevant to the session topic, all presentations were made following learner engagement principles. One hundred thirty-five (n= 135) participants from all over India had participated in this course during the period under review. The age of participants ranged from 28 years to 66 years. Fifty-eight percent (n =78) of the participants were males and remaining were females. All of the participants in our study were teachers in medical institutions and had different levels of teaching experience. Feedback on individual sessions in terms of 'whether the objectives of the session were met' and 'whether learners had scope for active participation' elicited 89% positive feedback each. Global rating such as 'very good' and 'good' was given by 90% of the learners as the overall feedback for the course as. In addition to these objective feedback questions which elicited objective responses, participants were encouraged to submit subjective feedback responses also in the form of statements and suggestions. Two simple feedback questions were provided to the participants: 1. What factors particularly facilitated your learning today? and 2. What factors hindered your learning today? These subjective feedback responses were then stratified into two categories for the purpose of this study a) those that reflected LES and b) feedback pertaining to other factors (eg. comments on refreshments, lunch quality etc) or general feedback (eg: thank you team, great effort etc). Among the 86 responses received for the question "What factors hindered your learning today?" nearly 12 responses pertained to LES., which included comments on connectivity issues, learning many technologies in a day,

pace of learning or 'slide transitions made using Prezi presentation software in one of the sessions made me dizzy!' (Table 1).

For the question "What factors particularly facilitated your learning today?" nearly 110 responses were collated among which 58 responses reflected feedback for LES. These included responses like 'active involvement', 'lots of interaction', 'brainstorming interactive sessions' or 'teachers were very enthusiastic.'

Table 1: Responses to subjective feedback questions relating to LES

Facilitating factors	Hindering Factors
Activity based learning	Connectivity issues
Hands-on training	Learning many technologies in one day
New technologies	Speed of delivery
Opportunity for participation	
Teachers' interaction	
Teachers' enthusiasm	
Skilled teachers	
Immediate applicability to workplace	
The facilitators were open to suggestions, feedback.	
Lively sessions	

4. Discussion

Learner engagement refers to meaningful engagement involving students' time and energy to learn the prescribed content and skills, demonstrate the same independently or by involving others in the class. Hence, engagement is all about involving all the three domains of learning i.e. cognitive, affective and psychomotor.^{2,3} With development of software technology, presentations became synonymous with multimedia presentation and more specifically PowerPoint although newer visual presentation software cropped up in the last few decades.^{4,5}

Our study results reflect the impact of well-planned LES to engage learners and improve learning outcomes. While LES is a fluid concept which changes course according to the topic, audience, learning environment and expected learning outcomes, the underlying principles remain constant. (Figure 1)

4.1. Principles of multimedia learning

Learning outcomes for the audience from a presentation takes into account principles derived from the cognitive load theory. According to this theory, any information presented to learners will be retained to working memory (WM) and later on to their long-term memory (LTM) depending on the load characteristics of the information. There are essentially three types of load characteristics which the learners

Table 2: Principles applicable in learning through multimedia

Type of cognitive load	Presenter goal	Principle which addresses the cognitive load	Description of the principle
Extraneous load (extraneous processing)	Reduce	Coherence Principle	Learning is better when extraneous words, images and sounds are excluded from the presentation
		Signaling Principle	Cues on the text being presented help learner organize and process information
		Redundancy Principle	Learning is less efficient when visual text information on the slide and verbal text by the presenter is same. Since audience cannot focus on both the information at the same time one of the information becomes redundant
Intrinsic load (essential processing)	Modify	Spatial Contiguity Principle	Aligning graphics near text describing them helps information retention
		Temporal Contiguity Principle	Audio narrations aligned with the graphics being presented helps learners
		Segmenting Principle	Presenting information in smaller 'bite sized' chunks help learner retention
		Pre-training Principle	Providing key information related to a topic before the actual presentation helps learner process the information being presented faster
Germane load (generative processing)	Optimize	Modality Principle	Providing audio narration rather than text on slide for a topic with complex graphics
		Multimedia Principle	Words and graphics presented together help in better retention than when presented alone
		Personalization, Voice, and Image Principles	More applicable to online learning. Audience learn better when words are spoken in a conversational style rather than a formal style.

Table 3: Generational learning behaviours

	Baby Boomers	Generation X	Generation Y (Millenials)	Generation Z
Birth Years	1944-1964	1965-1979	1980 -1994	1995- present
Current age group (as in 2020)	56-76 years	41 - 55 years	26 - 40 years	Up to 25 years
Learning Traits	"Me" generation Equate work with self worth Thrive on praise Tend to solve problems Digital immigrants	Comfortable working alone. Appreciate leisure and time off. Clever, pragmatic resourceful "work to live not live to work"	They like to parallel process and multitasking, Expect stimulation in the learning environment Open and eager to new experiences. Accustomed to adult supervision. Considered to have poor self management and conflict resolution skills. Prefer structured curriculum. Digital natives	Need rewards that are changed frequently to meet changing expectations and demands. Adopts technology at high levels and push others to do the same. Crave for regular and technology-enhanced learning opportunities. Look for educational opportunities that use visually enhanced methods of teaching

Table 4: Digital tools for interactive presentation

	Criteria	Features	Technology	
1	Presentation tools	<p>Latest version</p> <p>License</p> <p>Presentation style</p> <p>Offline availability</p> <p>Advantages</p> <p>Disadvantages</p> <p>Available from</p>	<p>PowerPoint</p> <p>16.0 (2019)</p> <p>Paid</p> <p>Linear, hierarchical</p> <p>Available for editing and presentation</p> <p>User familiarity</p> <p>Intuitive and easy to create</p> <p>Ubiquitous</p> <p>Failure of audience engagement if the slides are not engaging or extensive</p> <p>Linear style of presentation where audience is likely to lose attention after a few slides</p> <p>https://www.microsoft.com/en-us/microsoft-365/powerpoint</p> <p>Voxvote</p> <p>Completely online</p> <p>Slides can be made in the program online to appear as powerpoint slide</p> <p>Live quiz, opinions, one word views can be collected live https://www.voxvote.com/Products/features</p> <p>Mobile app available</p> <p>Option for free usage with educational institute email id https://www.voxvote.com/offers/2014-education-teachers-for-free</p> <p>Kahoot</p> <p>Presenter can create engaging quizzes in a fun format.</p> <p>Top winners, trending lists are displayed online to foster competition.</p> <p>https://testmoz.com/</p>	<p>Prezi</p> <p>Classic Prezi (2009) No longer available</p> <p>Prezi next (2017)</p> <p>Paid</p> <p>Non-linear, conversational</p> <p>Available for presentation, however editing requires online access</p> <p>New non-linear presentation style will gain audience engagement</p> <p>Easy to jump to different sections of the topic to maintain a conversational style of presentation</p> <p>Possibility of distraction, motion sickness</p> <p>Likely to create confusion if presenter jumps frequently between different subtopics</p> <p>https://prezi.com/</p> <p>Poll Everywhere</p> <p>Online as well as on the PowerPoint itself</p> <p>Can be integrated with Powerpoint</p> <p>Live quiz, opinion polls, word cloud can be collected live https://www.polleverywhere.com/features</p> <p>Mobile presenter and creator app available</p> <p>Introductory plans free (limited participants) https://www.polleverywhere.com/plans</p> <p>TestMoZ</p> <p>Presenter can create tests on the go without registering, in question formats available.</p> <p>Professional clean look with low bandwidth consumption so can be used with limited internet access.</p> <p>https://kahoot.com/</p>
2	Audience Polling Software	<p>Capabilities</p> <p>Mobile application</p> <p>License</p>		
3	Quizzing software	<p>Capabilities</p> <p>Available from</p>		

Table 5: Selective content resources for multimedia presentations

Category	Resource with URL	Type	License
Multimedia	Freesound: https://freesound.org/browse/	Collection of sounds	Creative common license
	Health Education assests library: HEAL: http://collections.lib.utah.edu/search?facet_setname_s=%22ehsl_heal%22	Collection of medical pictures, videos	Mostly creative common license
	J Willard Marriott library: https://collections.lib.utah.edu/search?	Collection of general and medical pictures, videos	Mostly creative common license
	MedPix® https://medpix.nlm.nih.gov/home	Collection of medical (Radiological mostly) pictures	Free for personal noncommercial use and for local teaching at institutions
	MERLOT (Multimedia online resource for learning and online training): https://www.merlot.org/merlot/index.htm	Collection of medical material, text, lesson plans, images	License to be checked before using and permissions may be needed
	Public Health Image Library (PHIL): https://phil.cdc.gov/default.aspx	Collection of medical Images	License to be checked before using and permissions may be needed
	Wikimedia Commons: https://commons.wikimedia.org/wiki/Main_Page	Collection of general Images	Creative common license
	Wellcome library: http://wellcomelibrary.org/ / http://wellcomelibrary.org/collections/digital-collections/	Collection of general and medical Historic Images	License to be checked before using and permissions may be needed
	Morguefile https://morguefile.com/	Collection of general images	Creative common license available
	Flickr https://www.flickr.com/	Collection of general images	Creative common license available (search filters to be placed)
Digital resources for anatomy	Embryo images: https://syllabus.med.unc.edu/courseware/embryo_images/	Collection of embryo images	Obtain permission before using
	BioDigital: 3D Human Visualization Platform for Anatomy and Disease: https://www.biodigital.com/	Anatomy atlas	Subscription model
			Images can be used freely after obtaining permission

Table 6: Functional strategies for learner engagement

Aspect	Strategies
Presenter	<ul style="list-style-type: none"> Start presentation with an icebreaker¹ Include a question and answer session Use props along with the presentation eg; specimen, model etc
Presentation	<ul style="list-style-type: none"> Present with a structured narrative Use one or two concise video clips Present in a nonlinear flow Use visualization tools for data Use animations, music and recorded audio narrative strategically in the presentation Include an interactive quiz
Audience	<ul style="list-style-type: none"> Use audience poll Encourage movement in the audience Invite questions from audience Allow audience to decide the direction of presentation

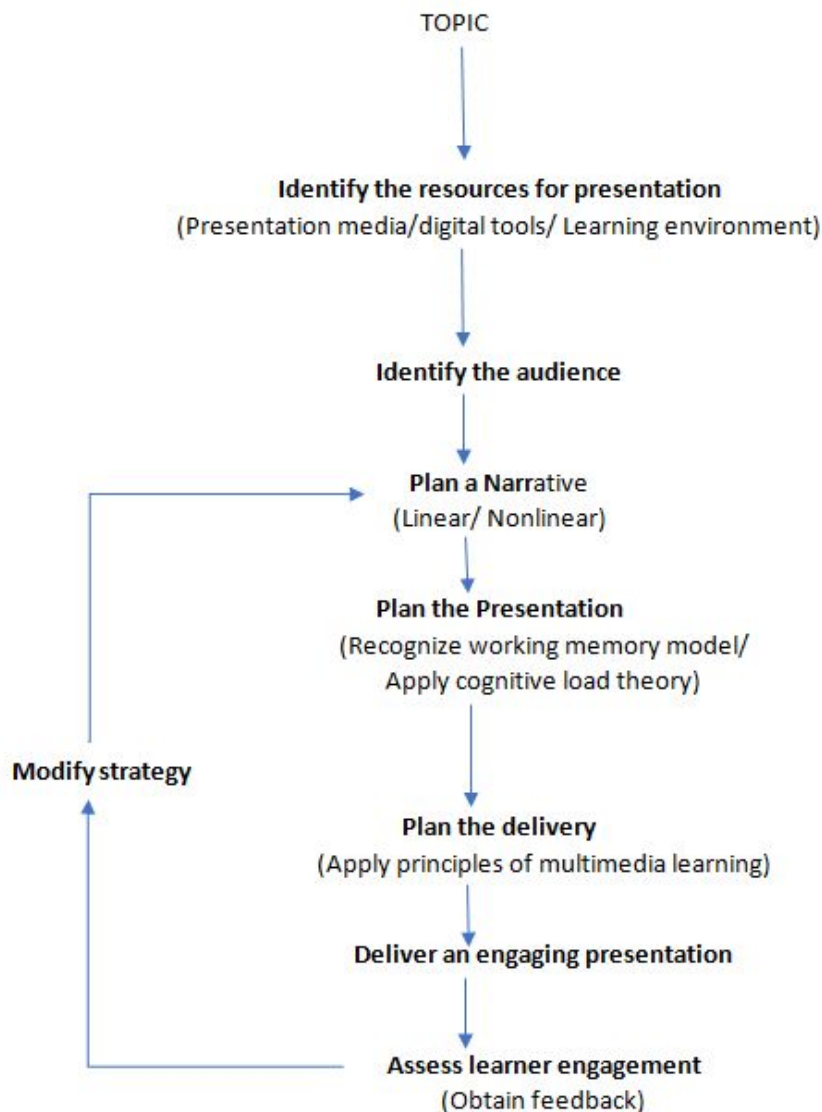


Fig. 1: Flow diagram for learner engagement strategy (LES)

encounter during an instructional presentation.⁶ Firstly, the intrinsic load which refers to the inherent difficulty of the subject being presented, secondly the extraneous load which refers to the distraction elements in a presentation for eg; unrelated graphics, which divert learner attention and reduce learner retention, and finally the germane load, which refers to how the learners actually understand and retain the information. (Figure 2) Since it may be challenging to alter the intrinsic load, the presenter should aim to minimize extraneous load and optimize germane load. To this effect, Mayer in 2001 initially proposed a set of six principles in his theory of multimedia learning to maximize learning by effectively presenting the content taking into consideration, cognitive aspects of working memory and cognitive load for

processing the new information. Later, six more principles were added on to the initial list to have twelve principles.⁷ (Table 2)

Making an interactive presentation is a definitive way to improve audience engagement and learning. Some of the benefits of an interactive presentation from a presenter's point of view are that it involves audience in the learning process, keeps them alert and thinking, helps to assess audience knowledge, provides feedback on presentation to the presenter and helps presenter learn from the audience too. For the audience especially students, interaction helps bolster confidence and spontaneity.^{8,9}

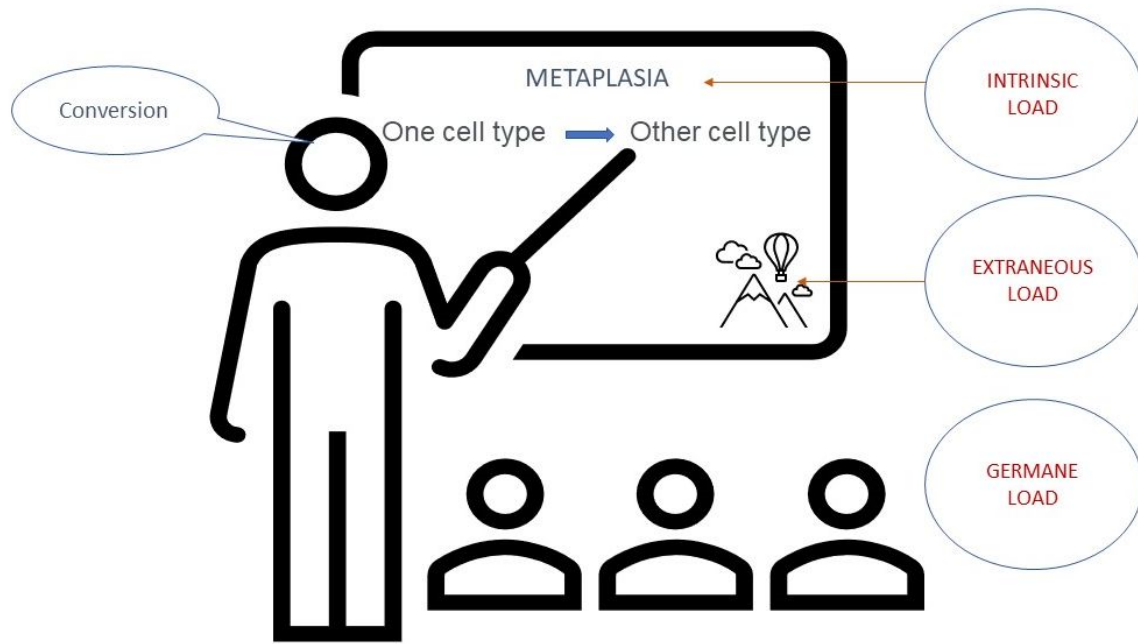


Fig. 2: Schematic representation of cognitive load theory

4.2. Elements of a good presentation

Presenting learning material in a way to enhance learner retention is an essential focus of instructional design. The presenter needs to pay attention to the three elements considered necessary to create a good presentation so that learners will have a satisfactory experience and outcome.

1. Visual design
2. Content
3. Delivery

4.3. Design

Individual learning differences have been described by different authors. Barbe and colleagues suggested three learning modality strengths among learners, visual, auditory and kinesthetic. It has been observed that majority of learners (65%) prefer a visual modality for learning.¹⁰ Keeping an appealing visual style will gain attention of learners. Slide design is an important part of visual design. The basic elements of a presentation slide are dimensions, text, images and colour and it helps audience when slides are visually simple. Principles for content and slide preparation are well described which include sequence of slides, amount of text to be placed, appropriate usage of fonts (type, size, colour and contrast), slide colour and layout. While designing a presentation, the presenter should consider four factors, audience, understanding, readability, and engagement.

4.3.1. Identify the audience

It is the responsibility of the presenter to learn about their audience well in advance before presenting. This knowledge will help the presenter develop the right approach in designing and presenting the content. Generational theory suggests the presence of distinct generations with specific characteristic traits which influence their learning.^{11,12} (Table 3)

The present classrooms in medical school will have students of generation Y and gradually these will be replaced by Generation Z students. In contrast most teachers will be from the previous generations, majority being from Generation X. To ensure that the students remain engaged, medical teachers have to find ways to upgrade and remain abreast of technological tools which the generation Y and Z students will readily adopt.

4.3.2. Enhance understanding

Baddeley and Hitch in 1974 proposed a working memory model (Figure 3) with three components, firstly, a central executive which directs attention to relevant information, suppresses irrelevant information and coordinates action between the components of working memory, secondly the phonological loop, one of the subordinate component to central executive which receives and stores sound information and the visuospatial sketch pad the other subordinate component to central executive which stores visual and spatial information. A fourth component was added on later, the episodic buffer which is a subordinate component to central executive that temporarily holds

information not accommodated by the previous components and also behaves as a link between short term and long-term memory.⁶

The primary goal of any presentation is to get the audience to take the next step needed of them, for example, explore more on the topic, adopt an idea etc. Central to this goal is developing a good narrative which will keep the audience engaged. Narrative refers to a structural framework of how an idea is conveyed to the audience. A proper narrative will provide meaning to the content on each slide and bind the slides together. Once the narrative is defined, contents of the slide can be refined. Appropriate usage of text, pictures, audio, animations and videos is needed to ensure that the audience understands what the presenter wants to convey. The concept of working memory combined with a good narrative can be leveraged to create engaging presentation slides and enhance understanding. Visually simple slides without distractions like excess animations are readily accepted by the audience. Simple animations in form of bullet points appearing one after the other while the presenter is explaining the idea is sufficient to keep audience focused to the slide being presented. Animations causing movements of slide elements outside their borders are distracting to audience and decrease learning retention. Simple short animations and videos with sound or voiceover, which convey the message clearly, help in knowledge retention. It is important for the presenter to maintain the same style, layout and design throughout the presentation to avoid distractions and cognitive overload among learners.

4.3.3. Improve readability

Most visual instructional presentation software like PowerPoint or Prezi have a constraint on screen space. So, presenters need to be prudent with amount of text they can place on the screen in a particular slide. Too much text crowded on the screen decreases readability while too less text may make it difficult for the learner to understand. Williams in 1994 coined the term CARP which refers to arrangement of text in instructional visuals.¹³

C: Contrast: A good contrast helps in better readability (eg; White text on black background or black text on white background)

A: Alignment: Multiple lines of fully centred text is more difficult to read whereas left justified texts are easier on the eyes

R: Repetition: Consistent repetition pattern of headings, titles, fonts, font sizes, and backgrounds, improves readability

P: Proximity: Grouping spatially related text and graphics together helps readability and learning

Finally, simple sans serif fonts like Arial and Verdana, avoidance of all caps and selecting font size (usually more than 24 point) appropriate to the learning environment helps

readability.^{14,15}

4.3.4. Ensure engagement

Visual instructional software has been used extensively in learning for the last few decades. The most popular of these is the PowerPoint. Presently numerous instructional software dot the digital landscape. Medical teachers need to make themselves familiar with few of these and consistently use them during their presentations. Audience response systems have been in use during presentation in form of clickers for quite some time now and have been found to ensure learner engagement.^{16–18} Recently these systems have integrated into mobile devices and with the ubiquity of smartphones¹⁹ and wireless internet access, provide a convenient way to integrate polls and quizzes in the presentations.(Table 4)

4.4. Content

Studies have shown that content is responsible for just 7% of audience engagement while presenter characteristics like voice and non-verbal communications account for the remaining 93%. However, content needs to be planned well in advance. Content of a presentation is predominantly determined by the curriculum or topic being presented. In addition, apparently unrelated content intended as icebreakers are included. Cognitive psychology research shows that information retention by audience is significantly improved if visual as well as text of the information is displayed simultaneously.²⁰ While availability of visual content is easy now a days due to internet, presenters need to take into consideration, copyright restrictions of images, sounds and videos used in their presentations. Appropriate permissions for usage of multimedia files need to be obtained and sources of multimedia used, including for those under creative common licenses should be attributed. Multiple resources are available (some free and some paid) which presenters can use to obtain professional multimedia files for their presentations. (Table 5) Similarly, when presenters create their own artwork for instructional purposes, option of obtaining intellectual property rights may be kept in mind.

Sharing handouts of topic being presented is good practice and helps learners. Particularly, when a new concept is being presented, working memory of the learners may not be sufficient to listen to the lecture, process new information, convert it into notes and at the same time keep pace with presenter's speed. Well-designed handouts in such situations rather than copy of the PowerPoint slides as handouts have been found to be beneficial as it reduces cognitive load on the learners.^{21,22}

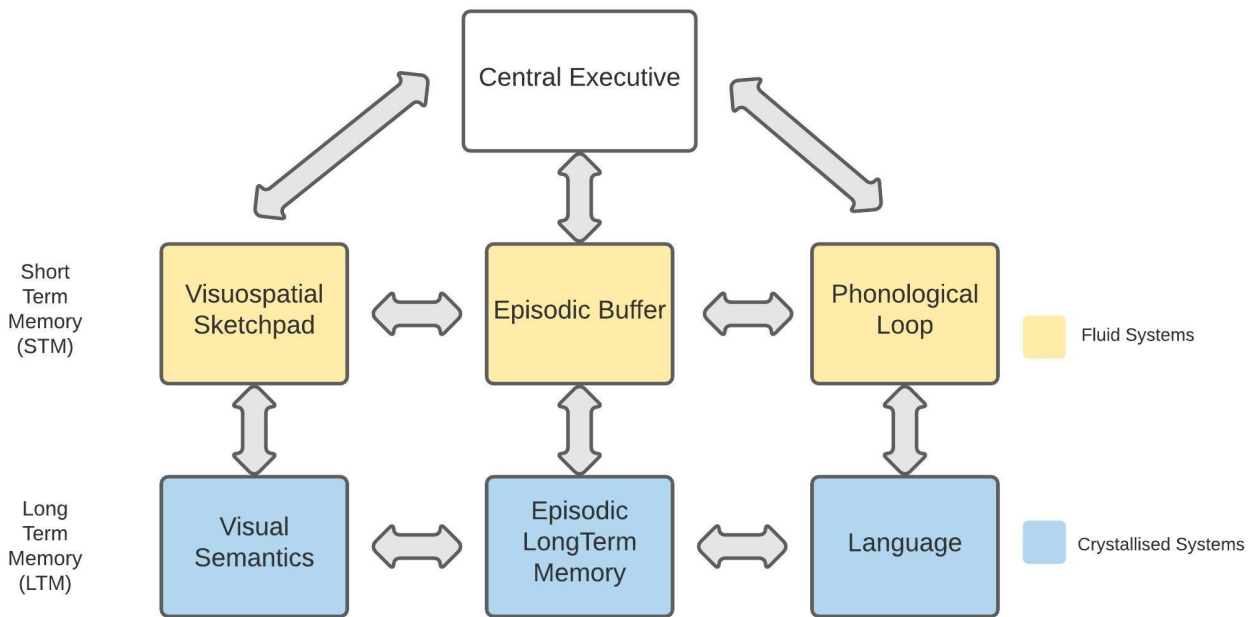


Fig. 3: Baddeley and Hitch model of working memory

4.5. Delivery

Research on using digital resources supports the idea that engagement of learners is crucial to student success. Hence, creating a learning environment through visual digital presentations that is cohesive and interactive will yield the expected outcomes of the teaching-learning session. To make the learning experience more meaningful, the engagement strategies of the presenter should create connections between instructor (presenter), students and the course content.^{23,24} Presenter confidence helps to deliver an effective presentation. This is more so in case of new presenters. While fear of public speaking especially in front of a large audience is one of the important reasons for an ineffective presentation, these can be overcome by practice. The major reason, however, for an inefficient presentation is anxiety that comes from lack of preparation. Studies have shown that to effectively present a given material, the presenter needs to practice mock presentations at least 10 times before the actual delivery. Simple strategies like starting the presentation with an icebreaker, keeping eye contact with different members of the audience, conversational style of delivery, moving among the audience and getting questions out of the audience will help learner engagement in a big way.^{1,25} (Table 6)

4.6. Indicators for effective engagement

Indicators for effective engagement during a visual presentation may be measured using several behavioural indicators. These behavioural indicators such as active

listening, responding to the quiz, volunteering to answer, attempting a question, applying the concepts, questioning, giving feedback, seeking clarification, reflecting, creating resources, etc may help the presenter to understand whether their presentation is educationally sound and effective with reference to the learning goals.^{23,26} Evidence for meaningful learning may also be established by doing a systematic interaction analysis using a standardized tool. Encouraging teacher-learner participation during visual presentations by incentivizing the achievements of learners and teachers with grades, certificate of appreciation, reward for group performance, gamifying with badges and certificates, providing timely constructive feedback, adding self-assessment rubrics and so forth, will encourage more teacher and student participation during visual presentations.^{26,27}

5. Conclusion

New strategies must be used to engage newer generation of learners during presentations. The best way to engage learners is by having an interactive presentation with a structured narrative that holds their attention and allows them to participate in the presentation process. Medical teachers should make themselves familiar with digital tools which help in interactive teaching. Further prospective research studies need to be carried out to understand outcomes and improve strategies of learner engagement.

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7. Conflict of Interest

None.

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