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Insights towards Multisensory learning approach during the pandemic times

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ملخص البحث العربي:

((رؤي معاصرة نحو التعلم القائم علي تعدد الحواس خلال أوقات الأوبئة : كوفيد ١٩))

يعتمد إدراكنا للعالم الخارجي بشكل كبير على أنظمتنا الحسية ، وخاصة قدراتنا السمعية والبصرية. من المثير للاهتمام معرفة كيف ترتبط أدمغتنا وأجسادنا ببعضها البعض للاستفادة من المعلومات المستمدة من البيئة من خلال الأنظمة الحسية المختلفة. عندما تكون هذه الأنظمة الحسية سليمة ، فإنها تعزز قدرة الفرد على الإدراك في البيئاتالتعليمية المتنوعة المصادر (نصر ، 2012). يترجم الدماغ المعلومات الواردة في وقت واحد من هذه المدخلات الحسية عن طريق إنتاج سلسلة من الإشارات المعالجة. ومع ذلك ، عندما يتعلق الأمر بمنصات التعليم بالمؤسسات التعليمية ، وخاصة التعليم التقليدي المباشر وجها لوجه ، فإن الأمر مختلف تمامًا ؛ عادة ما تركز على حاسة واحدة أو اثنتين فقط ، اعتمادًا على أنماط التعلم التي يقدمها المعلمين ، وإعداد البيئة التعليمية ، والإمكانات المادية والوسائط التعليمية المستخدمة ، بالإضافة الي طريقة التفاعل بين المعلم والطالب (Franceshin، 2017). وفي الوقت الحاضر ، وخاصة بعد ظهور وباء كشفت العديد من الدراسات أنه من أجل الحصول علي تعلم يبقي أثرا ، لا بد من التركيز علي المزيد من الحواس أثناء التعليم، وهذا ما وفرته الوسائط التكنولوجية التي هيمنت علي الوسط التربوي منذ اجتياح وباء كوفيد العالم. لقد هيمنت انظمة التعلم عن بعد عبر المنصات التكنولوجيةعلي عمليات التدريس في جميع المؤسسات والأنظمة التربوية حول العالم . لذا اصبح من الضروري استثمار المتاح من الآليات الغير تقليدية حاليا والتي تعتمد في جذورها علي مزايا استخدام النهج متعدد الحواس في الفصول الدراسية،بهدف تحسين مهارات وقدرات الطلاب من خلال تحويل عملية التعليم إلى تجربة غنية وثرية في بيئات تعليمية فاعلة لتحقيق نتائج تعليمية وتربوية افضل. وتهدف الورقة الحالية الي التعرف علي كيفية الاستفادة من مميزات التعلم القائم علي تعدد الحواسواستعراض عدد من الادبيات والدراسات التي تبرز أهمية هذا التوجه المعاصر وتدعمه وخاصة في الوضع الراهن وما يفرضه من معطيات ومتغيرات تمس بشكل كبير الحقل التربوي.

الكلمات المفتاحية: التعلم القائم علي تعدد الحواس، وباء كوفيد ١٩

Abstract

Our perception of the external world relies heavily on our sensory systems, especially our hearing and visual abilities. It is quite interesting to know how our brains and bodies are completely bounded together to make use of information derived from the environment through different sensory systems. These sensory systems, when intact, enhance an individual's ability to thrive in what can be a hostile and ever changing environment. Several studies have revealed that in order to obtain learning that has an impact. It is imperative to focus on more than one o senses during education, and the learning environment are expected enrich it. Since the epidemic hit the world, distance-learning systems via technological platforms have dominated the teaching processes in all educational institutions and systems around the world. Therefore, it became necessary to invest what is available from the currently unconventional mechanisms using the advantagesof multisensory approach in the classroom aiming of improving students' skills and abilities, by transforming the education process into a rich and enriching experience in effective educational environment, and to achieve better educational outcomes. Therefore, the present descriptive paper aims to shed the light on the importance of this contemporary trend and imposes that its effect within the educational field as well as to identify the mechanism of the brain works during the multisensory approach.

Key words: multisensory learning, the Covid-19 epidemic

1. Introduction

Newborns learn to use the information derived from the sensory organs for survival purposes like finding food, escaping from danger. The brain translates the information coming simultaneously from these sensory inputs by producing cascades of signals processed. However, when it comes to education platform, especially the traditional scenario, it is quite different; it usually focus on one or two senses alone, depending of the teachers' learning styles, setting of the environment, equipment used, interaction between teacher and student (Franceshin, 2017).

The facilitative effects of presenting multisensory approach were discussed over a number
of studies and have reported that perceiving the learning environment is facilitated to a greater extent when using integrated multisensory cues compared to unisensory cues (Shapiro et al., 2020) and during development (Nardini et al., 2015, Utley 2t al., 2011, 2010, Barutchu et al., 2009).

Broadbent, et al. (2020) study revealed that youngest children (6-year-olds) did benefit learning reliably to a greater extent when multisensory stimuli were combined compared to unisensory information.

Moreover, there are mixed results regarding the role of multisensory learning approach in task –object recognition, combinations of visuo –audio information have been are well established (Shapiro et al., 2020) and data collected found to improve perceptual accuracy by increasing the content available especially for object recognition and reaction times (Utley at al.,2011, 2010. Shams & Seitz, 2008). However, opposing findings of the efficacy of multisensory learning intervention did not provide an advantage over the structured intervention for participants (Schlesinger, Gray, 2017).

To conclude, there have been fundamental flaws limiting the generalization of the role and benefits of using multisensory learning in the education process due to a variety of reasons; the lack of studies comparing multisensory instruction to alternative learning approaches (Joshi et al., 2002), different populations and levels of development (Broadbent et al., 2020; Nardini et al., 2015).

Therefore, the present descriptive paper aims to shed the light on the importance of this contemporary trend and imposes that its effect within the educational field to identify how to the mechanism of the brain works during the multisensory approach. Several studies revealed that for retained knowledge, more senses are necessary. The science behind retaining knowledge and skills using are theoretical examined, although what's going on inside our brains while adopting more than one sense needs deeper insights, especially nowadays, through the pandemic times and the Covid-19 era, where distance learning and the usage of technology in teaching turns to be dominating institutions around the world. The present paper aims highlight the advantages of learning based on multiple senses and will review a number of literature and studies that emphasize the importance of this contemporary trend and support it, especially in the current situation during Covid-19, the data and changes it imposes that greatly affect the educational field.

2. Multisensory Maps in the Brain

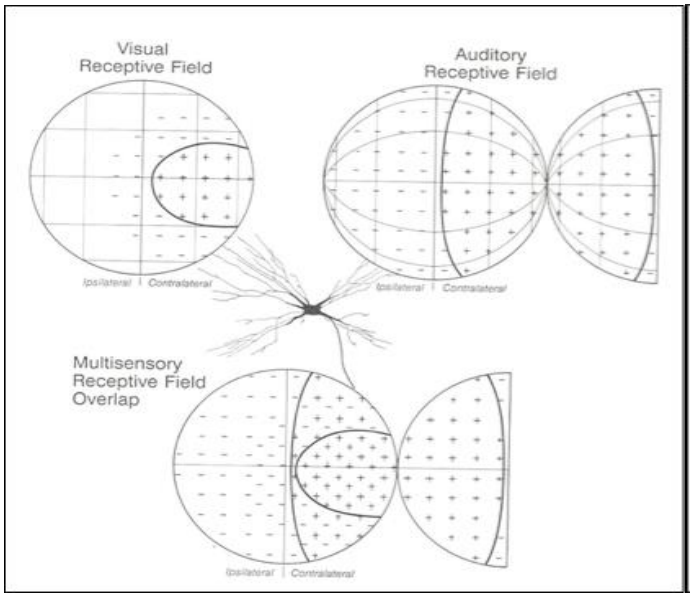
It has been demonstrated that visual, auditory and somatosensory inputs are organized into maps, and allows the translation of sensory stimuli into outputs that produce behavior. The best place where given sensory stimulus can be translated into a signal to produce an appropriate behavior, are based within well-organized maps found in different cortical regions. The

maps of different sensory modalities are aligned with one another and have some degree of overlap (Stein & Meredith, 2006; Stein et al., 2004). Many neurons in the deep layers of the superior colliculus (SC) respond to stimuli belonging to different sensory modalities known as multisensory neurons. Around 55% of these neurons are multimodal, 39% are unimodal and 6% unresponsive to sensory input. Therefore, it may be better to consider the deep SC as possessing an integrated multisensory map with the individual maps of the different modalities as components of this integrated map. This means that a small spatial stimulus often activates cells over a relatively large region and that the multi-modal neurons in the deep layers of the SC form different maps from different senses, which in turn help form individual receptive fields (RFs) for each sensory modality. The sensory modalities involved include the visual system, the auditory system, and the somatosensory system. Stein, Burr, Constantinidis, Laurienti, Meredith, Perrault et al. (2010), defined multisensory integration as:

"The neural process by which unisensory signals are combined to form a new product. It is operationally defined as multisensory response (neural or behavioural) that is significantly different from responses evoked by the modality-specific component stimuli"
(Stein et al., 2010, p.1719)

The SC neurons respond maximally to multisensory stimuli. Multisensory integration occurs at early processing stages in the brain where in particular, the SC plays a central role (Kaduence et al., 2004). A vast body of evidence exists regarding the ability of the human brain to take advantage of integrated information derived from different sensory modalities to improve the possibility of detecting, and responding to external events from the environment.

Studies of the multisensory properties of SC neurons provide evidence regarding when and why multisensory response enhancement/depression takes place. The outcome of these studies discovered several rules that govern multisensory responses. These three main rules are 1) the spatial rule, 2) the temporal rule, and 3) the law of inverse effectiveness based on the characteristics of RFs of each unimodal neuron (Stein & Meredith, 1993). Previous studies of the mammalian SC revealed that combining the same stimuli can either produce response enhancement or depression in the same neuron (Wallace, Meredith, Stein, 1996, 1998).



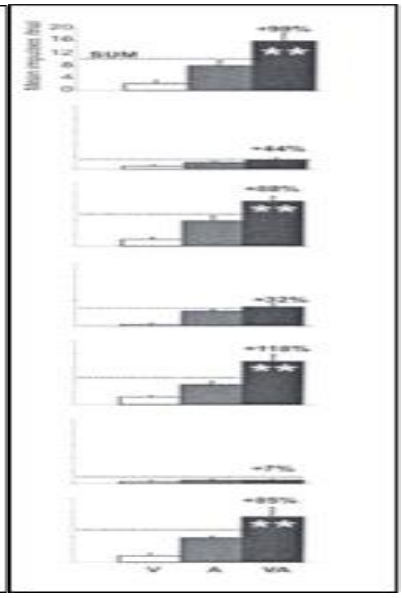


Fig (1) Fig(2)

Figure (1) Excitatory and inhibitory regions of a multisensory neuron. Taken from Stein & Meredith (1993, p.131), left. Figure (2) shows strong multisensory response enhancement when auditory-visual stimuli presented simultaneously, Taken from Alvarado et al. (2009, p 6582, 6584).

3. Multisensory Integration & Learning

Effective teachers prepare, select, and use the most meaningful approaches and teaching styles to promote learning, especially with different types of students (Dev et al., 2002) avariety of skills and tasks (Utley& Astill, 2008; Utley et al.,2010, 2011). More evidence highlighted the use of multimedia within the multisensory approach while in designing lessons, implementing lessons lead to deeper learning compared to the traditional way of teaching. Evidence from those studies revealed that using multisensory integration approach in teaching improved children's abilities in a variety of contexts. Dev et al. examined the impact of using of a multisensory approach including visual, auditory, and kinesthetic modalities in teaching reading abilities with first grade children at the special education, have proved gain that significantly took them out of the special education level. Similar to the findings of Joshi et al.(2002) examined the effect of using a multi-sensory approach to teaching reading with first graders, that the experimental group of children (using the multisensory approach) achieved significantly better than the control group in their phonological awareness, decoding, and reading comprehension.

In addition the work of Jubran (2017) aimed to examine the level of sixth grade students taught mathematical concepts using multisensory approach

would show higher mathematical achievement, indicating a significant difference between the pre-test and post-test scores of subjects who had participated in the multi-sensory approach those who had not participated.

The benefits and gains from using multisensory approach was widely examined for diverse populations;with and without any mental, physical, learning issues. Similar findings were found in patients with visual field deficit (hemianopia), and visuospatial attentional deficit (neglect), and patients with both hemianopia and neglect. Participants were instructed to either detect visual stimulus alone and/or combinations of audio-visual stimuli. The presentation of the auditory stimuli was presented either congruently and incongruently with the visual stimulus. Their findings revealed that combinations of auditory that were spatially and temporally aligned with visual stimulus did improved visual perception in the blind hemi field of patients with hemianopia improved but not in patients with hemianopia and neglect deficits (Frassinetti et al., 2005).

With respect to movement enhancement, Cappe' et al. (2009) investigated whether the integration of multisensory looming signal facilitated participant'sbehavior. Sixteen healthy participants were examined in a go/no-go detection task involving moving or static stimuli that were presented either unimodally (auditory vs. visual) or multimodally (audio-visual). The presence of both unimodal and bimodal stimuli to participants varied in size (looming-receding-constant) and in sound level that were presented concurrently/congruently and in-concurrently/in-congruently. As expected, facilitation of multisensory looming (audio-visual) occurred in terms of movement speed. Participant`s RTs was examined and their results indicated that the combination of both modalities facilitated RTs than unisensory conditions even when the direction of the motion was incongruent between the senses, as shown in see figure (3)

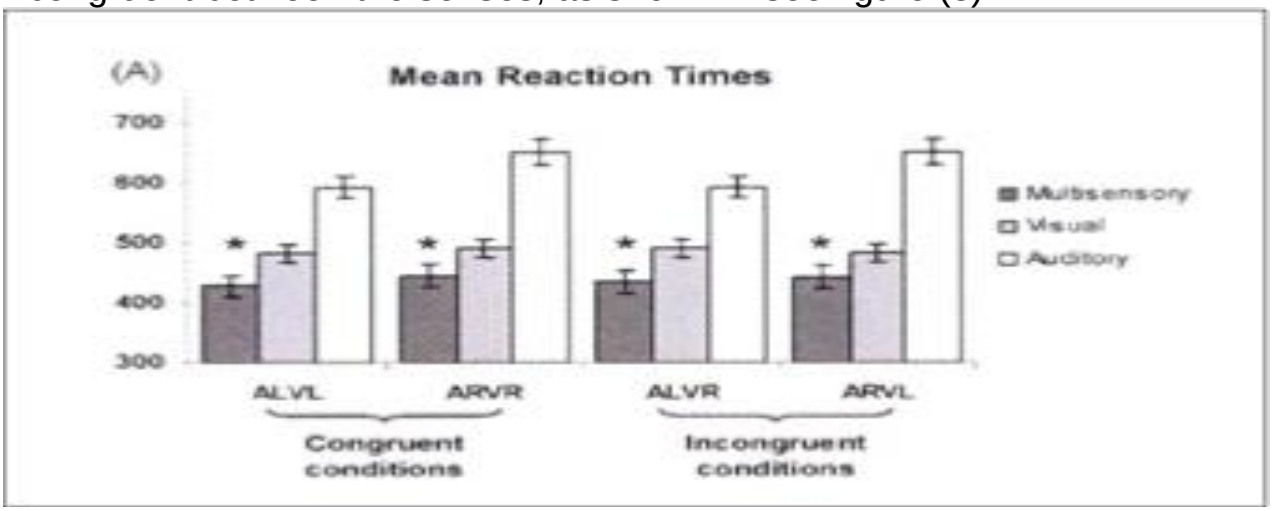


Figure (3) All RTs were faster in the multisensory conditions than in either unisensory conditions. Taken from Cappe' et al. (2009, p1047).

The study of Nasr (2012) was designed to take advantage of the existence of an integrated audio-visual system and examine how it influences movement control and coordination in children with cerebral palsy (CP). The perturbation of task (aiming/unimanual/bimanual) and stimulus type (light and/or sound) was found to influence movement control in participants with CP especially within the transport phase. However, the heterogeneity amongst participants who took part in the present studies indicates the need for more careful consideration before widespread use in the clinical or applied setting. Interventions could then be planned and employed which may assist manual independence in the future, but more research is required.

On the other hand, some populations with sensory impairment showed response inhabitation/depression. Williams et al. (2010) investigated if patients with schizophrenia and healthy control participants showed similar multisensory detection of simple, temporally congruent sensory cues from two different modalities. Participants were asked to respond as quickly as possible when a target was detected. The target that was presented could be either unimodal (auditory or visual) or bimodal (audio-visual). Patients with schizophrenia, when compared to healthy participants, did not temporally integrate auditory and visual stimuli strongly. This result suggested that patients with schizophrenia had impaired basic sensory processes, which reduced their ability to filter out redundant sensory information. In addition, they had higher levels of neural activity inhibition and an inability to detect and respond to relevant stimuli in the environment.

Inconsistent findings demonstrated from the above studies showed poorer and improved multisensory integration by individuals, these differences are likely due to large differences in task designs and/or deficits in basic sensory processing. The mechanism of multisensory integration might become particularly important when a sensory modality is damaged. This may enhance the impaired part to process, improve the perception of sensory events that are difficult to perceive using one sense only.

4. Conclusions

When teachers utilize more avenues of introducing/ presenting knowledge, skills, in their classes using multi-sensory teaching techniques can assist teachers in "translating" and “refining” a new path to provide theirlearners with meaningful concepts regardless of their abilities, performance, and attitudes. For the present time, during the pandemic (Covid-19), more in depth research is needed to address the implication of multisensory approach in the teaching environment. As with many other techniques and methodologies that heighten the efficacy of education, technology is providing new and more accessible tools for teachers to develop multisensory lessons. Nevertheless, as with most innovations, it is not

just the tools that matter, but how education professionals use them in a way that improves the outcome of their efforts. Under the present circumstances and turning from the traditional methods of teaching to remote forms, it is encouraging to get benefit from the use of multisensory materials, manipulative, interactive to enrich the learning environment.

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