



Development, validation and implementation of an online educational module on sensory processing disorders for special educators

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ABSTRACT

Purpose: Sensory Processing Disorder (SPD) is a dysfunction in children where the processing and use of sensory information for regulating motor function is affected. Even though special

educators are important stakeholders in identification and management of SPD's, this topic is not included in their formal curriculum in India.

Methods: An online module on SPD's was developed based on a Knowledge, Attitudes and Practices survey of special educators and literature review. It included eight lectures, each with a 30-minute presentation and 15-minute case scenario. Experts validated content using a 5-point Likert scale, calculating CVR and I-CVI. Participants' knowledge was assessed via pre- and post-tests, and feedback was collected to evaluate learning outcomes and content quality.

Results: The values of I-CVI (0.839) and CVR (0.84) values depict good content validity. The pre and post-test scores showed a statistically significant difference. The



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feedback proved that the online module was thorough, well designed and suited to the needs of the special educators.

Conclusion: The online educational module on SPDs is

a useful tool in providing knowledge about SPD's to special educators.

Key words: Online educational module, Sensory Processing Disorders, special educators, validation.

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Introduction

Sensory Processing Disorder (SPD) is a dysfunction in children where the processing and use of sensory information for regulating motor performance and function is affected. Sensory systems like proprioception, touch, smell & gustation, vision, audition and balance may be affected in SPD's. It may affect one or more sensory systems. It is estimated that the SPD's may exist in 5-16% of the general population of the USA [1]. Patients may exhibit hypo or hypersensitivity to stimuli [2]. More than 50% of children with various disabilities may exhibit signs and symptoms of SPD's [3,4]. Children with SPD have difficulties in responding to various sensory stimuli. They may show poor arousal, could appear emotionally dysregulated and have challenges in attention. The academic performance of these children may be significantly impacted and may even disrupt or disturb the classroom activities [5,6]. Children having SPD's are unable to understand complex activities and may find it difficult to multi-task. Special educators are crucial stakeholders in treatment of children with SPD's [7]. Education of special educators about SPD shall facilitate an improved interaction of students and teachers and also open the doors for an early and integrated rehabilitation of these children [8].

S. Mutsuddi and A. Sadhale in a study done in Pune, India showed that more than half of the children with learning disability exhibited signs of SPD [9]. The three widely used curriculum in India for special educators are : i) Rehabilitation Council of India Bachelor of Education-Special Education B. Ed. Spl. Ed. Curriculum [10] ii) ASHA special schools and iii) Curricular Adaptation for Inclusive Education of Children with Autism Spectrum Disorders. In these curricula, a general overview is given about neurological conditions like Cerebral Palsy, Autism Spectrum Disorders and Downs Syndrome. SPD's are not a part of the curriculum. The special educators lack the knowledge and are therefore unable to provide referrals of those who may have SPD's. This may adversely impact rehabilitation outcomes [11]. In Malaysia a study reported that most special educators had very little awareness of SPD's [12]. A Knowledge, Attitudes and Practices (KAP) survey regarding awareness of SPD's among special educators was done prior to the development of the module [13]. The results of this KAP survey further emphasised the need for this study.

Special educators are a widely dispersed community and work in a variety of set ups like schools, clinics, hospitals, and home schooling. Online education is an excellent alternative for special educators as the classes can be taken from anywhere where there is internet access. Also, the course content is easily accessible through phones or computers [14]. E- learning modules have online content and may be self - paced. This flexibility is a boon for adult learners who may



have work or personal obligations to fulfil. Keeping this in mind, an online educational module on SPD's was developed for special educators.

Although traditional teacher-centric approach to learning has been the cornerstone of education for centuries, educational research has now started to acknowledge the importance of student centric learning. This has radically altered teaching learning methods and the curricular frameworks across the globe [15]. The focus now is on how to train students to learn and therefore the emphasis on Instructional Design. Instructional Design (ID) is a methodical procedure which encourages training and development of educational programs which are centred around enriching and enhancing the learner environment [16]. Instructional design involves a need assessment of the learner and understanding the level of knowledge. Based on this instructional strategies are planned which help the learner to effectively transition to a higher level of knowledge and skill acquisition. Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model is one of the most common models used in the instructional design field and is a guide to producing an effective design. Teachers can use it create an efficient and effective teaching design. The ID's created by using the ADDIE model can be used in online, offline or even in the hybrid model [17]. The aim of this study is to develop, validate and implement an online educational module on Sensory Processing Disorders for special educators.

Material and Methods

Step 1: The online module on SPD was developed based on the results of a KAP survey regarding the SPD's in special educators. This was survey conducted across Mumbai, Mumbai suburbs, Thane and Raigad and Pune districts using the cluster sampling technique. It included 108 special educators with a Bachelor's degree in special education (B. Ed) or Diploma in special education (D. Ed) and having fluency in English language. General teachers were excluded from the study [13].

Step 2: Content validation of the module by the experts panel: Seven validators, four special educators and three neurophysiotherapists, were selected as subject experts for the content validation of this module. All the validators had a Post Graduate/ Master's degree in their subject and at least of 10 years of clinical and/or teaching experience in Sensory Integration and Sensory Processing disorders.

Step 3: To gauge the participants' knowledge level before and after delivery of the online module, a pre-test and post-test were administered. The 100 marks test consisted of Multiple



Choice Questions (MCQ's) (30 marks) and Case Based Scenarios (70 marks). The content validation was done by 3 subject with more than 10 years of experience in the physiotherapy academic field. A quasi-experimental study design was implemented.

Step 4: Participants were asked to give a comprehensive feedback of the online module post completion.

Research Design

This study incorporates the mixed-method approach as it involves collection and analysis of quantitative data for assessment and qualitative data for feedback.

Development of the online module

This study was based on the guidelines of the ADDIE model of instruction. Each step in ADDIE model is serially related to and interacts with each other [18,19].

For the analysis stage, the instrument was designed as per the aims and objectives of the study, extensive literature review was carried out and the existing knowledge of the special educators was discerned. The online module on SPD was developed based on the results of a KAP survey regarding the SPD's in special educators which was carried out by the researchers. The results revealed only 35% of special educators had awareness of SPD's through formal education. 42% were unaware that neurophysiotherapists are involved in treatment of SPD's. Majority were of the opinion that an integrated approach can be a solution for the treatment of children with SPD's and better communication between them and therapists will result in better and quicker outcomes for the students [13]. The results of the KAP survey along with a comprehensive review of literature and analysis of the results of the KAP survey helped in the designing and development of the online educational module on SPD's.

In the design stage the module was developed based on the needs assessment done in the earlier stage. The module consists of eight lectures of which the first is an introduction to Sensory Integration and SPD's, six lectures discuss the individual sensory system affections in SPD's and the last lecture explains the role of physiotherapy in treatment of SPD's (**Table 1**). Each lecture was of 45 minutes duration. Day one consisted of the first four lectures and day 2 consisted of the remaining four lectures.



Table 1: Delivery Plan of online module for special educators

Topic	Objectives	Topic	Objectives
Lecture 1 Introduction to Sensory Integration	- To understand the concept of Sensory Integration. - To understand SPD's and their incidence in the society. - To know the common signs and symptoms and its manifestations in students. - To know the effect of Sensory Processing Disorders on classroom performance. - To understand the role of special educators in students diagnosed with SPD's.	Lecture 2 Sensory Processing Disorder of Nasal system and Gustatory system	- To study Auditory Processing Disorders and its incidence. - To understand common signs and symptoms and its manifestations in students. - To know the effect of Auditory Processing Disorders on classroom performance. - To understand the challenges faced by special educators when dealing with students diagnosed with Auditory Processing Disorders - To know the FAQ's by parents, educators and caregivers.
Lecture 3 Sensory Processing Disorder of Proprioceptive system	- To study Proprioception Processing Disorders and its incidence. - To understand common signs and symptoms and its manifestations in students. - To know the effect of Proprioceptive Processing Disorders on classroom performance.	Lecture 4 Sensory Processing Disorder of Tactile system	- To study Tactile Processing Disorders and its incidence. - To understand the common signs and symptoms and its manifestations in students. - To know the effect of Tactile Processing Disorders on classroom performance. - To understand the



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	- To understand the challenges faced by special educators when dealing with students diagnosed with Proprioception Processing Disorders - To know the FAQ's by parents, educators and caregivers.	challenges faced by special educators when dealing with students diagnosed with Tactile Processing Disorders To know the FAQ's by parents, educators and caregivers.
Lecture 5 Sensory Processing Disorder of Visual system	- To study Visual Processing Disorders and its incidence. - To understand the common signs and symptoms and its manifestations in students. - To know the effect of Visual Processing Disorders on classroom performance. - To understand the challenges faced by special educators when dealing with students diagnosed with Visual Processing Disorders - To know the FAQ's by parents, educators and caregivers.	Lecture 6 Sensory Processing Disorder of Vestibular system - To study Vestibular Processing Disorders and its incidence. - To understand common signs and symptoms and its manifestations in students. - To know the effect of Vestibular Processing Disorders on classroom performance. - To understand the challenges faced by special educators when dealing with students diagnosed with Vestibular Processing Disorders - To know the FAQ's by parents, educators and caregivers.
Lecture 7 Sensory Processing Disorder of Auditory system	- To study Nasal and Gustatory Processing Disorders and its incidence. - To understand the common signs and symptoms and its	Lecture 8 Role of Physiotherapy in Sensory Processing Disorders - To know the treatment options for SPD's. - To be aware of the role of physiotherapy in SPD's and importance of early intervention. - To learn the



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manifestations in students. • To know the effect of Nasal and Gustatory Processing Disorders on classroom performance. • To understand the challenges faced by special educators when dealing with students diagnosed with Nasal and Gustatory Processing Disorders • To know the FAQ's by parents, educators and caregivers.	environmental modifications in school and role of special educators in treatment of SPD's. • To know the frequently asked questions by parents, educators and caregivers. • To understand the role of special educators in referrals to physiotherapists.
FAQ, frequently asked question; SPD, sensory processing disorder.	

Each lecture consists of:

1. PowerPoint presentations of 30 minutes duration.
2. Group discussion of Case Based Scenarios of 15 minutes duration.

Session 1 and 8 did not include MCQ test. At the end of each day a MCQ test and Feedback form in Google forms format was administered to the participants.

The development phase was critical in the identification of the module objectives and learner outcomes. The learning outcomes were also accordingly designed. The group discussions which involved case based scenarios in SPD's were designed to facilitate an in-depth understanding of the individual sensory systems. At the end of each lecture the doubts were clarified. The opinions and thoughts shared by the participants were used to further refine the module.

A standard checklist having a 5 point Likert scale scoring system (1: Strongly disagree, 2: Disagree, 3: Neutral, 4: Agree, 5: Strongly agree) was adapted for validation of the module. This checklist was mailed to the validators. It evaluated the content of each lecture on three very specific parameters viz. i) Importance, ii) Relevance and iii) Clarity. To evaluate the content



validity of the module, the CVI (Content Validity Index) is calculated. Content Validity Index indicates the concurrence proportion of the evaluators of a particular tool or instrument. Relevant items in the instrument are scored as 1 and irrelevant as 0. Expert' concurrence can hence be calculated as the I-CVI value. An I-CVI value of equal or more than 0.78 is considered to be highlight good and have sufficient validity. Usually, three or more subject experts are included for content validation [20]. Seven subject experts validated this module. The statistical analysis for this module showed the I-CVI value as 0.84, which depicts good content validity. CVR scores items of an instrument in terms of their essentiality. CVR values fall between +1 and -1. A score closer to 1 indicate greater agreement among panel members. The CVR score for this module was 0.839 which depicts excellent consensus among the validators.

The module aimed to provide learner centric instructional medium. The Zoom platform was selected as the online medium due to its easy accessibility and ease of use. The link for the online lectures was mailed to the participants on the previous day. A pre-test was administered at the start which was then followed by the online lectures, case based discussions, post-test and feedback for the topics covered in that day. 150 special educators having more than 1 year of experience were included in the study. The participants included 17 males (12%) and 133 females (80%).

Results

The online module spanned two days, hence a pre-test was administered at the beginning of each day and the post-test and feedback form was administered at the end of each day.

There are 7 types of SPD's depending on the system involved:

MCQ's : 30 marks (5 marks per sensory system, Olfactory & Gustatory system were combined)

Case Based Scenarios: 70 marks (10 marks per Case Scenario)

The pre and post-test scores were calculated out 100 marks. The mean score of the pre-test was 39 whereas for the post test was 53. The significant difference (P value <0.0001) between both the scores depicted that there was a significant improvement in the knowledge of SPD's in the participants.

MCQs are quick and effective tool to assess the cognition of learner and hence are commonly used [21]. There is a significant difference between the average pre-score (10.88) and post scores



(16) in the MCQ section. The p-value is highly significant (<0.0001). The scores reflect the ability of the participant to basic recall basic facts and information related to SPD's and also the ability to analyse information related to different sensory systems. There was a significant difference in the average pre-test score (10.88) and post test scores (16) in this domain indicating that participants were capable of analysing and applying their knowledge.

Table 2. Comparison of pre & post test scores fore Case Scenarios

	Mean + S.D. (Pre-test)	Mean + S.D. (Post-test)	P Value
CS-1 (OLFACTORY)	3.9 + 1.7	5.5 + 1.7	<0.0001 (Highly significant)
CS-2 (GUSTATORY)	4.0 + 1.7	5.4 + 1.8	<0.0001 (Highly significant)
CS-3 (PROPRIOCEPTIVE)	4.0 + 1.7	5.6 + 1.8	<0.0001 (Highly significant)
CS-4 (AUDITORY)	4.1 + 1.7	5.6 + 1.8	<0.0001 (Highly significant)
CS-5 (TACTILE)	4.1 + 1.7	5.7 + 1.7	<0.0001 (Highly significant)
CS-6 (VESTIBULAR)	4.2 + 1.7	4.7 + 1.7	<0.0030 (Significant)
CS-7 (VISUAL)	4.2 + 1.6	4.9+ 1.7	<0.0002 (Significant)
CS, case scenario; SD, standard deviation.			

The theory of Bloom's taxonomy has developed a classification system to categorize intellectual skills and behaviour important to learning. It has six stages, namely: remembering, understanding, applying, analysing, evaluating and creating [22]. Critical thinking is important from the point of view of understanding, analysing and applying knowledge. It is also essential for health promotion to overcome increasingly complex health issues. Case studies can be used to improve critical thinking among international students [23]. The analysis of individual mean test scores of each of the case-based scenarios also revealed a significant difference (**Table 2**). The case-based scenarios were a reflection of the participants' in-depth understanding of the seven sensory systems. It depicted that the participants were able to effectively understand each of the seven sensory systems and apply their knowledge in the context of realistic patient cases.

Feedback for the online module

Table 3. Structured Feedback



Questions	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Q1. The content in this educational module was comprehensive and included all aspects of Sensory Processing Disorders.	61%	37%	1%	1%	0%
Q2. The presenter had good communication skills.	73%	26%	1%	0%	0%
Q3. The presenter was well versed and thorough with the contents of this module.	68%	30%	2%	0%	0%
Q4. Were the questions of the case-based scenarios easy to understand.	46%	51%	3%	0%	0%
Q5. Were the case-based scenario discussion helpful in providing an in-depth understanding of sensory processing disorders?	48%	51%	1%	0%	0%
Q6. Do you feel appropriate teaching-learning aids were used?	48%	50%	2%	0%	0%
Q7. Do you feel your doubts and queries were appropriately addressed?	51%	49%	0%	0%	0%
Q8. Did the assessment methods test your knowledge thoroughly?	45%	53%	2%	0%	0%
Q9. Did this educational module improve your knowledge of Sensory Processing Disorders?	57%	43%	0%	0%	0%
Q10. Do you feel there is a need for such educational modules for special educators?	65%	34%	1%	0%	0%
Q11. You feel confident enough to IDENTIFY and REFER a child having Sensory Processing Disorder.	47%	51%	2%	0%	0%

Table 3 depicts the comprehensive structured feedback to the online educational module on SPD's. The feedback comprised of 11 close ended questions and one open ended question regarding feedback of the module. Majority of the participants strongly agreed that the content in the module was comprehensive and included all aspects of SPD's. Most participants were in



strong agreement that the presenter had good communication skills and was well versed and thorough with the contents. They agreed that the questions of the case based scenarios were easy to understand and that they were helpful in providing in-depth understanding of the SPD's. Majority felt that appropriate teaching and learning aids were used and doubts and queries were appropriately addressed. Almost all participants were in agreement that the assessment methods tested their knowledge thoroughly. There was a strong agreement that there was an improvement in knowledge of SPD's and that there is a need for an educational module for special educators. Most participants feel confident enough to identify and refer a child having SPD's for physiotherapy treatment after attending the online module. In the open-ended feedback most participants acknowledged the informative sessions and agreed that monthly programs would help in updating the special educators. There were also a few suggestions for in-depth discussions of and tactile and proprioceptive sensory processing disorders and hypo/hypersensitive responses.

Discussion

This study is a detailed account of the process of the development of an online module on Sensory Processing Disorders for special educators. It was specially created keeping in mind the need of understanding of this topic among special educators. A total of 16% of school aged children are likely to be affected with SPD's and their cognitive and behavioural deficits will impact the affected individual and families [24]. The learning environment plays a crucial role in the child's output and knowledge of SPD's may bring about positive changes in the child's performance in school and society at large. A collaboration between special educators and the physiotherapists is essential for an integrated rehabilitation of children having SPD's [25]. This module is important as it is tailored to suit the needs of special educators. All the guidelines of the ADDIE model were followed to chalk out a detailed module. The module not only includes didactic lectures but also group discussions for the case-based scenarios. Content validation was done after the designing and development phase was completed. A study done by Yousouff MSB states that a score of at least 0.83 is an acceptable value where the number of experts is between 6-8 [20]. Both CVR and I-CVI were found to have acceptable values. The assessments included MCQ's and case based scenarios. The MCQ scores showed an improvement by 20%. This reflects the ability of the participant to basic recall basic facts and information related to SPD's and also the ability to analyse information related to different sensory systems. The case-based scenarios showed a significant improvement in the post test scores as compared to the pre-test scores. The case-based scenarios were a reflection of the participants' in-depth understanding of the seven sensory systems. The critical thinking and applied knowledge ability of the participants



was also tested in the case-based scenarios. This applied knowledge is especially crucial from the point of view of special educators because this will enable them to identify students who may have SPD's, encourage them to make changes in the classroom scenario and counsel the family for referrals to neurophysiotherapists. The structured feedback about the module was positive and highlighted the need for a module on SPD's. Means et al. (2013) conducted a meta-analysis of the empirical literature and found that online and blended learning can be as effective as traditional face-to-face instruction [26]. Online education provides access learning and opportunities for knowledge and skill upgradation, additional courses and personal enrichment [27]. In this study the researcher could interact with the participants during discussions of case based scenarios which followed a didactic session thereby limiting the drawback of an online educational module. This also prompted the participants who may have been reluctant initially to ask questions and solve doubts. This made the module student centric and interactive. The suggestions provided by the participants in the structured as well open-ended feedback were incorporated to make the module more robust and comprehensive.

Conclusion



The validation of the module showed the contents of the module had very good clarity. The validators agreed that the module is highly important and relevant in providing knowledge of Sensory Processing Disorders to special educators. A comparison of the pre-test and post-test scores effectively demonstrated an improvement in the knowledge of SPD's among special educators. The feedback for the online module proved that the module was thorough, well designed and suited to the needs of the special educators. The online educational module on SPDs is therefore a useful tool in providing knowledge about SPD's to special educators.

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