

## Development of learning model based on sensory integration for students experiencing learning disabilities age 7–8 years

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### Abstract

This study aims to develop a learning model, based on sensory integration, for improving academic abilities in low-grade elementary school students, aged 7-8 years experiencing learning disabilities. This intervention is known to be an effective learning model for students experiencing learning impairments. The methodology included a mixed design with research and development techniques, as well as Martini Jamaris's Model. The subjects were 400 students of an elementary school in DKI Jakarta. The results showed that the learning model using interventions based on sensory integration is more effective than the conventional type, which is used in reducing sensation hypersensitivity and hyposensitivity to an adaptive response. All students with learning disabilities who received an intervention based on sensory integration are 100% progressed in acquiring better academic skills and more adaptive.

**Keywords:** Model development, Learning disabilities, and Sensory integration

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### Introduction

A child is known to follow normal sensorimotor developmental stages when carrying out daily activities without significant difficulties. These activities include physical exertion and involve the seven sensory organs functioning together. Children learn through eyes that integrate with other senses, such as tactile, auditory, taste, smell, and movements. The eyes with the hands give a signal to express wishes, while the child learns to understand the function of an object and the purpose of action before being able to put out the words (Aziz, 2019).

The need to combine one sensory organ with another often occurs in early childhood. Some children have a strong urge to always touch the objects around them and wander around. The learning process of recognizing an object, not only requires the sense of sight but also touch. The normal process in learning is to combine various inputs from the sense organs (Bundy, Lane, & Murray, 2002).

The COVID-19 pandemic has a serious impact on all areas of human life. The outbreak has also caused serious concerns for the global educational system, prompting school closures in over 100 countries around the world (Onyema & Eucheria, 2020). The global school closure certainly has an impact on learning process (Oviyanti, 2021), and in turn affect the sense organs due to the pandemic.

School is where children spend most of their time besides being at home, experiencing different problems, such as learning difficulties (Gephart, 2019). Schools demand logical assignments from children, and when it is not met, it is attributed to learning disability (Maehler & Schuchardt, 2016).

The first signs of learning disabilities appear in early kindergarten, but it is rarely identified till the end of the level or before the first grade (Pesova, Sivevska, & Runceva, 2014). School-aged children who experience learning disabilities have varying incidence. In developed countries, such as the United States and Europe, the incidence is approximately 10-15% of the school population. The incidence in boys is more common compared to girls at the ratio of 8:1 (Chodijah, 2014). In Indonesia, there are several studies on the existence of children with learning disabilities. Among others is the research conducted by Nafsiah Ibrahim on 3,215 students of first to sixth-grade elementary school in DKI Jakarta. The study showed that there were 16.52% of students with learning disabilities (Abdurrahman, 2012). It was also found that there were 35.9% of students with learning disabilities at one of the elementary schools in West Jakarta from grades one to six.

In general, students with impairment usually experience problems in sensory integration (Bundy, et al., 2002; Leong, Carter, & Stephenson, 2013, 2015; Young & Furga, 2016). Learning disabilities caused by problems of sensory integration lead to difficulty in managing incoming information, concentrate, and absorb subject matter (Chuang, Kuo, Fan, & Hsu, 2017). The impairment caused by a disturbance in one of the sensory systems are usually substituted in the remedial process with an alternative (Hahn, Foxe, & Molholm, 2014).

Many research have previously investigated interventions for children with learning disabilities based on sensory systems. Aeni (2019) conducted a research entitled "The Effectiveness of Motion Therapy in Handling Learning in Students of State Elementary School, Kranji 2 Purwokerto". The study showed that motion therapy is not effective in overcoming learning difficulties, does not establish the right diagnosis, and there are no other supporting examinations. The research of Sa'adati entitled "Psychological Interventions for Students with Learning Disabilities (Dyslexia, Dysgraphia, and Dyscalculia)" showed that brain exertion is an alternative instrument used to help improve children's intelligence and achievement (Sa'adati, 2015). However, students were treated equally, despite the fact that every child who had the same disorder would have different problems. Hussaindeen et al conducted a study with the title "Efficacy of Vision Therapy in Children with Learning Disability and Associated Binocular Vision Anomalies". The research explained that vision therapy improves children's reading skills (Hussaindeen, Shah, Ramani, & Ramanujan, 2018). There are five sensory system that affect the learning process in a student, namely, vision, auditory, tactile, vestibular, and proprioceptive. H.M. Leong et al conducted a research entitled "Sensory Integration Therapy in Malaysia and Singapore: Sources of Information and Reason for Use in Early Intervention". The study examined the sources of information and the use of sensory integration as an intervention in children with learning disabilities and was carried out in two countries, namely Malaysia and Singapore. It was also stated that one of the professionals performed interventions based on sensory integration is the teacher. In respect to the main examination, it should be carried out by an occupational therapist (Leong, et al., 2013).

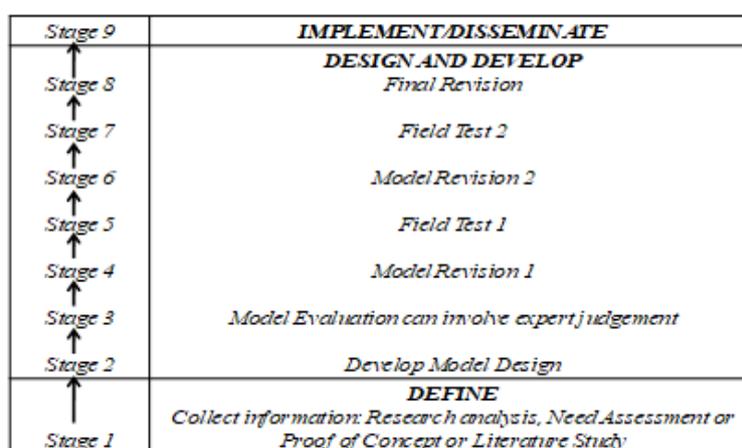
Based on the empirical data found in the field and several related studies described above, the focus of this study include, 1) providing an integrated supporting examination (intellectual test (IQ), hearing and vision function, learning disability, and sensory integration profile assessment), 2) giving interventions in accordance with the student's sensory profile, to increase efficacy, 3) performing sensation tests that affect the learning process, namely visual, auditory, tactile, vestibular, and proprioceptive, 4) providing interventions that do not only affect the physical activity but also modify the classroom environment for the adaptive response of students, and 5) giving interventions that is carried out by teachers who have attended the training.

This study focuses on developing a learning model based on sensory integration used for intervention of students with learning disabilities aged 7-8 years, given by teachers to improve academic abilities.

## Method

This research was conducted between September 2017 – March 2019 in four elementary schools in DKI Jakarta, which included a total of 400 participants. It was divided into two core activities, namely developing instruments test and validating the resulting learning model.

A mixed design was used with a research and development approach(Creswell, 2013; Creswell, Fetters, & Ivankova, 2004), which are processes for developing a model to be carried out in the field of education. According to Borg and Gall, research and development in the field of education is a developing model used to design a new product, which is then systematically tested, prospected, and refined to meet the intended criteria for effectiveness, quality, or in accordance with predetermined standards(Gall, Borg, & Gall, 1996). Based on the seven steps of research and development from Borg and Gall and Dick & Carey(2015), the implementation of this research was carried out in three stages, namely: 1) preliminary, 2) development, and 3) model validation. In a more practical aspect, the study procedure used Martini Jamaris' research and development model, as shown in figure 1(Martini & Edwita, 2014).



**Figure 1**<Martini Jamaris’s Research and Development Model(Martini & Edwita, 2014)>

The research procedure modifies the steps of Martini Jamaris' R&D model from preliminary studies to the preparation of the final model product. The first stage is the preliminary study which is the initial or preparation phase for development. The preparation begins by analyzing research needs in terms of community demands for alternative models as illustrated in the study background(Setyosari, 2016). This stage uses a descriptive method, which consists of three steps, namely: 1) literature, 2) field, and 3) compiling a model. Based on the literature study and data obtained from the field survey (Kim & Klinger, 2018)at SDN Mangga Besar 15 Pagi West Jakarta, an initial draft of the product was prepared and validated by experts. In the second stage, namely the development study, the draft is tested using the evaluative method. Learning model based on sensory integration was developed through two trials and each was evaluated. During the research process, observations were made, notes of various incidents were taken, and responses, activities, and progress made by the children were recorded. Based on the findings, evaluation, revision, and formulation of a hypothetical model were carried out. In the third stage, the hypothetical model was validated by conducting experimental research on other subjects at SDN Tugu Utara, 21 Pagi North Jakarta. The validation aims to test the effectiveness of the resulting product, namely the sensori-integration-based learning model. in this case, low-grade elementary school students aged 7-8 years, who have learning disabilities at different schools of SDN Tugu Utara 21 Pagi North Jakarta, were used as a control group in carrying out independent t-test or Mann Whitney test and an inter-case analysis. These steps are described in figure 2.

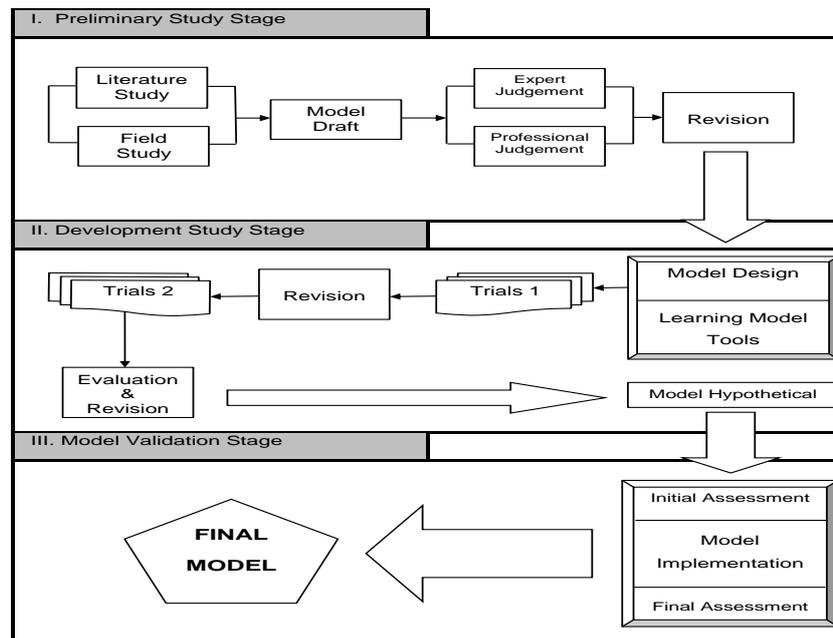


Figure 2<Research and Development Design of Learning Model, Based on Sensory Integration (Modification of the Martini Jamaris’s Research and Development Model)>

## Results and Discussion

### Results of Model Development

The model development through the application of learning design showed that, there were differences in the pre and post-test of learning disabilities and sensory integration profiles in the experimental and control groups. Finally, a learning model based on sensory integration was obtained for students with learning disabilities aged 7-8 years and explained in Figure 3.

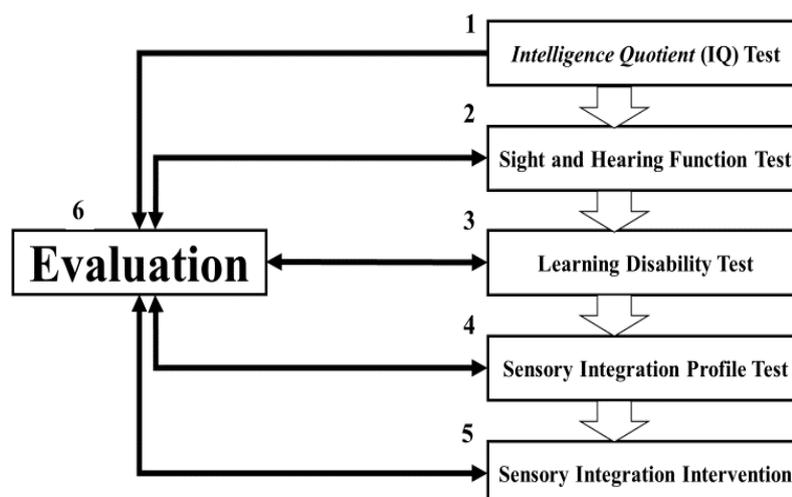


Figure 3<Final Model>

The development of a learning model that is produced using an intervention, resulted in six steps as follows: 1) conducting an intelligence/IQ test to enforce a minimum level of normal understanding, 2) examining the vision and hearing function to determine whether it is impaired or not, 3) carrying out a learning disability test, 4) testing the sensory integration profile, 5) performing sensory integration interventions according to students' profile to improve responses to stimuli received adaptively, and 6) evaluating the progress experienced by students after being given a sensory integration intervention.

### **Eligibility of Model**

The tests carried out in the experimental group using the paired t-test or the Wilcoxon test (Rey & Neuhäuser, 2011) provided the information before and after learning using interventions, in small, medium, and large groups. This produced a great value < significant alpha 5% or 0.05, except for the small group dyslexia dimension, then H1 is accepted. It is observed that there are differences before and after learning using interventions, on the dyslexia, dysgraphia, and dyscalculia dimensions of the medium and large groups. These results showed that in each group, students have difficulty in completing tasks in learning, reading, writing, and the mathematics given. The mean value of disabilities after learning using the interventions was smaller than before. This indicated that the interventions were able to reduce the difficulty level of learning disabilities in the aspects of reading, writing, and mathematics assignments given.

The test conducted in the experimental group using the paired t-test or the Wilcoxon test, provided the information about testing the sensory integration profile, before and after learning using the intervention on all dimensions, namely visual, auditory, tactile, vestibular, and proprioceptive. The medium and large groups produced a significant value of < 5% alpha or 0.05, and H1 was accepted. Therefore, there were differences in the sensory integration profile test before and after learning, in the medium and large groups. This indicated that after using the interventions, there was a change in children's responses to visual, auditory, tactile, vestibular, and proprioceptive stimuli both groups. The mean value of the post-test which is greater than the pre-test indicated that the intervention was able to reduce hypersensitivity or hyposensitivity for students with disabilities to adapt to the learning condition. However, the results also showed that the interventions had no effect on small groups.

### **Effectiveness of Model**

Based on the examination conducted using a learning disability test, there were differences in the level of impairment (dysgraphia and dyscalculia) before using the interventions in the experimental group. The mean value of the experimental group was lower than that of the control, indicating that the intervention was more effective in reducing the level of impairment compared to using the conventional learning on the dimensions of dysgraphia and dyscalculia.

Based on the sensory integration profile test, there were differences after learning using the interventions on the auditory, tactile, vestibular, and proprioceptive dimensions (Jorquera-Cabrera, Romero-Ayuso, Rodriguez-Gil, & Triviño-Juárez, 2017; Pekçetin, Akı, Üstünyurt, & Kayıhan, 2016; Pfeiffer, Daly, Nicholls, & Gullo, 2015). This showed that the intervention was more effective in children's responses to the sensational stimuli. The mean value of the experimental group was higher than the control, indicating that the intervention was more effective than the conventional learning in schools, in terms of reducing auditory, tactile, vestibular, and proprioceptive hypersensitivity and hyposensitivity to adaptive responses.

The effectiveness test were also described in the form of an inter-case analysis. The results showed that all students with learning disabilities who received interventions, improved by 100% progress in academic abilities and became more adaptive. Its shows that interventions help students to be more sensitives towards the stimulus (Fletcher, Lyon, Fuchs, & Barnes, 2018).

### **Discussion**

The analysis of the effectiveness of the learning model based on sensory integration on students with learning disabilities aged 7-8 years proved to be successful in improving academic abilities and more adaptive responses. The analysis was in line with the concept of the information processing model, which was one of the appropriate educational program for children experiencing learning disabilities (Juntorn,

Sripetcharawat, & Munkhetvit, 2017; Smith, 2012; Taderera & Hall, 2017). The information processing model describes learning as a series of components involving sensory stimulation (Kirk, Gallagher, Coleman, & Anastasiow, 2009; Pagliano, 2012). Interventions are designed for children experiencing learning disabilities involving controlled sensory stimulation (Leong, et al., 2013, 2015). Bundy et al., supported this research because interventions are very effective in children aged 3-8 years (Bundy, et al., 2002).

Improved academic ability and better sensation conditions occurred due to decreased levels of learning disabilities and sensations of hypersensitivity and hyposensitivity to adaptive responses (Blythe, 2017; Ip et al., 2018; Soto, Ciaramitaro, & Carter, 2018). It was found that the children's academic ability and sensation condition were better after receiving the intervention according to the theory used by Han Ming Leong et al., (2013) in a study titled "Meta-analysis of Sensory Integration Therapy Research for Individuals With Developmental and Learning Disabilities". The theory showed that interventions based on sensory integration are widely used in addressing academic problems. This was also conveyed by H.M. Leong et al., (2015) in another study entitled "Sensory Integration Therapy in Malaysia and Singapore: Sources of Information and Reason for Use in Early Intervention". The study stated that interventions based on sensory integration improves neurological problems in processing intellectual information. Therefore, this intervention is used to correct sensory processing disorders and improves learning and academic abilities (Leong, et al., 2013, 2015).

## Conclusions

The conclusion are the development of learning model is aimed at solving problems faced by students experiencing learning disabilities. There was an increase in the sensory profile of students, which in turn affected their academic condition and learning skills in reading, writing, and arithmetic/mathematical skills. This implies that in the future, teachers should pay more attention to sensory aspects to curtail learning problems experienced by students and improve their understanding skills.

There are obstacles related to the application of learning models, namely the lack of knowledge and skills possessed by the teacher. This study disseminate information to teachers about the newly developed learning model. Additionally, teachers' awareness is still lacking regarding the importance of the sensory model in supporting the learning process that contributes to improving academic achievement. This development needs to be followed up with training, which is aimed to improve teachers' knowledge and skills when dealing with students having learning impairments.

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