

Using Multisensory Strategies to Increase Student Engagement during Story Time Among Three-Year-Old Preschoolers

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Abstract: This action research showcases how multisensory strategies during storytelling can increase student engagement among three-year-old students. This qualitative quasi-experimental research was conducted in a Malate, Manila preschool, studying 4 students (sampled through convenience), using a revised version of the Student Engagement Observation Checklist (SEOC) by Finn, Folger and Cox, 1991; Cassar and Jang, 2010, measuring the students' engagement during storytelling pre-intervention, with interventions, and post-intervention. Three-year-old students find it difficult to focus during traditional storytelling, particularly those of this generation, being more exposed to fast-paced media. Thus, the researchers added olfactory and gustatory interventions to address this problem. Case study results showed that students struggled with focusing during pre-interventions. Contrastingly, engagement was higher during sessions including interventions, like using edible and scented items in activities. In these sessions, the students focused and interacted with the research team more (rather than making unrelated remarks similar to the pre-intervention sessions), and disrupted less often. Using said items therefore significantly helped immerse themselves in, understand, and remember the story more. Thus data implies that students' engagement during storytelling can substantially, positively be affected by the inclusion of interventions pertaining to the students' senses of smell and taste.

Keywords: *multisensory, student engagement, repeated interactive read-aloud, olfactory, gustatory*

1. INTRODUCTION

Stories grow children's linguistic, mathematical, scientific, and socioemotional skills, introduce them to experiences to help them better understand those who are different from them, and help them feel seen when they can relate to characters they see (Rahiem, 2021). Children's critical thinking is enhanced as they learn to infer story events by asking questions, sparking their innate curiosity, which encourages them to keep learning. Hence, storytime is an integral part of childhood education. Unfortunately, children do not always pay attention during storytime. Despite particular engagement activities that teachers have tried (Bartan, 2020) or trying to do multiple at once (Easy Ways to Engage Children During Storytime, 2020) these methods either bore or overwhelm the children. This issue continues to grow, as this generation is used to fast-paced technology (Hong, et.al, 2022). As such, according to Ponticorvo et.al., (2018) multisensory strategies provide multimodal input for the children. Using props that give sensory stimulation increases

attention and immersion, and thus, more learning (Slange, 2016). Hence, the researchers aim to update old and test new multisensory strategies. As trying too many strategies at once overwhelms children, and as storytelling is already multisensory in nature, (the visual strategy being the illustrations and the auditory strategy being the reading aloud), the researchers only focused on using gustatory and olfactory strategies.

1.1 BACKGROUND OF THE STUDY

In a small preschool in Malate, Manila, one Nursery class consisting of 10 students was observed. During story time sessions, teachers reflect traditional storytelling techniques such as the usual setting of putting the seats in a circle while holding a standard sized story book. Here, it had been observed that children would stand up and step out of the circle to get toys from the shelves from time to time. According to Hutton (2020), children in this age group can hold their attention between 3-8 minutes. However, this was in contrast to what was observed as the nursery students could not hold their attention for the minimum average

of 3 minutes. It was apparent that however well read by the teacher—pointing out the illustrations, modulating her voice, exaggerating her facial expressions and movements, as well as pausing to ask students questions—keeping them engaged during storytelling sessions was a challenge. In this light, the researchers engaged the children in a multisensory storytelling experience, tapping into their senses, particularly their sense of smell and taste, to keep and sustain their attention for better student engagement.

1.2 STATEMENT OF THE PROBLEM

This study aimed to answer the following:

1. How engaged are the students before the implementations of the multisensory strategies?
2. How engaged are the students after the implementations of the multisensory strategies?
3. Does multisensory intervention make a significant impact on student engagement during storytelling?

1.3 SIGNIFICANCE OF THE STUDY

This action research aimed to see if using gustatory and olfactory strategies such as the use of props for smelling and tasting for a more immersive experience during storytime would improve student engagement. In this study, educators and the parents involved learned new storytime strategies that allow children to engage with the story material more.

1.4 SCOPE AND LIMITATION OF THE STUDY

The following are the identified scope and limitations of the study: 1. This study was conducted at a small Preschool, in Malate, Manila; 2. Results were based on a small sample size of 4 nursery students; and 3. The available age-appropriate storybooks were limited.

1.5 RATIONALE

In pathways wherein physical storybooks were replaced with digital storytelling apps to address such concerns, this study offered exploration into the integration of sensory stimulating props and activities (Multisensory Strategies) as an interactive way to complement and maximize reading physical storybooks. Furthermore, presenting how targeting the different senses, particularly the uncommonly tapped, the sense

of smell and taste, during storytime allows children to be engaged in the process of storytelling.

1.6 REVIEW OF RELATED LITERATURE

The Three-Year-Old Child as an Active Sensory-Motor Learner and the Multisensory Brain

According to McLeod (2024), Leninger (n.d.), and Ariani, Intani, Sarli, & Podar (2021), the learning of three-year-olds depend on interacting with stimuli, as they are in the Symbolic Function Stage, this is especially true as Gu & Zaidel (2024) and Velasco & Obrist (2021) state that human experiences are innately multisensory. Multisensory strategies hence strengthen development (Sarudin et al. 2019).

Multisensory Strategies in Storytelling: Olfactory and Gustatory

According to Neumann et al, (2012), using activities that stimulate multiple senses is referred to as multisensory learning. New concepts may be introduced, whilst building familiarity, when integrating sensory props during storytime (Brug, 2015; Storykate, 2023). However, the multisensory stimuli should match the story (Frassinetti, Bolognini, & Ladavas, 2002; Koelewijn et al. 2010). Furthermore, these stimuli should be used by the children (Brug, 2015). Reading is a visual and auditory activity by nature (Lane, 2022), but olfactory and gustatory activities are not often incorporated (Sarah, 2018). Kurcikova (2024) states that the latter aforementioned senses pique children's interest better. Additionally, Purinton & Burke (2019) and Minshew (2019) state that targeting a single sense per time improves comprehension.

Repeated Interactive Read-aloud

According to McGee & Shickedan (2007), children understand stories better when the same story is read aloud thrice in different ways. This is especially effective when multisensory activities are implemented.

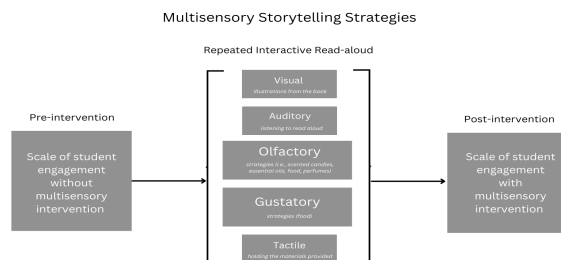
Rao, Newlin-Haus, & Ehrhardt (2016), stated that Repeated Interactive Read-aloud is a research-based technique, proven to be effective not only in increasing children's engagement but also understanding and appreciation toward reading.

Definition of Student Engagement

Student engagement measures how involved students are in class, including the amount of effort they put into activities and interactions (Fife, n.d.). With three-year-olds, this focuses on how curious, attentive,

and interested they are in the activities (Joyce n.d.). “Student engagement involves three main factors: behavioral, emotional, and cognitive factors. The behavioral factors include effort, persistence, concentration, asking questions, and class communication.” (Li & Xue 2023). Student engagement allows teachers to examine what their students are thinking and feeling about what they are learning.

1.8 CONCEPTUAL FRAMEWORK



(Figure 1. Conceptual Framework for observing the three-year-old preschooler's scale of student engagement during pre and post intervention.)

Student engagement without interventions were needed beforehand, and thus is highlighted in the framework, using an edited version of Cassar and Jang's (2010) Student Engagement Scale. The independent variable is the multisensory storytelling, the dependent variable is student engagement, and the progress is tracked by the pre- and post- tests.

2. METHODOLOGY

2.1 RESEARCH DESIGN

A qualitative quasi-experimental design using a convenience sample was used for the student's engagement to be evaluated. According to Majka (2024), a baseline is provided by pretest scores, while the intervention's effectiveness is implied by the post-test results.

2.2. SAMPLE/SUBJECT/RESPONDENTS

This study used convenience sampling, as the participants all come from the same section, who are all Filipinos and three years of age, living in Malate, Manila. The class consisted of 10 students, with 6 boys and 4 girls. A consent form was issued to the students' parents/guardians to ensure that they allowed their children to participate, under the condition that their identities were not disclosed in this study as well as

ensuring their child's safety – wherein all practices are aligned to the ethical standards of the student researchers' university. 6 out of the 10 students have submitted their accomplished parents' consent forms, however, inconsistent attendance among the 6 participating students has impacted their eligibility to participate. Consequently, the sample size decreased to a total of 4 student research participants *Table 2*.

Name	Gender	Age	Primary language
Child 1	M	3	Filipino
Child 2	M	3	Filipino
Child 3	F	3	Filipino
Child 4	F	3	Filipino

Table 2. Description of research participants.

2.3 SOURCES OF DATA/INSTRUMENTS

The SEOC includes Effort, Initiative, Disruptive, and Inattentive traits rated on a Likert Scale for a quantitative analysis. (These behavioral traits were adapted and edited from the revised SEOC of Cassar and Jang (2010), and approved by education expert Ms. Maria Rita Tapales.). Behavioral documentations are written as well via observation notes.

2.4 DATA GATHERING PROCEDURE

The research team visited the sample class for a total of 13 sessions in a span of 4 weeks. The first session was used to select story books, here, two factors were considered: age-appropriateness and the presence of the olfactory and gustatory elements in the story. The 4 selected story books are as follows: *Kayang-kaya* by Alyssa Judith Reyes, *Araw sa Palengke* by May Tobias-Papa, *Bahay Kubo*, illustrated by Hermes Alegre, and *Asul na Araw* by Pipa Escalante. All books selected have been approved by the Class Adviser of the Nursery class.

Pre-intervention

Since the research team adopted the 3-day Repeated Interactive Read Aloud, Day 1 of each book serves as the introductory session. Here, story books are read using the existing traditional strategies such as reading the storybook while asking them questions from time to time as the main form of engagement.

Intervention

Day 2 of the 3-day Repeated Interactive Read Aloud is for the integration of the multisensory strategies while story reading, particularly, targeting the olfactory and gustatory senses. During reading, students are presented with edible or scented items congruent to the elements found in the story book (i.e., eating pandesal and spread to match the breakfast picture in *Kayang-kaya*) – as a strategy to increase student engagement. The integrated edible and scented materials and activities were also aligned to the lesson objectives.

Post-intervention

Day 3 of the 3-day Repeated Interactive Read Aloud was for reviewing the story that served as a wrap up session. Here, students' understanding and recalling of events are challenged and observed.

2.5 DATA ANALYSIS

Over four books, the Likert Scale will be used to measure scores during a pre-intervention, intervention, and post-intervention. A case study presents each child, which includes direct quotes and behaviors observed, showing the impact of the multisensory interventions on their engagement, (making this a mixed-methods approach [Creswell, 2009]).

3. RESULTS AND DISCUSSION

Child 1

Child 1 (M) is playful and active but can often get disruptive as he prefers to engage in play activities.

Book 1				
Session	Effort	Initiative	Disruptive	Inattentive
Pre-intervention	13	5	15	10
Intervention	18	5	8	12
Post-intervention	6	3	15	15
Book 2				
Pre-intervention	11	5	12	6
Intervention	A	A	A	A
Post-intervention	6	2	14	7
Book 3				
Pre-intervention	6	2	12	7
Intervention	7	2	15	11
Post-intervention	8	2	11	8
Book 4				
Pre-intervention	17	7	15	12
Intervention	16	7	11	7
Post-intervention	18	8	8	4

Table 3. SEOC Scores of Child 1 across all 4 books.

It can be seen that Child 1's Effort score was significantly higher on the first pre-intervention and has then declined towards the last book. His Initiative scores were consistently low with scores ranging from 2-5. On the other hand, his score in negative scales such as Disruptive and Inattentive behaviors revealed lower

scores on Book 2 and 3 while having a slight rise on the last book. Yet, still his scores for disruptive scale behavior were generally high. In the first pre-intervention session, Child 1 was more responsive to the storyteller's questions and prompts. For instance, as soon as the storyteller began to ask them, "*Handa na ba kayo?*" He immediately replied "*Opo.*" When it comes to his initiative, he only responds when directly asked and does not show an attempt of sharing thoughts and ideas in class (hence the low score). Likewise, every pre-intervention session, Child 1 was observed to be disruptive and unable to keep still in one place before the story even started (hence, high score on the disruptive scale). Lastly, for inattentive scale, while he consistently disrupted his classmates he began showing interest in listening to the storybook when none of his peers entertained him (hence, lower inattentive score towards the end as he shifted his interest towards the book). For the intervention sessions, his Effort score for the first book was the highest recorded among the four books, it then dropped down for the third book and significantly rose again for the last book. On the other hand, Child 1's Disruptive behavior peaked in the third book and then dropped for the last book by, having a 4-point difference. In the first intervention session, he volunteered to be the first to try the intervention activity (sandwich making related to the breakfast scenario – gustatory intervention). However, when called or asked to answer a question about the story, he mostly did not respond with an answer related to the story. He also only shared his thoughts about the activity when the storyteller asked "*masarap ba?*" he nodded his head and gave a thumbs up to show how much he liked it (lower scores in both the negative engagement scales). Based on his results, his behavior improved once again in Book 4. He even guessed the first item right when he said "*candy*" after sniffing the item as part of the intervention — regaining better SEOC scores across 4 scales). Generally, it can be seen that Child 1 became more interested and engaged in listening to the story when he showed higher Effort scores throughout the intervention sessions compared to his pre-intervention Effort scores. This suggests that the integration of the olfactory and gustatory senses such as making and eating the sandwich and smelling edible items pushed him to put in more effort to stay engaged. Overall, Child 1 seemed to have better scores at the latter part of the AR implementation. Comparing the first post-intervention results to the last post-intervention results, it is worth noting that his scores for Effort (from 6 to 18) and Initiative were higher (from 3 to 8), while his recorded

scores for negative scales were significantly lower (Disruptive, from 15 to 8) and (Inattentive, from 10 to 4). It can be assumed that Child 1 had a gradual adjustment on the integrated multisensory activities throughout the sessions.

Child 2

Child 2 (M) may be initially playful, but will quiet down once you call his attention. He pays great attention to stories as well.

Book 1				
Session	Effort	Initiative	Disruptive	Inattentive
Pre-intervention	17	7	15	12
Intervention	22	8	3	7
Post-intervention	18	8	8	4
Book 2				
Pre-intervention	18	8	13	10
Intervention	23	9	10	7
Post-intervention	A	A	A	A
Book 3				
Pre-intervention	14	8	15	10
Intervention	20	7	15	7
Post-intervention	13	5	10	12
Book 4				
Pre-intervention	17	7	15	12
Intervention	20	8	9	10
Post-intervention	21	9	7	7

Table 4. SEOC Scores of Child 2 across all 4 books.

This child's initiative and inattentive scores somewhat resemble a pattern, as their scores for Books 2 and 3 were similar. Another pattern is the child's initiative scores, which inclined from the first to the last book, as well as their inattentive scores declining towards the same direction. Additionally, Book 4 provided the best scores for effort and initiative and the least scores for disruptive and inattentive, while Book 1 provided the best scores for disruptive and inattentive.

Child 2 received high effort scores during times when he was quick to point out illustrations featured in the book even before being asked about it. However, his effort was not consistent, as he was often bringing up matters that were unrelated to the story as well, hence leading him to being unable to answer questions about the book. Even during times he would "answer", it was usually to do so unseriously, such as bringing up his beloved character Venom. Child 2's effort and initiative scores were highest during the intervention session of Book 2. There are no consistent patterns aside from the child's inattentive scores, which suddenly increased by the final book. Additionally, the third book boasts the highest disruptive score. Although Child 2's effort remained inconsistent due to his habit of bringing up topics unrelated to the story, his scores are still noticeably higher than before, as he would enthusiastically participate in the intervention activities provided, such as when the storyteller covered his eyes

to identify an object that was mentioned in the book only based on its taste. An example of this is when he tasted peanuts, to which he guessed "*Mani! Kinakain ito ng mama ko!*". Even when the storyteller prompted interactions during the actual story, he would happily cooperate, such as when he was asked to repeat the phrase "Magandang gabi!", as mentioned in the book. On the other hand, effort and initiative scores are higher for the post-intervention scores, while the second pattern is that the disruptive and inattentive scores are lower for the post-intervention. Overall, the fourth book had the best post-intervention statistics, with it having the highest effort and initiative scores and lowest disruptive and inattentive scores among the four books. The initiative scores were mostly high for the post-intervention, as Child 2 was more willing to participate, interact with the storyteller, and answer questions properly. Particularly, he could recall what the activity we did was or what the story was about. An example of this was when he remembered the activity before having him eat pandesal, to which he remarked "Kumain tayo ng pandesal!" Although signs of inattentive and disruptive behavior were still present, such as when he would continue to roam around the classroom, these scores were still lower for the post-interventions as he was still more attentive than he was during the pre-interventions.

Child 3

Child 3 (F) normally pays attention as soon as the storyteller asks for it. She often points out the tiny details of a book's illustrations.

Book 1				
Session	Effort	Initiative	Disruptive	Inattentive
Pre-intervention	19	8	7	8
Intervention	A	A	A	A
Post-intervention	22	10	6	7
Book 2				
Pre-intervention	21	10	5	9
Intervention	22	10	3	7
Post-intervention	23	10	8	7
Book 3				
Pre-intervention	13	6	8	10
Intervention	21	10	6	7
Post-intervention	18	9	6	7
Book 4				
Pre-intervention	13	6	8	6
Intervention	22	10	7	5
Post-intervention	A	A	A	A

Table 5. SEOC Scores of Child 3 across all 4 books.

In the table it can be seen that the book with the highest effort and initiative scores is Book 2, while the book with the highest disruptive and inattentive scores is Book 3. Additionally, the books with the lowest

effort and initiative scores are Books 3 and 4. There is no pattern present in these statistics, aside from the inattentive scores inclining from Books 1 to 3, until suddenly dropping during Book 4.

When Child 3 experienced difficulties in focusing on the story and remembering important parts after it was read, as well as shared unrelated thoughts, her effort scores would lessen. However, her scores would pick up once she sincerely tried to answer questions and often gestured at parts of the story's pictures. In contrast, on the occasion that she would unseriously respond to questions, her initiative scores would drop, while they would pick up once she tried her best to interact with the storyteller, even when her peers would be distracting. An example of her disruptive behavior was when she would tap on the book. Child 3's intervention scores are mostly consistent, notably how her initiative scores are the same throughout Books 2 to 4. Her inattentive scores suddenly dropped during Book 4, while her disruptive score continued to incline. She did not completely cooperate during the activities (such as the instance where she refused to eat a vegetable for one of the games), she still willingly participated in her own way, such as copying the guesses of her peers, "Mani!", despite not tasting it herself. Hence, she received high scores for effort. Her initiative remains consistent as she always appropriately interacted with the storyteller. The effort and initiative scores are generally higher for the post-intervention, while the disruptive and inattentive scores are generally lower. The only times this pattern did not occur were: the tied initiative score for the pre and post-interventions of Book 2 and the higher post-intervention disruptive score. Her post-intervention inattentive scores were consistent throughout all books. The highest post-intervention effort scores belong to Book 2, the highest post-intervention initiative scores are tied between Books 1 and 2, and the highest post-intervention disruptive score belongs to Book 2. Moreover, her effort score increased post-intervention as her answers to questions about the story had grown more specific, especially as he put in more effort to recall tiny details (hence the higher score in initiative).

Child 4

Child 4 (F) is quiet and observant but is only comfortable to directly share her thoughts with the teacher. She rarely becomes disruptive but gets easily distracted by her peers.

Book 1				
Session	Effort	Initiative	Disruptive	Inattentive
Pre-intervention	16	7	4	12
Intervention	20	9	3	8
Post-intervention	21	10	4	7
Book 2				
Pre-intervention	20	10	3	11
Intervention	23	9	3	7
Post-intervention	23	9	4	7
Book 3				
Pre-intervention	10	4	8	8
Intervention	21	8	4	7
Post-intervention	16	7	5	7
Book 4				
Pre-intervention	18	6	3	6
Intervention	25	7	3	4
Post-intervention	19	8	6	9

Table 6. SEOC Scores of Child 4 across all 4 books.

The table above shows that Child 4's Effort scores are high with no score lower than 10. Among the 4 books, her Effort and Initiative score in the 2nd book is the highest. Generally, her SEOC scores across the 4 variables for book 3 appears to be the lowest in the record. During the pre-intervention sessions, Child 4 would be easily distracted with her peers' playful behavior. For instance, seeing Child 1 moving around and playing made her want to play with him too. Despite the divided attention, she was able to make an effort to answer to the storyteller's prompts. For example, when the storyteller asked: "kaya niyo na ba magsuot ng inyong sapatos?" she replied, "opo" or whenever the storyteller would get their attention by saying "batang?" she would immediately respond "handal!" (classroom hook) – hence the high recorded scores in effort – not having an effort score lower than 10. Among all the books read, she appeared to have been most active and attentive to the story of Araw sa Palengke (Book 2). In this book, she willingly shared her ideas and answered prompts. On the other hand, her SEOC scores for book 3 is the opposite of book 2. Book 3 being a folk song Bahay Kubo, with no story plot, could have been a factor as to why she had the lowest score in this book compared to her scores in the other 3 books. With this in mind, selecting storybooks that cater to the students' interests should be considered. For the intervention sessions, Child 4's Effort scores are all high, with scores progressing with a slight low on the 3rd book and peaking on book 4. Her Initiative scores, on the other hand, seemed to have declined from books 1 to 4, from 9 down to 7. Similarly, her Inattentive scores dropped significantly from having a score of 8 in the first book to a score of 4 in the last book. Looking at her Disruptive score, she showed a consistent score of 3 but peaked in

book 3 for getting a score of 4. Child 4 throughout the intervention sessions has consistently shown interest in participating in the activities. In every intervention session, Child 4 would usually sit close to the storyteller to get a better view of the book's illustrations, patiently waited for her turn, and consistently engaged with the materials with so much eagerness – such as giving sincere guesses, asking to have another whiff or taste, as well as making connections. This being her usual behavior during intervention sessions justifies the scores reflected above. With Child 4's observed behavior and high score in effort and involvement during the intervention sessions, suggests how the integrated olfactory and gustatory materials do effectively support and increase student engagement among children. Looking at her Effort and Initiative scores for post-intervention sessions were almost consistently higher than the pre-intervention. Except for Book 2 wherein her initiative score for post-intervention score was 1 point lower than the pre-intervention. On the other hand, her scores for the Disruptive scale fluctuates with books 2 and 4 having a higher Disruptive score in their post-intervention sessions, while books 1 and 2 had no to little difference.

4. CONCLUSION

Overall, the research questions can therefore be answered as follows:

First, the students lacked engagement before the multisensory (gustatory and olfactory) strategies were implemented into the storytelling. The students often did not put effort into paying attention, disrupted the storytelling by talking to the researcher or their classmates about unrelated topics, and although attempted to answer questions asked by the researcher after the stories, gave lackluster answers.

Second, the multisensory storytelling exhibited in the intervention improved the students' engagement drastically. The same can be said for the post-intervention sessions, but they did not reach the engagement level of the intervention.

Third, there is indeed a significantly positive impact created by multisensory interventions when done during storytelling. When presented with these interventions, not only are the students less likely to disrupt the storytelling session and shift their attention elsewhere, but they also put in more effort to truly comprehend what happened in the story, which helps them to remember what happened even after the story is over.

Ultimately, the findings of this research may encourage educators to consider olfactory and gustatory

senses to advance reading experience. This research proves that the integration of multisensory activities helps students pay more attention and remember the story better. For further research, a larger sample size would be more ideal to strengthen the study. Moreover, in terms of practicality concerns in adapting the intervention inside classrooms, educators may use available materials or may assign students to bring needed materials.

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6. REFERENCES

- Ariani, N., Intani, T., Sarli, D., & Poddar, S. (2021). Psychosocial Stimulation Towards the Development of Toddler 1 – 3 years Old. *Malaysian Journal of Medicine and Health Sciences*.
https://medic.upm.edu.my/upload/dokumen/2021061711405219_MJMHS_0167.pdf
- Bartan, M. (2020). The Use of Storytelling Methods by Teachers and Their Effects on Children's Understanding and Attention Span. <https://files.eric.ed.gov/fulltext/EJ1272217.pdf>
- Brug, A. (2015). A good read: a study into the use and effects of multi-sensory storytelling; a storytelling method for persons with profound intellectual and multiple disabilities. University of Groningen.
<https://research.rug.nl/en/publications/a-good-read-a-study-into-the-use-and-effects-of-multi-sensory-sto>
- Cassar, A. & Jang, E. (2010). Investigating the effects of a game-based approach in teaching word-recognition and spelling to students with reading disabilities and attention deficits. *Australian Journal of Learning Difficulties*. 15(2), 193-211.
<https://doi.org/10.1080/19404151003796516>
- Chiang, I. A., Jhangiani, R. S., & Price, P. C. (2015). *Quasi-Experimental research*. Pressbooks. <https://opentextbc.ca/researchmethods/chapter/quasi-experimental-research/>

- Coombs, H. (2022). *Case Study Research: Single or Multiple [White Paper]*. Southern Utah University. <https://doi.org/10.5281/zenodo.7604301>.
- Creswell, J. (2009). *Research Design. Qualitative, Quantitative, and Mixed Methods Approaches*. Third Edition. SAGE.
- Fife, J. (n.d.) Defining student engagement at your institution. <https://mainstay.com/blog/defining-student-engagement-at-your-institution/>
- Gu, Y. & Zaidel, A. (2024). *Advances of Multisensory Integration in the Brain*. Springer. AEMB, (1437). <https://link.springer.com/book/10.1007/978-981-99-7611-9>
- Harris, A., McGregor, J., Perencevich, E., Furuno, J., Zhu, J., Peterson, D., & Finkelstein, J. (2006). The use and interpretation of quasi-experimental studies in medical informatics. *Journal of the American Medical Informatics Association : JAMIA*, 13(1), 16–23. <https://doi.org/10.1197/jamia.M1749>
- Holly. (2018). Pre and Post Tests | Are they Beneficial in the Classroom? *Teach Starter*. <https://www.teachstarter.com/au/blog/pre-and-post-tests-are-they-beneficial-in-the-classroom>
- Hutton, N. (2020). *Attention span — Natalie Hutton Educational Psychologist*. Natalie Hutton Educational Psychologist. <https://www.nataliehutton.com/blog/attention-span>
- Kucirkova, N. (2024). The explanatory power of sensory reading for early childhood research: The role of hidden senses. *Contemporary Issues in Early Childhood*, 25(1), 93-109. <https://doi.org/10.1177/14639491221116915>
- Lane, H. (2022). *Multisensory instruction: What is it and should I bother?* Collaborative Classroom. <https://www.collaborativeclassroom.org/blog/multisensory-instruction-what-is-it-and-should-i-bother/>
- Leninger, S. (n.d.). Piaget and Vygotsky on the child becoming sign-minded. Lund University. <https://lucris.lub.lu.se/ws/files/4639100/625653.pdf>
- Li, J., & Xue, E. (2023). Dynamic Interaction between Student Learning Behaviour and Learning Environment: Meta-Analysis of Student Engagement and Its Influencing Factors. *Behavioral sciences (Basel, Switzerland)*, 13(1), 59. <https://doi.org/10.3390/bs13010059>
- McGee, L. & Schickedanz, J. (2007). Repeated Interactive Read-alouds in Preschool and Kindergarten. *The Reading Teacher*. 60 (8): 742-751. DOI:10.1598/RT.60.8.4
- McLeod, S. (2024). Piaget's Preoperational Stage (Ages 2-7). Simply Psychology. <https://www.simplypsychology.org/preoperational.html>
- Minshew, A. (2024). *Multisensory Strategies for teaching how to read - Waterford.org*. <https://www.waterford.org/blog/multisensory-learning/>
- Neumann, M., Hyde, M., Neumann, D., Hood, M., & Ford, R. (2012). *Multisensory Methods for Early Literacy Learning*. <https://www.researchgate.net/publication/257811381>
- Ponticorvo, M., Di Fuccio, R., Ferrara, F., Rega, A., Miglino, O. (2019). Multisensory Educational Materials: Five Senses to Learn. In: Di Mascio, T., et al. *Methodologies and Intelligent Systems for Technology Enhanced Learning*, 8th International Conference. MIS4TEL 2018. *Advances in Intelligent Systems and Computing*, vol 804. Springer, Cham. https://doi.org/10.1007/978-3-319-98872-6_6
- Rahiem, M. (2021). Storytelling in early childhood education: Time to go digital. Retrieved from <https://ijccep.springeropen.com/articles/10.1186/s40723-021-00081-x>
- Sarah. (2018). *Storytelling – How can we engage all the senses?* Sense of Learning. <https://senseoflearning.com/2017/11/29/storytelling-how-can-we-engage-all-the-senses/>
- Sarudin, N. a. A., Hashim, H., & Yunus, M. M. (2019). Multi-Sensory Approach: How it helps in improving words recognition? *Creative Education*, 10 (12), 3186–3194. <https://doi.org/10.4236/ce.2019.1012242>
- Slange, R. (2016). *Sensory Storytelling Stimulates Responsiveness*. Utrecht of University. <https://studenttheses.uu.nl/bitstream/handle/20.500.12932/29437/Slange,%20R.pdf?sequence=1>
- Storykate. (2023). Top Storytelling techniques for early childhood classrooms. <https://storykate.wordpress.com/2023/09/25/top-storytelling-techniques-for-early-childhood-classrooms/>
- Velasco, C., & Obrist, M. (2021). Multisensory Experiences: a primer. *Frontiers in Computer Science*, <https://doi.org/10.3389/fcomp.2021.614524>