

# **Effect of Class Size and Multisensory Intervention on the Reading Performance of Selected Primary-Level Public School Children**

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**Abstract:** This quasi-experimental research using pretest-posttest design explored if, within the context of a multisensory reading intervention, class size will affect the reading performance of primary school children (n=89) enrolled in public schools in Laguna, Philippines. Three intervention groups of varying class sizes were administered a pre-intervention reading test, provided a reading intervention, then administered a post-intervention reading test. Paired t-test comparing pretest and posttest mean scores revealed that, in all of the class size conditions, there was a significant improvement in the children's reading. Further analysis of covariance revealed that after controlling the effect of participants' pretest scores, class size had a significant effect on post-intervention reading performance. Implications of the results were discussed in conclusion.

**Keywords:** reading, class size, multisensory approach, school ecology, children

## **I. Introduction: Importance of Reading**

Almost 17% of the world's adult population and some 122 million of the world's youth are illiterate, while more than 67 million children are out of school (United Nations Educational, Scientific and Cultural Organization; UNESCO, 2015)<sup>1</sup>. In some countries, majority of children at the end of their second grade are unable to read a single word of a simple paragraph in the language they are taught (Gove & Cvelich, 2011)<sup>2</sup>. In developing and developed countries, on the other hand, illiterate people are mired in poverty (Kay, 2015)<sup>3</sup>.

In the Philippines, there has been a disturbing occurrence over the past decade. Literacy rate has plunged in between 1994 and 2003, such that more than 5 million Filipinos cannot read or write (Luz, 2007)<sup>4</sup>. More revealing is the realization that school-age children fared beneath the expected level, and this might be attributed to lack of solid foundation in the 3Rs, that is, reading, writing, and arithmetic (Luz, 2007)<sup>4</sup>.

In the aforementioned circumstances, literacy refers to a person's "ability to read and write, with understanding, a short statement about one's everyday life" (UNESCO, 2013, p. 23)<sup>5</sup>. Literacy has two kinds. First is basic or simple literacy, which is "the ability of a person to read and write with understanding of simple message in any language or dialect" (Luz, 2007, par. 6)<sup>4</sup>. Second is functional literacy, defined by the United Nations as "the ability to use reading, writing and numeracy for effective functioning and development of the individual and the community" (UNESCO, 2006, p. 158)<sup>6</sup>. In the present study, the focus shall be on one aspect of literacy: reading.

Reading is an important skill that needs to be developed, especially among children. Whether in school or in everyday life, children's ability to learn new knowledge, find new information, and solve problems relies heavily on reading ability. Thus, for a child to be literate not only for the purpose of school but also for the purpose of functioning well within the larger society, a strong foundation and interest on the basics of reading should be communicated properly (Santiago, 2008)<sup>7</sup>.

With due consideration on how necessary reading skills are, the Philippine government has initiated a program to rehabilitate reading problems of Filipino school children, as stipulated by Memorandum No. 244 (Department of Education, 2011)<sup>8</sup>. The program, bannered the title, "Every Child A Reader Program" (ECARP), promotes reading and literacy among elementary students most especially in public schools. It also aims to make every child a reader by Grade 3 (Department of Education, 2010)<sup>9</sup>. Interventions to support Filipino children who are struggling readers are also implemented (Department of Education, 2011)<sup>8</sup>. These aim to endow public school children with reading and writing skills they require in order to become successful independent learners.

By and large, reading is a core skill needed to address other learning concerns, hence, it is essential to strengthen reading instruction especially among younger children. Reading is of much value to students' success; hence, with low levels of reading performance among students in the Philippines based on local and international standards, improvement should be done in the way reading should be taught. Today, the status of teaching reading in a fast changing world has taken a back seat. It did not cope with the "e-living" lifestyle of the present. This implies that there might be a need to teach reading in efficient and effective ways.

Multisensory approaches, defined as "helping a child to learn through more than one of the senses" (Bradford, 2007, par. 2)<sup>10</sup>, in teaching reading have been explored as potential ways through which reading can be taught among children. They are deemed as

applicable to all sorts of learners, particularly those who might have difficulties (Ureno, 2012)<sup>11</sup>. Results of exploring the effect of multisensory intervention were varied. Some did not find significant improvement in learner's reading performance (Reed, 2014)<sup>12</sup>; although, there were more who asserted gains in the use of such modality (Magpuri-Lavell, et al., 2014<sup>13</sup>; Donnell, 2007)<sup>14</sup>, particularly in developing decoding and encoding abilities and increasing automaticity (Donnell, 2007)<sup>14</sup>, and even among struggling adult readers (Geertz, 2001)<sup>15</sup>. Inconclusive evidence in the use of multisensory modality in teaching reading only justifies future studies, exploring this modality's effectiveness in context, say for instance in the case of Filipino learners.

Amidst the necessity to arrive at innovative ways on teaching reading to learners is the challenge of setting up an optimal environment where reading can effectively be taught. The school ecology plays a significant role in reading development, specifically factors such as classroom and school characteristics (Kainz & Vernon-Feagans, 2007)<sup>16</sup>. Reading is a rigorous process, which involves decoding and comprehension (Gough et al. 1993)<sup>17</sup>. If struggling readers continuously find it difficult to read, the more they will not benefit from the intervention. Hence, ensuring optimum learning environment during a reading intervention session is equally important. This study particularly explored one element of the learning environment: class size.

Class size, which, in this study, pertains to the total number of children in the reading class at a particular learning instance, is defined differently by different authors (Kornfeld, 2010<sup>18</sup>; Costello, 1992)<sup>19</sup>. For instance, Costello (1992)<sup>19</sup> mentioned that small class size ranges from 14 to 25 students; while Kornfeld (2010)<sup>18</sup> operationalized small class size as having 11 students or fewer. Likewise, studies are varied in opinion as to the effect of class size in learning (Hanushek, 1998<sup>20</sup>; Costello, 1992)<sup>19</sup>. There are even studies showing that class size does not influence performance such as that of Aranjuez, et al. (2011)<sup>21</sup>. Although the evidence is inconclusive (Hanushek, 1998<sup>20</sup>; Costello, 1992)<sup>19</sup>, it remains necessary to look into class size. First, class size must be "manageable for a teacher to give adequate attention to motivating each child" (UNICEF, 2009, p. 4)<sup>22</sup>. Second, just like what Ehrenberg, et al. (2001)<sup>23</sup> opined, class size has a potential effect not only on how much students learn but also on the how learning happens. Third, class size has been deemed as predictor of reading achievement (Vandenberg, 2012)<sup>24</sup> and performance in student performance among Filipino college students (Arenillo & Arenillo, 2013)<sup>25</sup>. Most importantly, exploring class size is relevant in the Philippine context where, due to insufficient classrooms, typical class size is relatively large. In a Philippine legislative proposal to reduce class sizes in public schools, large class size was operationalized as ranging from 35 to 50 students (Philippine Senate, 2013)<sup>26</sup>, which aligns with the stipulation of the Commission on Higher Education (2007)<sup>27</sup> that ideal class size is below 35. For basic education, previous orders indicated that class size should not exceed 40 for first to fourth grade classes, and must be within the range of 15 to 60 students for fifth grade to high school (Department of Education, 2012)<sup>28</sup>. A study on high school physics classroom, however, revealed that, the average class size can reach up to 54 students (Orleans, 2007)<sup>29</sup>.

In spite of the relevance of the discourse on class size, the present study, in the literature review, only found the studies of Arenillo and Arenillo (2013)<sup>25</sup>, Aranjuez, et al. (2011)<sup>21</sup>, and Orleans (2007)<sup>29</sup> as focusing on the effect of class size on academic achievement in the Philippine setting but did not find studies on class size's effect particularly focusing on reading performance among Filipino children.

With the aforementioned context, the present study aimed to explore factors which might have an effect on children's reading skills; namely, multisensory reading program and class size. Specifically, this study sought to: (1) determine the reading level of the primary students' prior the intervention, (2) determine the effect of the reading intervention on primary children's reading performance; and, (3) determine the effect of class size on primary children's reading performance. Achieving the aforementioned objectives is deemed to provide enlightenment to teachers, parents, and other significant adults engaged in working with children's reading development.

## **2. Method**

The study employed quasi-experimental method using pretest-posttest design to compare the reading performance of the primary school children before and after the intervention and across different class sizes.

Eighty-nine (89) primary school children, who were recommended by their teachers for inclusion in the reading intervention, were the participants in this study. Small class size group was comprised of 18 pupils, mean age 6.2 years; 10 were females. Medium class size group was comprised of 28 pupils, mean age of 7.9 years; three were females. Large class size group was comprised of 43 pupils, age ranging from mean age of 7.5 years; 16 were females. Each group came from a different school, as it was also the aim of the study to provide reading intervention to a wider audience from diverse school setting. All of the schools were public schools to ensure comparability among the intervention groups.

Looking at the class sizes 18, 28, and 43, as inspired by Costello's (1992)<sup>19</sup> definition of small class size (14-25 learners), it can be gleaned that all conditions still fell within, or were just slightly above in the case of the large class size condition, the recommended class size for basic education, i.e., less than 40, in the Philippines (Department of Education, 2012)<sup>28</sup>.

In terms of composition, the Small class size group was a homogenous group comprised of Grade 1 pupils. Reading program was done every morning. Children did not have any other classes except the reading program. Only two students shared the same desk. The room had an electric fan and a bathroom, and was large and comfortable enough to fit all participants. On the other hand, the Medium class size and the Large class size groups were mixed groups, composed of Grades 1 to 3 students. Reading program was done in the afternoon. Rooms were hot because there was only one functional ceiling fan.

Instant Reader "Read in 30 Days" Program (ReadRIGHT Inc., 2001)<sup>30</sup> was used as the reading intervention in this study, and the tools used to measure reading level, in both pretest and posttest, were standard reading tests, which came along with the program. The pretest was comprised of 106 items, while the posttest was comprised of 75 items. Both tests included tasks such as alphabet writing and identifying letter name, blending, and word reading.

At the beginning of the study, children were administered a pretest to assess their reading performance. Thereafter, for a spread of six months, primary school children who were participants in the study were provided with reading intervention using the Instant Reader "Read in 30 Days" Program (ReadRIGHT Inc., 2001)<sup>30</sup> by the main author, who had intensive training in the use of the program.

The 30-session reading intervention adapted a multi-sensory curriculum and had components addressing various reading areas; namely, (1) phoneme awareness (i.e.,

specific sounds of the various letters of the alphabet), (2) phoneme combination and blending, (3) phoneme auditory skills, (4) basic sentence reading, (5) vocabulary and spelling, (6) word and sentence writing; and, (7) sentence and simple paragraph comprehension, among others. In terms of method, the program uses multiple strategies such as storytelling, flashcard presentation, using stickers, auditory drills, writing, and coloring among others, appealing to various senses such as the visual, auditory, and kinesthetic faculties of the reader.

After the intervention, a posttest to assess post-intervention reading performance was administered.

Reading test scores were analyzed using statistical software (i.e., Statistical Package for Social Sciences). Effect of the intervention on reading performance was analyzed using two-tailed paired t-test, at  $p < .05$ . Effect of class size was analyzed using Analysis of Covariance (ANCOVA) to see if class size will have an effect on post-intervention reading performance upon controlling for pretest reading performance, at  $p < .05$ . While Owen and Froman (1998)<sup>31</sup>, citing Pedzahur and Schmelkin (1991)<sup>32</sup>, discouraged the use of ANCOVA as a means of adjusting difference in pretest measures, other authors such as Johnson and Christensen (2010)<sup>33</sup> and Rutherford (2001)<sup>34</sup> permit the use of such test for the same purpose.

### 3. Results

#### 3.1 Reading Level of the Participants

The first objective of this research was to determine the reading levels of the study participants at the onset and at the end of the multisensory reading intervention. A score of zero categorizes the participant as a *non-reader*, which means that the child has insubstantial reading ability; a score of below 60 in the pretest or below 45 in the posttest categorizes the participant as *struggling reader*, which means that the child's reading skill is not at par with the expected reading level in a particular grade level; while, a score greater than 60 in the pretest or greater than 45 in the posttest categorizes a participant as a *non-struggling reader*, which means that the child's reading skill is within the expected level according to his or her grade.

Before the intervention, 88 out of the 89 participants were struggling readers: 42 of which came from the large class size condition, 28 from the medium class size condition, while 18 from small class size condition. These results show that the participants in this study were struggling readers prior to the intervention such that their reading skill was below the expected level according to their grade. After the intervention, the number of struggling readers was down to 29. Majority's scores in the posttest categorized them as non-struggling readers. None of the participants was a non-reader.

**Table 1 Level of Reading Performance of the Respondents**

Class Size	n	Pretest		Posttest	
		Struggling	Non-Struggling	Struggling	Non-Struggling
Large	43	42	1	14	29
Medium	29	28	0	10	18
Small	18	18	0	5	13
<b>Total</b>	<b>89</b>	<b>88</b>	<b>1</b>	<b>29</b>	<b>60</b>

#### 3.2 Effect of Multisensory Reading Intervention on Children's Reading Performance

The second objective of this research was to determine if there is a difference in the reading performance of the participants before and after the multisensory intervention.

Table 2 presents the mean scores of each class size condition in the pretest and posttest, as well as the results of the paired t-test analyses.

In the pretest, the large class size condition had the highest mean ( $M=34.57$ ,  $SD=12.24$ ), followed by the medium class size condition ( $M=32.91$ ,  $SD=11.90$ ), then, lastly, by the small class size condition ( $M=18.97$ ,  $SD=13.99$ ). In the posttest, however, the mean score for the small class size condition ( $M=52.11$ ,  $SD=15.53$ ) was the highest, followed by that of the medium class size condition ( $M=46.14$ ,  $SD=19.33$ ), then, lastly, by the large class size condition ( $M=48.21$ ,  $SD=12.12$ ). It was notable that the mean scores of the participants varied before and after the intervention. Hence, a paired t-test analysis was conducted to ascertain if these differences were significant (Table 2).

Based on the t-test results, there was a significant difference in the mean scores of children before and after the multisensory reading program in all groups: large class size condition ( $t=-6.534$ ,  $p<.05$ ), medium class size condition ( $t=-4.687$ ,  $p<.05$ ) and small class size condition ( $t=-9.656$ ,  $p<.05$ ). Inspecting the means scores between the pretest and posttest would reveal that the averages increased after the primary school children have undergone the multisensory reading intervention. These findings align with those of Magpuri-Lavell et al. (2014)<sup>13</sup>, Donnell (2007)<sup>14</sup>, Geiss (2005)<sup>35</sup>, and Geertz (2001)<sup>15</sup>, which revealed reading gains after multisensory reading intervention.

**Table 2 Mean Reading Scores of the Participants in the Pretest and Posttest**

Class Size	Reading Performance		t	df
	Pretest	Posttest		
Large	34.57 (12.24)	48.21 (12.12)	-6.534*	42
Medium	32.91 (11.90)	46.14 (19.33)	-4.687*	27
Small	18.97(13.99)	52.11 (15.53)	-9.656*	17

*Note.* \*= $p<.05$ . Standard deviations appear in parentheses beside means.

### 3.3 Effect of Class Size on Children’s Reading Performance

The third objective of this research was to determine the effect of class size on children’s performance. To answer this objective, the present study employed ANCOVA, treating the pretest score as a covariate. Assumptions, including homogeneity of variance,  $F(2, 86)=1.407$ ,  $p>.05$ ; and, heterogeneity of regression slopes,  $F(2, 83)=3.067$ ,  $p>.05$ , were satisfied. Independence of the covariate and treatment effect was however not satisfied since the pretest scores varied across the class size conditions,  $F(2,86),10.407$ ,  $p<.05$ . It was for this purpose that ANCOVA was used in this research to adjust the differences in pretest scores (Johnson & Christensen, 2010)<sup>33</sup>.

The ANCOVA revealed that there was a significant effect of class size on post-intervention reading performance after controlling for the effect of participants’ pretest scores,  $F(2, 85)=6.151$ ,  $p<.05$ . Scrutinizing the adjusted means would show that children in the Large class size condition and Medium class size condition had significantly lower reading posttest mean scores compared to those in the Small class size condition.

**Table 3 ANCOVA Results and Descriptive Statistics for Post-Intervention Reading Scores by Class Size and Pre-Intervention Reading Scores**

	Post-Intervention Reading Score			
	Observed Mean	Adjusted Mean	SD	N
Large-sized Class	48.21	45.97	12.12	43
Medium-sized Class	46.14	44.91	19.33	28
Small-sized Class	52.11	59.33	15.53	18
Source	SS	df	MS	F
Class Size (CS)	2230.94	2	1115.47	6.151*
Reading Pretest (P)	4938.893	1	4938.898	27.23*
Error	15415.429	85	181.358	

*Note.*  $R^2 = .26$ , Adj.  $R^2 = .23$ , adjustments based on Pre-Intervention Reading Mean=30.89, Homogeneity of regression tested and not significant:  $F = 3.05$ ,  $p > .05$ . Pre-intervention Reading regression coefficient = .606\*. \*  $p < .05$

#### 4. Discussion

It must be noted that the participants came into the intervention program as struggling readers, which means that undergoing reading tasks was difficult for them at the onset. This is notwithstanding the reality that, in itself, the process of learning to read is already much tougher than it seems. To learn to decode and read printed language, children must be aware that spoken words are composed of individual sound parts. They must possess phonemic and phonetic knowledge, as well as fluency and automaticity in decoding and recognizing words.

For the group of readers in this study, the already challenging task of reading is worsened by their inability to keep up with the reading performance expected from them. It is at this juncture where multisensory approach in teaching reading plays a quintessential part. Multisensory intervention tends to engage and motivate learners to enjoy reading as they learn (Ureno, 2012)<sup>11</sup>. It balances the rigor of reading skill acquisition with enjoyment, which make it bearable if not easy for learners to learn how to read. Likewise, since the child is exposed to various forms of stimuli, they become equipped with sensory memories to anchor upon as they learn reading (Bradford, 2007)<sup>10</sup>. Multisensory intervention further enables struggling readers to experience little successes in the process, as facilitated by the non-threatening learning environment afforded by expressive and play-based techniques such as story-telling, use of stickers, and coloring among others. These successes, according to Geertz (2001)<sup>15</sup>, are perhaps what constitute achievement, especially when the struggling reader begins to gain confidence in engaging with reading tasks.

Also, findings supported that of Costello (1992)<sup>19</sup>, Vandenberg (2012)<sup>24</sup>, and Arenillo and Arenillo (2013)<sup>25</sup>, which revealed significant reading gains in smaller class size compared to larger class size. Smaller class size enables teachers to provide sufficient attention to individual learners (UNICEF, 2009)<sup>22</sup>. In the present study, it must be noted that the learners entered the intervention program as struggling readers. As learners with difficulty in reading, the participants needed considerable amount of attention from the teacher, which could have not been possible in larger class sizes. Just as what Orleans (2007)<sup>29</sup> suggested, larger class size may cast undue burden to teachers and might disable them from monitoring and facilitating quality learning. Along the line of the Ehrenberg, et al.'s (2001)<sup>23</sup> assertion that class size might potentially affect the learning process, classroom management might be easier in smaller classes. Larger class sizes are prone to

classroom management concerns, since more students entail greater possibility of classroom disruptions. Especially, in the context of multisensory reading where learners are allowed to engage with reading tasks more flexibly than the traditional directive approaches, movement within the learning space is less restricted and contact between and among participants are more frequent, which, when unmanaged, might lead to undesirable interactions.

Results in this study must still be taken with caution considering that intact groups were used instead of randomized groups. Hence, in interpreting the result, it must be noted that arguments asserting inconclusive or unfounded evidence on the effect of class size on learning remain (Costello, 1992<sup>19</sup>; Hanushek, 1998<sup>20</sup>; Kornfeld, 2010<sup>18</sup>; Konstantopolous & Traynor, 2014)<sup>36</sup>.

A reasonable direction is to think that aside from class size other variables might have an impact on reading, or in learning, in general, say for instance, teacher and school factors (Konstantopolous & Traynor, 2014)<sup>36</sup>. In this particular study, it was earlier mentioned that except the small class size group, other groups had a learning environment, which was seemingly non-conducive for reading (e.g., hot air temperature, small room size). However, the principal investigator decided to work with that set-up because apart from that what was available during the research, it mirrored the day-to-day scenario in the participants' actual learning environment. Exploring on the impact of the physical environment in the reading process might be an interesting direction in future research among Filipino children. This is in line with Kainz and Vernon-Feagans (2007)<sup>16</sup> findings that class and school characteristics also influence reading performance, emphasizing how the school ecology matters in the learners' reading development process.

Similarly, since it was beyond the scope of this research to look into actual learning and reading experiences of the participants prior to the intervention, teacher factor was also not controlled. Although a single reading teacher implemented the reading intervention in this study, the participants belonged to different learning environments facilitated by different teachers prior to intervention. Considering teacher factor in the actual school environment might enlighten succeeding explorations on teaching-learning process and reading performance.

## **5. Conclusion**

Generally, the purpose of this study was to test the effectiveness of the multisensory reading program in varying class sizes among primary students in public schools. The researchers strongly believe that reading is a very important ingredient and a vital skill needed for every child to perform well in school and in life, at large.

In conclusion, this quasi-experimental study revealed that: (1) Almost all of the primary school children were struggling readers at the beginning of the reading program. The number of struggling readers dropped after the intervention. (2) The multisensory reading program had an effect in the reading test scores of the participants after the intervention, whereas, comparison between pretest and posttest mean scores showed that the posttest mean scores were relatively higher. (3) After controlling for pretest scores, the class size manifested a significant effect on the post-intervention reading performance.

From the outcome of this study, it is recommended that more public school students be given the chance to learn reading through multisensory approaches. Integrating the program to the mainstream curriculum might be of greater advantage to



the learners. It is also recommended that the reading program be held during class hours or be integrated in regular reading class. Lessening environmental distractions, by employing effective classroom management, might also promote reading performance. Most importantly, a follow-up study on how the students who participated in the program eventually performed in their academic subjects, especially those requiring heavier use of reading and speaking skills, might also be done to explore long-term effectiveness of the reading program.

In this study, participants were not randomly assigned. More stringent experimental research design (i.e., randomized controlled design) is recommended in succeeding researches to yield more generalizable results. Controlling for other learning conditions, i.e. size of the room, instruction time, teacher training, ventilation (ceiling fan), and schedule of implementation, could also be done to avoid extraneous variables.

By and large, the outcome of the present study only emphasizes that appropriate means of teaching children how to read might yield meaningful results. Particularly for those children who are finding it difficult to keep up with expectations of literacy from school or from the society, augmenting traditional reading modalities in teaching with creative and engaging modalities such as multisensory approaches might lead to beneficial outcomes for the learners. The teacher is, then, challenged to explore more ways on how to enhance the teaching-learning process to achieve desirable outcomes, for the betterment of the learner.

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