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# Investigating the effect of reading level on achievement in mathematics and science

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**Abstract:** *The current study aimed at investigating the effect of reading level of students in multiple-grade classes of Sardasht region of Dezful province on their academic achievements in mathematics and science. The design of the study was pre-experimental; thus, 42 individuals of the students were selected from the student population of elementary schools of Sardasht-e-Dezful region using convenient sampling and they were placed in two experimental and control groups randomly. Data collection tools included a researcher-made questionnaire to determine the reading level and data obtained from it were analyzed using SPSS, version 22, software. The results of statistical tests of independent t-test showed that there was a significant difference between academic achievement scores of mathematics and science of students who had received reading trainings and those who had not received them. Moreover, the results indicated that the effect of gender was significant in this relation regarding mathematic lesson and it was insignificant regarding science lesson. In other words, these results cause girl students obtain higher means in mathematics compared to boy students. Therefore, it is required that educational authorities consider the increase of reading level of students specially boy students*

**Keywords:** *Reading level, Academic achievement, Multiple-Grade classes.*

## INTRODUCTION

Reading literacy is among the important issues of learning in students that can affect other aspects and subjects. The importance of reading is to the extent that national organization has considered the reading right as the children's right (Zare and Naghsh, 2016).

Constantly obtaining knowledge through reading can lead to academic achievements. Having skill in reading is one of the most important needs of learning in today's life of students. This skill focuses on the comprehension, interpretation and extracting meaning and concepts of messages that have been written. The success and educational development of each student has a direct relationship with his ability and comprehension (Maleki and Ahmadi, 2013).

In fact, learning reading skill is the learning key for all kinds of learnings since most of the lesson related learnings occur accordingly (Dibayi Saber et al., 2010). In elementary levels, the foundation of knowledge and skills of Persian language and other skills are established in the students and their education continues to all school years. Moreover, students' skills in each level depends on the skills they have obtained in the previous level; thus, paying attention to the reading level, as the basis of other learnings, needs special attention.

The importance of reading is to the extent that every five years, a test entitled PIRLS is administered worldwide and our country also participates in this test. However, according to the world statistics, Iran doesn't have a good performance in these tests. The ultimate goal of PIRLS tests is improving the learning level inside the educational system and developing policies, educational programs and administrative methods related to the training and learning processes (Zare and Naghsh, 2016).

Education takes a great step toward solving educational problems through having exact programming and presenting appropriate contents; however, in case all required actions be prepared without paying attention

to the reading level of students, all efforts would be useless since it is through reading and comprehension that a student can comprehend a content and take steps toward making it real; doing so, he seeks to solve the problems. In case the reading level of students be low, all efforts would be as beating a dead horse.

According to the PIRLS test, our county's students, specially fourth grade students, perform better in memorable issue than inferential issues; this result can be generalized to multiple-grade classes. Multiple-grade classes face various problems due to the lack of time and space as well as the great number of students and levels. If these multiple-grade classes be held in tribal regions, problems would be duplicated. Considering the importance of reading and reading level in advancing educational purposes and the problems of multiple-grade classes in tribal regions, the reading level of students should be specifically considered. Reading is one of the most important learning needs of students in their today's life. This skill focuses on the comprehension, interpretation and extracting meaning as well as concepts of messages that have been written.

Academic achievement has been defined as the proficiency regarding the information and theoretical knowledge in a certain field. Academic achievement means the extent of learners' success in meeting their education course's purposes. The issue of academic achievement of students is one the most important indexes in evaluating education and all efforts of this system is toward covering this issue. The success of students in the school includes obtaining appropriate experiences in all cognition, emotional, social, behavioral and biological dimensions. Obtaining these experiences at school can have a crucial effect on the current life of children and youth (Mir Heidari and Nistani, 2015).

Since reading and reading level is an effective factor in the academic achievement of students, and academic achievement of students and their success can create their personality and self-confidence, reading level and academic achievement of students is of utmost importance for education, family, society and most importantly for the individual himself. Therefore, in case the reading level of multiple-grade class students be ignored, individual development wouldn't be obtained and society would face losses; so, the reading level should be specifically considered.

As it was stated above as well as the analysis of TIMSS and PIRLS international studies regarding the development of reading literacy of Iran compared to the past, we are still in a low range considering the world mean and a special program and initiation is required (Karimi et al., 2012). The investigation of studies carried out on the reading level and academic achievement well signifies that reading level and academic achievement have a direct relationship with each other. Mathematics and science are main lessons among elementary level lessons especially considering multiple-grade classes. The researcher in his three year experience of multiple-grade classes has considered this issue that those students having high levels in reading, perform better in other lessons and among these lessons, the current research has considered the investigation of reading level and its effect on the academic achievement in science and mathematics in multiple-grade classes.

## **Theoretical Foundations of the Study**

### **Reading**

International Association for the Evaluation of Educational Achievement (IEA) has defined reading literacy as the following: the ability of comprehension and using written language forms that society asks or the individual values (Karimi, 2008). Reading is an active and comprehensible process that considers inclined information and those data and skills that were previously familiar so that the read text could be comprehended. Furthermore, reading is an essential and vital means for the curriculum and is considered as the success basis for the learner so that failure in academic programs is somehow related to not having reading skill. Epcasan and Epcasan (2010) had the following words regarding reading: reading is an activity that increases knowledge and awareness capacities of individuals and forms their beliefs and identity as well as personality. Reading is a mental process. The purpose of reading is comprehending the meaning of what we have read; this increases our comprehension of the reading. Reading is an activity that intends to improve interpersonal relations through being affected by internal and cognitive features such as motivation, attention, perception of the self, memory, comprehension and language skills. Reading is among

basic skills that helps individuals in perceiving and processing new information. Reading includes a complex set of skills such as recognizing the written words, determining the meaning of activities and phrases and adjusting these meanings with the overall subject of the text. Reading problems more than other specified learning problems in various fields, impedes academic achievement since reading is the way of having access to a wide range of information (cited by Chagini et al., 2015).

### **Students' reading level based on international tests**

Trends in International Mathematics and Science Study (TIMSS) and Progress in international Reading Literacy Study (PIRLS) are among the most important and wide adaptive studies in evaluating academic achievement, which is observed by International Association for the Evaluation of Educational Achievement (IEA). This committee is an independent and valid research organization worldwide and aims at improving and developing the educational status of participating countries; through which, it could explore multiple adaptive studies regarding educational development. The findings and data obtained from such studies are an important and determining sources for discovering and identifying weaknesses and strength points of countries' educational systems in national and international scales and presenting scientific approaches for the improvement of learning and teaching processes.

In a report published by international trends of TIMSS and PIRLS as well as the international committee of evaluating educational achievement, Iran has been named as a country that has been significantly increased in terms of educational performance during last ten years. In this report, the performance process of Iran in the science lesson of fourth and eighth grades as well as reading literacy was among the best countries compared to previous periods. This is while the performance process of some of the developed countries had decreased in TIMSS and PIRLS compared to previous periods. In a regional report, as well, Islamic Republic of Iran has obtained the first score among other countries of the participated regions regarding the performance process during three periods of studying PIRLS (2006, 2001 and 2011) in terms of development in the reading literacy of fourth grade students.

However, the performance of Iranian students in science and mathematics and reading literacy was lower than international mean in all TIMSS and PIRLS periods and it was lower as compared to some of the participating countries of the region (without considering the performance process), which is somehow concerning considering the expectations of the vision document (Iran 1404).

In the report of annual journal of international committee regarding academic achievement evaluation, the long-term experience of the Iran's participation in TIMSS and PIRLS studies (since 1995 to now) as well as the scope extent of the coverage of educational grades in these studies (three grades including fourth, eighth and twelfth), the most important changes resulting from TIMSS and PIRLS have been considered in educational system of Iran and the involvement of respondents, teachers and educational experts and book editors with TIMSS and PIRLS projects have been investigated.

The difference between girls and boys performance in three studies of PIRLS 2001, 2006 and 2011 indicated the superiority of girls' performance over boys in all participating countries. In Iran, the performance of girls compared to boys, in PIRLS 2001, had a difference of 27 scores (girls had a mean of 426 and boys had a mean of 399) and in PIRLS 2006, the difference was 15 scores (girls having the mean of 429 and boys having the mean of 414) and in PIRLS 2011, the difference was 19 scores (girls having the mean of 467 and boys having the mean of 448), showing the superiority of girls' performance in all three studies (Karimi et al., 2012).

### **Multiple-grade education in Iran**

Having reviewed the education history, it could be comprehended that the history of multiple-grade classes dates back to the beginning of group educations and considering the population of the rural fabric, it is possible also in the future. This kind of education is used in countries where observe multiple-grade classes as an opportunity, having the following purposes (Haji Eshagh, 2009).

1. Providing elementary education period in rural regions having few population.
2. Educational services continue in small cities and villages having few student population.
3. Optimal use of limited sources.

4. Improving education quality to avoid being dropout and not repeat the grade.

Having investigated the literature of multiple-grade classes in few decades, it was shown that in the developed educational system (such as America and Canada) multiple-grade classes are held intentionally. In other words, in developed countries, although they have access to the education and facilities for holding single-grade classes in elementary levels, multiple-grade classes are also welcomed. Multiple-grade classes increase children`s, specially girls` access to educational opportunities and play an important role in helping countries to meet their goals and reduce poverty. These schools are mostly located in secluded and deprived regions, where teachers live and work under difficult conditions and are not that much supported by educational system. According to Lebtel, the increase of access to learning in schools having insufficient teachers, ultimate use of the teacher and class space and effective use of existing sources have been among the main reasons of the existence of multiple-grade classes in some of the countries. In this regard, the conducted studies in the country considered the continuance and increase of the number of multiple-grade classes inevitable due to the difficult environmental conditions, lack of student population and human forces as well as educative spaces, natural and obligatory migration, the spread of villages and inappropriateness of relational ways.

In Iran also, we are currently having 46900 multiple-grade classes that need special consideration. Education is the right of all children. One of the main issues of educating children that lack the possibility of being educated in urban and rural schools of single-grade classes is having multiple-grade classes since it is practically impossible to have a teacher for each grade of elementary students with any numbers (sometimes one individual in a grade) in near future. In the past, multiple-grade was considered as a abnormal educational situation and stating its various problems was an important factor in not considering appropriate official and educational approaches of these classes. It was not taken into account that any problems and insufficiencies in the education system would be also true for any kind of school, facilities and conditions.

**Methodology**

Since the purpose of the study was investigating the effect of reading level on the academic achievement in mathematics and science, the design of the study of the current research was pre-experimental and the statistical population included all multiple-grade students of Sardasht including 123 individuals, among which, 70 individuals were girl and 53 individuals were boy. Sample of the research included two groups of 21 participants; one group was experimental and the other was control. Convenient sampling method was utilized for the section.

**Research Instruments**

Research instruments included a questionnaire for determining the reading level, which was researcher-made and included 15 questions of 4 items in the scale of : very good, good, acceptable and needs more efforts. The respondents of this questionnaire were teachers; in fact, students` reading level were determined by them. Another instrument of the study was the working folder of students (two first months of the year), which could determine their academic achievement in mathematics and science.

Validity of the questionnaire: To investigate the validity of the questionnaire of determining reading level, it was given to 5 educational science experts to diagnose the validity of the questions. These experts evaluated the questions of the questionnaire as appropriate and confirmed its validity.

Reliability of the questionnaire: to check the validity of the questionnaire, Cronbach alpha coefficient was utilized. Table 1 shows the results.

**Table 1.** The results of the Reliability of the questionnaire

Number of questions	Cronbach alpha coefficient
15	0.94

The results indicated that the questionnaire had a high validity since the Cronbach alpha was more than 0.07.

**Procedure of the Study**

The researcher firstly asked teachers to educate students of the experimental group for 10 sessions, but students in the control group didn't receive any trainings. It should be noted that the training content has been selected from reading book of students and they were trained till October based on budgeting. Then, a researcher-made questionnaire was given to the teachers. After collecting information, it was referred to the working folder of the students and their first two month scores were set as the basis to extract their academic achievement in mathematics and science. Finally, all data were analyzed.

The following issues were asked from teachers of the experimental group to train students:

1. Train how to correctly read.
2. Train how to observe the tone.
3. Train how to observe writing points.
4. Ask the considered student to have an appropriate sound and speed to not read the words wrongly.
5. At the end of reading, ask the student to state what has read in informal language for his friends.
6. Ask students questions in addition to what has been presented in the book so that the comprehension could be increased and the text could be understood.
7. Ask him to tell the time, place, features and characteristics of the read stories and anecdotes.

**Table 2.** Training reading level

Number of session	Training duration (ad minute)	Purpose
1	45	Training how to read correctly
2	45	Training how to observe the tone and rhythm
3	45	Reviewing previous sessions and solving problems
4	45	Training the use and observing writing points
5	45	Training how to observe the speed and appropriate sound in reading
6	45	Reviewing previous sessions and solving problems
7	45	Training how to state the phrases to informal language
8	45	Training comprehension
9	45	Training how to recognize personalities, time and place of the story
10	45	Reviewing previous sessions and solving problems

**Data investigation methods**

Statistical t-test methods of independent groups were utilized. Moreover, in the descriptive statistical part, the demographic data of students were analyzed based on descriptive statistic features. These data were analyzed in SPSS, version 22, software.

**Results and Findings**

Descriptive statistics

**Table 3.** Frequency distribution, percentage and cumulative percentage related to the gender of students

Gender	Frequency	Percentage	Validity percentage	Cumulative percentage
Boy	16	38.09	42.9	42.9
Girl	26	61.91	57.1	100
Total	42	100	100	

Table 1 indicates the gender of students whose reading level have been investigated showing that the number of girls were more than boys.

**Table 4.** Frequency and educational level of students' fathers

Educational level	Frequency	Percentage
Illiterate	13	31
Elementary school	27	64.2
High school	2	4.8

Table 4 indicates the educational level of students` fathers that have been investigated. It was shown that the highest percentage of 64.2 was related to the elementary school.

**Table 5.** Frequency and educational level of students` mothers

Educational level	Frequency	Percentage
Illiterate	24	57.1
Elementary school	17	40.5
High school	1	2.4

Table 5 indicates the educational level of students` mothers that have been investigated. It was shown that the highest percentage of 57.1 was related to the elementary school.

**Table 6.** Frequency and occupation percentage of fathers

Occupation	Frequency	Percentage
Animal husbandry and agriculture	40	95.2
Others	2	4.8

Table 6 indicates the frequency of fathers` jobs. It was shown that the highest percentage of 95.2 was related to the animal husbandry and agriculture.

**Table 7.** Frequency and occupation percentage of mothers

Occupation	Frequency	Percentage
Housewife	42	100

Table 7 indicates the frequency related to the mothers` jobs. It was shown that all mothers were housewives.

**Analytical Results**

The results of investigating the effectiveness of reading level of students in multiple-grade classes on their academic achievement in mathematics have been presented in Table 8.

**Table 8.** The statistical results of mathematical lesson

Lesson	Group	Number	Mean	Standard deviation	Standard error of the mean	T-value	Freedom degree	Significance level
Mathematics	Experimental	21	3.47	0.67	0.14	2.1	40	0.04
	Control	21	3	0.77	0.16			

To analyze the results, t-test method of independent groups was utilized. As it was shown in Table 8, the significance value (0.04) showed that groups` mean had a significant difference with each other. The mean of mathematics in the experimental group was 3.476 and it was 3 in the control group, this difference was significant.

Regarding the effect of reading level of students in multiple-grade classes on the academic achievement of them in science, the following results were obtained.

**Table 9.** The statistical results of science lesson

Lesson	Group	Number	Mean	Standard deviation	Standard error of the mean	T- value	Freedom degree	Significance level
Science	Experimental	21	3.61	0.58	0.12	2.7	40	0.009
	Control	21	3.04	0.74	0.16			

To analyze the results, t-test method of independent groups was utilized. As it was shown in Table 9, the significance value (0.009) showed that groups` mean had a significant difference with each other. The mean of science in the experimental group was 3.61 and it was 3.04 in the control group, this difference was significant.

Having investigated the effect of gender on academic achievement of mathematics and science in multiple-grade classes, the following results have been obtained (Table 10).

**Table 10.** The statistical results of the effect of gender on academic achievement

Lesson	Group	Number	Mean	Standard deviation	Standard error of the mean	T- value	Freedom degree	Significance level
Mathematics	Boy	16	2.93	0.77	0.19	-2.09	40	0.04
	Girl	26	3.42	0.70	0.13			
Science	Boy	16	3.12	0.80	0.20	-1.41	26.7	0.16
	Girl	26	3.46	0.63	0.12			

To analyze the results, t-test method of independent groups was utilized. As it was shown in Table 10 the significance value (0.04) showed that there was a significant difference in mathematics among group means. The mean of mathematics in boys was 2.9 and it was 3.4 in girls. The significance value in science indicated that there was no significant differences among group means. The mean of science score in boys was 3.1 and it was 3.4 in girls.

### Discussion and Conclusion

The current study investigated the effect of reading level on the academic achievement of mathematics and science in multiple-grade classes of Sardasht region during 2018-2019. The research methodology was pre-experimental and statistical population of the study included all elementary students of multiple-grade classes of Sardasht (Shahivan), whose number were 123 individuals including 53 boys and 70 girls. Among these individuals, 21 participants were selected to be in the experimental group and 21 individuals were chosen to be in the control group using convenient sampling method.

The obtained results showed that the reading level was effective on the academic achievement of multiple-grade students in mathematics and science.

Moreover, gender affected the academic achievement of students in mathematics, however, no significant relationships were observed in science. This meant that there was a relationship between gender and mathematics but there was no relationships between science and gender.

#### **Reading level of multiple-class students affected their academic achievement in mathematics and science.**

The analysis of the results indicated that reading level affected academic achievement and there was a significant relationship between reading level and academic achievement. These results could be explained more since it could be stated that reading literacy has a relationship with students` performance in lessons. In other words, reading is the basis for all kinds of learnings which affects students` academic achievement in schools (Karimi and Kabiri, 2011). The results of this study were in line with the results of Ahmadi Chenari Faryabi (2011) who conducted a study entitled "the relationship between reading skills and comprehension and academic achievement of fourth grade elementary school students in mathematics in region 1 of Shiraz". The results of the current study were also in line with the study of Vahedi and Jangi (2015) entitled "the effect of strategy training in reading comprehension of mathematics and meta-cognitive strategies on elementary school students` problem solving". The results of this study were in line with the study of Arabsalari (2013) who investigated the relationship between reading literacy of fourth grade

elementary school students and their mathematic performance in TIMSS and PIRLS 2011 studies. Furthermore, the results of this study were in line with Yazdani (2017) research entitled "the relationship between reading skill and problem-solving skill of mathematics in the fourth and fifth grade of elementary school students". Hawii and Tetrostiden (2006) considered good reading ability as the main key of success in school, which confirmed the findings of this study that reading level and good comprehension affects academic achievement of students. In addition, the results of the study were in line with the results of Peterson (2006) showing that comprehension increases reading skill and academic achievement.

#### **Reading level of multiple-class students affected their academic achievement in science**

The analysis of the results indicated that the mean of the performance of experimental group was better than control group, showing that the reading level affected academic achievement of science. Moreover, statistical findings showed that this relationship was significant. The results of this study could be explained. The results of this study were in line with the study of Ziayian (2013) since his research stated the significance of the relationship between reading literacy and academic achievement of science. Martin Di and Balestouk (2008) investigated monolingual and bilingual children in a research and concluded that those having high reading skills, have also higher academic achievement, which confirmed the results of this study. The results of the current study were also in line with Holia (2013) study. In case students were trained regarding the reading skills, academic achievement would be obtained. In this study, the statistical analyses showed that the group being under education, had a better performance than control group. The results of this study were in line with the results of Teren and Page (2009), which indicated that one of the academic achievement factors that affect students specially elementary level students is the reading and language skills. The results of this study were in line with the results of Romance (2011) study. Findings showed that if reading and comprehension be developed, learning science would also improve. The results of this study were in line with the results of Molis et al., (2011) and could be explained. In questions where more reading is required, the questions can be challenging for students that are weak in reading.

In explaining the findings, it could be stated that students who are good at reading and do its practices well and spend less time for its learning and problem-solving and enjoys reading, has more tendency toward reading. The lack of interest and ability in correct reading is accompanied with learning weakness; so the necessary condition for academic success in reading well.

#### **Gender affects the academic achievement of mathematics and science in multiple-grade classes.**

The analysis of the results showed that there was a significant relationship between gender and academic achievement of mathematics in multiple-grade classes, however, there was no significant relationships between gender and academic achievement of science in multiple-grade classes. To explain the findings, previous studies and researches have been utilized. Shams Esfand Abad (2014) in the psychological book of individual differences has stated that women are more aural. Girls have a verbal and consecutive learning style, while boys have an emotional verbal style. Loura Berk in the psychology book, second edition, (2011) has stated that girls obtained higher score in reading development and writing tests during elementary school years and few of them needs reading trainings to correct their mistakes. Girls also obtain higher scores in verbal ability tests in their adolescence, but, although girls` development in reading and writing increases during adolescence, boys perform weaker in writing. In another part of the psychology book, first version, (2013) this superiority has been considered as a privilege that girls have in terms of biology and this is the earlier growth of the left hemisphere of their cerebral cortex, in which language is developed. The results of this study could be explained through the results of Saadati Shamir et al., (2010). The results showed that there was a relationship between reading performance and academic achievement of monolingual and bilingual boys. Karimi et al., (2012) stated in their research that girls performance was superior than boys in three performances (2001, 2006, 2011) whose reason could be the superiority of biological privilege of girls over boys that had been stated by Loura Berk (2012); boys performed weaker in tests related to writing. Loura Berk in the psychology book, 2<sup>nd</sup> version, (2012) stated regarding the sexual differences in mathematics that: sexual differences in mathematic skills are observed since the first grade of elementary school. Girls are dependent on objectives to solve mathematical problems, while boys



represent the numbers mentally and recover the responses from the memory quickly. Some of the researchers believe that inheritance is significantly involved in sexual differences of mathematics. There are much evidence that spatial reasoning of the superiority of boys helps them in solving the problems. Social pressures also affect them a lot. A long time before revealing the sexual differences in the mathematics development, girls and boys considered mathematics as a masculine lesson. In our study also, gender affected mathematical development, however it didn't have any effects on science.

Since in this research, the reading level affected academic achievement of mathematics and science, the editors and programmers of science and mathematics lessons were suggested to use sentences, words and phrases appropriate to the age of students in the mathematics and science contents.

As it was indicated in the PIRLS 2001 and 2006 studies as well as previous researches, there was a relationship and correlation between reading performance of students and children's interaction with literary activities before stating to go to school; thus, it is suggested to include storytelling, singing songs and playing with words in preschool periods.

It is suggested that education authorities obtain appropriate approaches for the improvement of reading level and comprehension.

At the end, it suggested to the researchers who intend to conduct studies related to TIMSS and PIRLS tests that do these studies in multiple-grade classes.

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