



Connecting Science with Story Tale: How *Sainsmatika* Story Tale Book Decrease Science Anxiety of 4th Graders Student

*Agnestasia Ramadhani Putri**, *Ali Mustadi*

Postgraduate Program of Primary Education, Yogyakarta State University, Indonesia

This study investigated the effectiveness of using *Sainsmatika* story tale book towards student science anxiety. The study was an experimental research with pretest-posttest control-group design, involving 122 fourth-grade students in one of the district in Indonesia. Characteristically, this research employs quantitative data which were collected from the questionnaire results regarding science anxiety. The data were analyzed using statistical methods to calculate the values and determine the frequency as well as the mean of pretest and posttest scores in control and experimental classes. To determine the effectiveness of using fairy tale books to reduce students' science anxiety, the one-way analysis of ANOVA was used with a significant difference at the level of $\text{Sig} < 0.05$. The results of this study reveal that the use of *sainsmatika*-based fairytale books is effective to reduce science anxiety of the fourth-grade students with significance 0.00 (< 0.05).

Keywords: *Sainsmatika*, Science Anxiety, Storytale

Penelitian ini mengkaji bagaimana pengaruh penggunaan bahan ajar buku dongeng berbasis *sainsmatika* dalam mereduksi kecemasan siswa pada mata pelajaran IPA. Penelitian ini merupakan penelitian eksperimen dengan desain pretes-posttest, yang melibatkan 122 siswa sekolah dasar negeri di salah satu kabupaten di Indonesia. Penelitian ini merupakan penelitian kuantitatif dimana pengumpulan data dilakukan dengan kuesionair. Data yang terkumpul dianalisis menggunakan pendekatan statistik untuk mengetahui frekuensi dan rerata dari hasil pretest posttest baik di kelompok kontrol maupun kelompok eksperimen, sehingga dapat diketahui sejauh mana keefektifan buku dongeng berbasis *sainsmatika* dalam mengurangi kecemasan siswa pada mata pelajaran sains. Hasil analisis statistik menggunakan analisis ANOVA satu jalur menemukan bahwa penggunaan buku dongeng berbasis *sainsmatika* efektif menurunkan kecemasan siswa pada mata pelajaran IPA, dengan signifikansi sebesar 0.00 (< 0.05).

Kata kunci: Dongeng, Kecemasan IPA, *Sainsmatika*

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***Correspondence:**

Agnestasia Ramadhani Putri
agnestasia_ramadhani2015@stud
nt.uny.ac.id, alimustadi@uny.ac.id

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INTRODUCTION

Our nature greatly has various interesting phenomena which we can learn. Due to our inherent curiosity about these natural phenomena, science exists and continues to develop. In the scope of learning, science is an essential subject to discover what happens in the nature. Science is even viewed as the main subject in many levels of education. According to [Kelly \(2000\)](#), science encourages students to develop their independent learning skills such as raising hypotheses and observing their surroundings, and also enhances their curiosity about phenomena which catch their interest.

Science learning in elementary school comes from the understanding of the concepts of science. Basically, it is knowledge from the systematic study of the physical world. It is what we do to discover the facts about natural phenomena. UNESCO (1983) gives a simple illustration of science as an approach which helps the students improve their logical reasoning skills in understanding and solving the problems related to natural phenomena. Apart from the facts and concepts in the scope of science, science learning in the classroom directed to the processes of observation and verification, so that the students can advance to a deeper understanding of the facts, concepts and principles of what they pursue.

In agreement with UNESCO about science, Mclelland (2006) says that with science as an approach to study the natural phenomena, we must raise questions such as, "How does the world work? How did the world come to be? What was the world like in the past, what is it like now, and what will it be like in the future?" Those questions are then answered through observation, tests or examinations, or logical interpretations. Many logical approaches to natural phenomena have been implemented in science, and they have schematically helped build the understanding of science and improve the students' cognitive skills in reasoning.

Science is the representation of what happens in the nature. In Bandu (2006)'s view, science is commonly perceived as *natural science*, which is a body of knowledge about how the physical world (nature) around us works. This leads to the perception that science is the science of nature and all phenomena in it. According to Howe et al. (2009), science provides a way of understanding the world and answering scientific question-through methods which emphasize the importance of empirical evidence, logic and explanation done to physical objects. Therefore, what is solved or discovered through science shows the reality of the studied objects. In this way, truth in science is scientific truth which orients on evidence and logic.

Based on the concepts of science which have been previously described, it can be concluded that science is a subject or an area of study about natural phenomena which involves scientific attitudes including the formulation of hypothesis, curiosity (critical-mindedness) and logical thinking. For this reason, science needs a special approach. Different from mathematics which places importance on continuous drillsto gain understanding, science only needs processes which are driven by scientific attitudes. The initiative to study is the key to success in science learning. However, it arises only if the students have the motivation and comfort to study. If there is not anything which provides comfort in the environment of science learning, the students generally tend to think that science is 'difficult' or 'frightening'. This condition can be identified as 'anxiety'. This word is derived from the Latin word '*anxius*' and the German word '*anst*', referring to negative effects and physiological stimuli (Bellack and Hersen (1988); Kready (1916)).

In *Taylor Manifest Anxiety Scale (TMAS)*, Taylor explains that anxiety is a condition characterized by mental tension and restlessness as general responses to the incapability of sufficiently coping with problems or to a sense of insecurity. Anxiety is experienced only when one fails to control his emotions when dealing with a difficult challenge. According to Connolly et al. (2009), "anxiety generally occurs when a system or concept is misinterpreted or unsound". In this case, science anxiety

occurs because it is misinterpreted as a difficult subject of study.

Yildirim et al. (2008) defines anxiety as a condition which causes one to feel agitated and distressed, and stimulates worry. Anxiety can thus negatively affect students' performance in learning activity because it reduces comfort. A learner with anxiety will tend to be a passive participant faced with problems in the process of science learning. Unfortunately, the worst consequence of science anxiety is the feeling of worry which one keeps until he becomes an adult. One who has science anxiety during the elementary school period will tend to grow up with it, suffering from bad outcomes it brings about. As expressed by Daniels (1983), "this anxiety makes them (students) avoid the science courses in high school or university, so only a minority of individuals enter the scientific arena".

There are many reasons why one experiences anxiety. One of them may be identified as 'difficulty'. Insufficient knowledge of science contents potentially makes the students feel worried and nervous during the process of learning. Specifically in science learning, it is very important to feed a motivational understanding of the nature of science to students since the very beginning, so they can continuously build self-confidence in learning concepts of science for the next phases of study which are more complex. It is because the younger the students when they experience problems in science learning, the higher the likelihood that they deem science difficult to understand. The presence of worry which tackles the students each time they learn science will gradually turn into anxiety, and this condition can result in bad impacts on their psychological development. Mallow (1981) even describes science anxiety as an experience of a learner who cannot grasp the concepts of science. With this perspective, it can be said that anxiety comes from the incapability of understanding science, while it is in fact an area of study which is contextual in nature. Science is completely different from mathematics which characteristically deals with abstract things. Science explores real phenomena which occur in human life, so it actually can be understood even with the most basic logic or simplest observation. Furthermore, Udo et al. (2004) state that "the causes of science anxiety are many, including past bad experiences in science classes, exposure to science anxious (SA) teachers who are teaching science in elementary and secondary schools". Having the same point of view, Daniels (1983) also argues that science anxiety can be provoked by the personality traits of the educator and methods of learning.

METHOD

In this study, student in experimental group were learning with Sainsmatika storytale book and then examined to respond 33 question (3-point scale) of science anxiety scale which developed by Sagir (2012). The study were an experimental research with a pretest-posttest control-group design, involving control and experimental groups with the same characteristics which were taken from homogeneous population.

Research samples

Subjects of the research were elementary school students and teachers in Special Region of Yogyakarta, particularly schools run by the government (*negeri*) with Curriculum 2013.

The selection of the state elementary schools (*Sekolah Dasar Negeri*) aimed at achieving uniformity and homogeneity. This research involved 122 students which specifically consisted of 55 male students and 67 female students. All of these subjects were taken from four regencies in Special Region of Yogyakarta. The following table shows the details about the research subjects, where there are 59 students in the control group and 63 students in the experimental group.

Data analysis

The data were analyzed using statistical methods to calculate the values and determine the frequency as well as the mean of pretest and posttest scores in control and experimental classes. To determine the effectiveness of using fairy tale books to reduce the students' science anxiety, the one-way analysis of ANOVA was used with a significant difference at the level of $\text{Sig} < 0,05$.

RESULT

Based on the data collected from the questionnaires previously given to 122 students, it was shown that the level of their science anxiety is quite high.

[Table 1 about here.]

[Figure 1 about here.]

Tabel 1 gives the details about the students' level of science anxiety. Gambar 1 shows the comparison and exposes a significantly wide gap between the control group and experimental groups. The level of anxiety in the control group before and after the treatment is relatively similar, which is around 60 and therefore in the category of a quite high level. Meanwhile, two experimental groups show a significant change after receiving the treatment, in which there is a quite high level of anxiety reduction. The mean of the science anxiety level before the students in the experimental groups learned science through *sainsmatika*-based fairytale books is 65,30; which is in the category of a quite high level of anxiety. Then, after they learned science through *sainsmatika*-based fairytale books, the mean of the science anxiety level drops to 25,18; which is in the category of a low level of anxiety. These results indicate that there are positive responses toward the use of *sainsmatika*-based fairytale books as teaching materials.

Based on Tabel 1, it can be seen that there is very much difference between the control group and experimental groups before and after the treatment. The gain scores give the details about anxiety reduction after the students in the experimental groups learned science through *sainsmatika*-based fairytale books (experimental 1 & 2), and also about the level of anxiety in the control group where the students learned science only through conventional teaching materials.

[Table 2 about here.]

The information in Tabel 2 shows that the significant difference is at the level of 0.000 which is less than 0.05 ($0.000 < 0.05$). From this statistical analysis, it can be concluded that the use of *sainsmatika*-based fairytale books is effective to reduce science and mathematics anxiety of elementary school students.

DISCUSSION

Science is a body of knowledge about nature, and it is not enough to rely only on theories to learn what is going on in the physical world we live in. Inevitably, the study of science demands direct participation of the students so their knowledge can be put into practice in the real-life setting. Science learning which does not provide the students with opportunities to directly and actively investigate the natural phenomena may instill anxiety in them. Depending only on abstract concepts without having any real experiences of studying the objects of science, the students are likely to develop science anxiety. Besides that, boredom in the classroom can also trigger anxiety, mostly caused by the teacher's lack of ability to more creatively deliver teaching materials when science learning is supposed to be experienced through curiosity-raising experiments and exciting practices. So, it can be said that science anxiety occurs in the complexity of science learning when the students face a lot pressure from abstract concepts and boring methods of teaching and learning.

In the perspectives of elementary school students, learning science can be easy if the methods of teaching and learning fascinate them. This highlights the importance of revivifying the atmosphere of learning science and mathematics with the sense of accomplishment and happiness in order to prevent them suffering from anxiety.

Elementary school is the most crucial level of education where one begins to create perceptions of what he learns. Therefore, there must be fun ways of teaching and learning which are suitable for children and their characteristics to change their paradigm about science.

If science is a contextual way of studying the nature, then it must be contextually introduced to the students in the most exciting manners. Griffiths and Clyne (1995) reveal that "students are enjoying what they are doing, when they are motivated, when they have an interest in the outcome, it is more likely that learning will take place". In addition, Sullivan (1993) suggests that "games may motivate children to learn. For children who do not enjoy mathematics, games allow teachers a way of building the students' interest".

Presenting science as an inspiring and interesting subject of study especially to elementary school students is thus necessary, because in this way science and mathematics anxiety can be reduced. Science in fact does not merely contain scientific ideas or concepts which need to be memorized. Instead, it is an area of study which should be pursued through stimulating experiences. This means that the students' active involvement in the process of science learning is the main orientation. Various kinds of learning activity can be implemented to create an effective learning climate. One of them is through the implementation of teaching materials which the students are fond of, so they are led to a situation where they enjoy the process of learning. Especially for children as learners, Gallenstein (2005) explains that "a key element for children in understanding science and mathematics knowledge on the early childhood level (preschool-primary grades) is through active, creative, intellectual engagement. Children actively engage in acquiring basic science and mathematics concepts as they explore environment".

Science activities can be manifested in the learning process which directs the students to have systematic experiences of science. One of them is through the arrangement of teaching materials into a fairytale book which is *sainsmatika*-based (science-and-mathematics-based). In this research, the development of the fairytale book was based on several perspectives and concepts from education experts who have proven that fairy tales can be used to bridge the gap between the students and the knowledge. Therefore, using children literature in the form of a fairytale book to facilitate learning will provide the students with easy ways to construct their knowledge. In this matter, Anderson (2009) states that “fairy-tales include a number of notions which help children get mathematical notions about the surrounding world, its variety and glory. Fairy-tales not only develop children’s imagination but also develop their skills to use mathematical connections and basic notions in a simple understandable language in primary and preschools mathematics education, at the same time putting stress on these connections and so paving the way to further serious acquisition of the systemic course of mathematics”.

Marpaung (2012) emphasizes the notion that science is fun and there are many ways to learn science. One of them is by reading books. However, the students do not only learn science from the conventional lesson books, because they can also learn it from fairytale books. In this research, the *sainsmatika*-based fairytale books are the representation of educative missions to connect science and mathematics with interesting fairy tales, supported by various kinds of activities which allow the students ‘to think and do’. Therefore the purpose of this research is to investigate the effectiveness of *sainsmatika*-based fairytale books to overcome the science and mathematics anxiety of elementary school students.

Several advantages given by the *sainsmatika*-based fairytale books can be the reasons to support the efforts to create a joyful atmosphere in the classroom where the students learn science and mathematics. Besides that, fairy tales, learning materials and learning activities are closely connected to one another insomuch that these *sainsmatika*-based fairytale books can overcome students’ anxiety in the process of learning. Singer (1980) says that anxiety is related to the tendency to perceive a situation which one considers threatening or stressful. It occurs when one thinks that some situation or some particular object which is actually not real is something frightening. In the same way, science and mathematics can be the sources of anxiety if they are presented in such a way which causes mental tension in the classroom. However, on the contrary, they can be enjoyable if the teacher knows how to engage the students in a more playful and interesting way.

These *sainsmatika*-based fairytale books provide various learning activities which stimulate the students to actively move and explore their environment, and also encourages the sense of accomplishment so the students feel more confident in problem solving. The self-trust that they are capable of coping with the challenges in the process of learning can motivate them to love what they learn and make them always want to know more. It is then expected that science and mathematics can be perceived by the students as interesting subjects of study.

About the connection between fairy tales and mathematics learning, Anderson (2009) emphasizes that “fairy-tales include a number of notions which help children get mathematical notions about the surrounding world, its variety and

glory. Fairy-tales not only develop children’s imagination but also develop their skills to use mathematical connections and basic notions in a simple understandable language in primary and preschools mathematics education, at the same time putting stress on these connections and so paving the way to further serious acquisition of the systemic course of mathematics”. This research is the continuation of Anderson’s research, but here the fairytale books contain learning materials where science and mathematics are conjoined. It is hoped that these *sainsmatika*-based fairytale books can engage the students with learning materials in an attempt to overcome their anxiety in science and mathematics.

Kready (1916) strengthens the notion that fairy tales are not only the bridge of education but also the sources of pleasure for students, as she says that “fairy tales bring joy into child life. The mission of joy has not been fully preached, but we know that joy works toward physical health, mental brightness, and moral virtue”. In this way, fairy tales allow the children to develop their personality traits through their learning experiences. With the enthusiasm and happiness in them, they will begin to love science and mathematics which are presented in the fairytale books. Based on the results of data analysis, it can be concluded that *sainsmatika*-based fairytale books are significantly effective to reduce students’ anxiety.

CONCLUSION

Based on the statistical results from the one-way analysis of variance, it can be concluded that the use of *sainsmatika*-based fairytale books is effective to reduce science and mathematics anxiety of elementary school students. This research also discovered more potential advantages of using *sainsmatika*-based fairytale books in science learning, which are: 1) fairy tales can be the bridge which connects the students to the knowledge of science and mathematics; 2) fairy tales can facilitate the students to develop their critical thinking skills; 3) fairy tales can stimulate students’ curiosity; 4) fairy tales allow the students to independently construct their knowledge of science and mathematics through the plots; 5) the *sainsmatika*-based fairytale books which cover the teaching materials provide various activities of science and mathematics to lead the students to experience ‘learning by doing’; 6) the *sainsmatika*-based fairytale books provide problem-solving exercises which are arranged and presented in an engaging way; 7) fairy tales are illustrated in the books with combinations of beautiful colors so they raise enthusiasm and attract the students to read them; 8) fairy tales are presented with interesting pictures which represent characteristically concrete objects of science and mathematics; 9) the *sainsmatika*-based fairytale books provide deeper information to achieve the standard of competency; and 10) fairy tales are rich in moral messages which the students can implement in their lives.

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Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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TABLE 1 | The characteristics of research subjects

Subjects	Male students	Female students
School A	Control 13	15
School B	group 18	13
School C	Experimental 12	20
School D	group 12	19
Total	55	67

TABLE 2 | Description of the gain score analysis

Groups	N	Mean	SD
Control	59	3.96	1.566
Experimental	63	45.13	6.102
Total	122	32.13	20.955

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