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Involvement of Teachers, Parents, and School Committees in Improving Scientific Attitudes of Elementary School Students: Application of Rasch Model Analysis

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Abstract: This research analyzed the involvement of teachers, parents, and school committees in improving scientific attitudes in science learning using Rasch model analysis. A survey method was used in this quantitative study. Participants in the study were selected using a purposive sample of 174 teachers, parents, and school committees in Sleman and Kebumen Regencies, Indonesia. A questionnaire was used in data collection to determine the involvement of teachers, parents, and school committees in improving scientific attitudes toward science learning. The questionnaires were completed using a Likert scale of 1-4, and the data were then analyzed using the Rasch model. The result showed that all participants were the average logit items (+1.03 logit). The reliability was 0.89, indicating a positive response to improving students' scientific attitudes. The results of the Rasch model analysis suggested that the involvement of parents, teachers, and school committees in improving scientific attitudes differed according to their roles. Each instrument element was analyzed in more detail in the Rasch model. Participants' roles were reflected in the specific involvements of teachers in learning, parents at home with children, and school committees participating in school policy-making.

Keywords: *Parents, Rasch model, scientific attitude, school committee, teachers.*

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Introduction

The challenges of 21st-century education must be able to prepare and ensure that students optimize various skills, such as technology and media, work, and life skills (Ahrari et al., 2016; Sari et al., 2021). In this case, attitudes and values are critical components that determine students' future success. They are a critical component of the Organization for Economic Cooperation and Development (OECD) Learning Compass 2030. Attitudes and values are integrated into the framework curriculum, knowledge competencies, and skills (OECD, 2021). Challenges in the era of globalization include the integration of economic problems, political divisions, independence, technological advances, and the emergence of a new culture. These challenges directly or indirectly lead to a crisis in character education (Astalini et al., 2020; Birhan et al., 2021; Brown et al., 2020). The existence of character education is a set of challenges facing every formal and non-formal educational institution in the 21st century. Aspects highlighted by researchers include goals, vision, mission, curriculum, materials, methods, approaches, sources, facilities and infrastructure, management techniques, and evaluation (Adams et al., 2018). More specifically, science learning that supports 21st-century learning must prepare students to solve problems in everyday life (Suryandari et al., 2021).

Science has three main aspects: a product, a process, a scientific attitude, and science as an application. Science as a product is a discipline that deals with facts, concepts, and theoretical principles of matter that can explain and understand nature and the phenomena that occur in it. Science is necessary to acquire knowledge and have many skills to detect, apply, and investigate natural phenomena at specific stages. Science learning also requires developing a scientific attitude (Kurniawan et al., 2019; Oh, 2017; Saputri et al., 2019; Suryandari et al., 2017, 2020).

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Scientific attitude in learning science is one of the characteristics that must be developed in elementary schools (Maison et al., 2020). A scientific attitude is formed by someone involved in science learning. The scientific attitude includes reasonableness, curiosity, an open mind, distrust of the supernatural, objectivity, and intellectual conviction. Students must have a scientific attitude when engaging in science activities (Kurniawan et al., 2019; Murphy et al., 2013). Science activities are conducted through observation, communication, measurement, and other methods. In addition, scientific attitudes need to be developed in learning activities because they can train a courageous and polite attitude in arguing and asking questions, as well as curiosity, cooperation, discipline, honesty, criticalness, objective, careful, creativity, and work ethics (Schneider & Plasman, 2011; Siko & Barbour, 2016; Wildayanto et al., 2020). The goal to be achieved in learning science is the development of a scientific attitude that each student brings with them. With this goal in mind, teachers, parents, and school committees have been preparing to develop an understanding encompassing aspects of scientific attitude. One of the ways to promote scientific attitudes is through the use of experiments or practicum (Pedaste et al., 2015).

Science learning objectives at all levels, including primary and secondary, aim to develop students' scientific character. Gogoi and Munda (2016), the Ministry of Education and Culture (2016a), and Stupple et al., (2017) stated that the science curriculum is structured to make provisions for scientific character traits through hands-on/experimental activities using scientific methods so that students can think critically and appreciate evidence/facts. Sormunen and Köksal (2014) stated that the curriculum and educational reform strongly emphasize scientific attitudes to improve the quality of science education.

The scientific attitude increases education quality and process, and the attitudes are increasingly developed, cultivating students' noble character. Students have these two things in a complete and balanced way in line with the competence of graduates who become the standard of education units (Cheung & Lee., 2010; Kim et al., 2019; White, 1998). On the other hand, character education has a function and direction oriented toward moral intelligence. The development of moral intelligence is the basis of ethical beliefs in action. Thus, character education must be harmonized with understanding, attitude, and embodiment of the values conceived and adopted by the ancestors as the embodiment of actions that intersect with God, humans, and the universe (Cheung & Lee., 2010). Its embodiment can be fulfilling the needs of moral and value education with a container for religious and civic lessons (Kim et al., 2019; Mubarok et al., 2021). The development of scientific attitudes also contributes greatly to national character development and as a capital for social change in a multicultural world. Scientific attitudes also play an essential role in shaping children's character in choosing a career after finishing school (Erdoğan, 2015; Stupple et al., 2017).

One of the essential aspects of science is the scientific attitude toward learning. Maranan (2017) asserts that a scientific attitude is critical to student achievement. Scientific attitude is a thinking disposition that has become a research trend and is integrated with higher-order thinking skills, such as critical and creative thinking, metacognition, choosing alternative solutions to problems, and making operational decisions. It largely determines the quality of individual students. In this case, elementary school students must have a scientific attitude in performing scientific activities (Alan & Spero, 2014; Kim et al., 2019).

Scientific actions are conducted in science learning through observation, communicating, measuring, and others (Murphy et al., 2013). Scientific attitudes include curiosity, prioritizing evidence, being skeptical or distrustful, accepting differences, working together, and being optimistic about failure (Kurniawan et al., 2019; Nugraha et al., 2020).

Furthermore, the reality shows that students' interest in becoming researchers thousands of residents in developed countries increased from 2000 to 2020. Scientific actions are performed in science learning through observation, communication, measurement, and others (Murphy et al., 2013). In 2016 (8,333 people), 2017 (8,587 people), and 2018 (8,896 people), the interest in becoming a researcher has tended to increase among thousands of residents, which has a positive impact on science learning (OECD, 2021).

Research on attitudes toward science learning has shown that students have difficulty using scientific knowledge and making decisions about social science topics (Bağcı et al., 2014; OECD, 2021). It is predicted to do with students with weak scientific literacy skills. Ardianto and Rubini (2016) also found that scientific attitudes scores in Indonesia are still low. Problem-solving skills of Indonesian students were very low compared to other countries such as Malaysia, Thailand, and the Philippines. Another study by Sormunen and Köksal (2014) also stated that science education did not emphasize scientific attitudes. In several relevant studies on scientific attitudes in science learning, attitude questionnaires and interview guides were used in data collection. The data analysis technique for the attitude questionnaire used descriptive statistics, while the data analysis technique for the interview used Miles and Huberman's model (Erdoğan, 2015; Kurniawan et al., 2019). This study investigated elementary students' scientific attitudes toward science learning. However, the novelty of this study is the use of the Rasch model analysis to measure the involvement of teachers, parents, and school committees in the development of elementary students' scientific attitudes in science learning.

Therefore, it is necessary to strengthen character education, in this case, a scientific attitude that involves parents, school organizations, and teachers. The collaboration of parents, schools, and teachers strengthens the implementation of character education. This cooperation is also an attempt to develop, train, familiarize and live the values of the nation's character. In addition, these characters become their identity, mindset, perspective, love, and national glory. Parents,

teachers, and the environment can also shape good characters for students' daily lives (Gross et al., 2004; Rescorla et al., 2014; Rosnati et al., 2010; Santos et al., 2020).

Teachers' involvement in character education, especially in science settings, includes (a) being a learning designer; Thus, teachers must have sufficient knowledge of learning principles as a basis for planning, (b) being able to manage the classroom by providing and using facilities for various teaching and learning activities, (c) act as motivators in all teaching and learning activities, (d) teachers should continuously monitor learning outcomes achieved by students to achieve optimal results, and (e) teachers as consultants are expected to respond to any behavioral problems in the learning process (Koh & Chai, 2014; Mishra & Koehler, 2006). Other research has shown that student success is associated with parental academic support (Berg-Nielsen et al., 2012; Santos et al., 2020). Schools with a positive learning climate that engage and collaborate with school committees are also an attempt to develop a scientific attitude (Halik et al., 2019; Šteh & Kalin, 2011).

The independent institution of several parents is the concept of a school committee, which includes stakeholders and leaders of the school community. Their role is to improve service quality to the maximum. Given the importance of school committees, they can be directly involved in planning, implementing, and monitoring school activities, especially in improving character education programs (PPK). School committee members comprise 50% parents, 30% education experts, and 20% community leaders (Ministry of Education and Culture, 2016b). Schools are places of success and mediate positive relationships between teachers, students, and the local community (Bunujevac & Durisic, 2017; Sanders & Sheldon, 2009).

In addition, the relationship between teachers, parents, and school committees in developing students' scientific attitudes can be measured using Rasch modeling. The Rasch model is a guide for developing an instrument development framework (Adams et al., 2020; Bond & Fox, 2012; Bradley et al., 2015). The advantage of the Rasch model is its accuracy in testing the validity and reliability of the instrument (Adams et al., 2018; Ling Lee et al., 2020; Sumintono, 2018). The Rasch model is a data analysis technique based on the supply of goods and quality (Maryati et al., 2019; Setiawan et al., 2018). The reference is the processing of the difficulty of the items in determining the quality of the item. This technique was developed because it is not based on the correct number of responses. The instrument's suitability can be analyzed and predicted through the Rasch model. The pattern of respondents is also the basis for identifying some data. Another advantage of this model is the classical test theory that follows from the prediction results of the missing data from the systematic response pattern (Beaumont, 2010; Chan et al., 2021; Van Zile-Tamsen, 2017).

In addition, a good assessment instrument should meet several criteria, including good item validity, good item reliability, different item difficulty levels, and different items that can distinguish respondents who are intelligent and can answer the questions from respondents who do not understand the question (Shin et al., 2015; Wijayanti et al., 2019). The right Rasch model can strengthen the development of new tools, especially in learning. The Rasch model can also be used to test the validity and reliability of the instrument with the logit value of each item (Bond & Fox, 2012; Bradley et al., 2015; Sumintono, 2018). In addition, the Rasch model provides a different approach to using baseline data in educational assessment. For raw data, the results of Rasch modeling measurements aim to obtain a measurement scale with interval similarity. As a result of this measurement, information about student ability and question quality can be accurately determined. Item characteristics and student metrics are generated from item analysis using Rasch modeling (Widhiarso & Sumintono, 2016). Moreover, Rasch modeling has an advantage over other techniques, especially traditional test theory, which can predict missing data because it builds on a systematic pattern of responses (Ling Lee et al., 2020; Setiawan et al., 2018; Sumintono, 2018).

For this reason, this study analyzes the comparison of instrument quality from various aspects, such as accuracy, consistency, and difference in questionnaire instrument difficulty using the classical test theory approach and the Rasch model. The test item analyzed in this research was a measurement instrument for designing a questionnaire item about the role of teachers, parents, and school committees in forming students' characters, especially in the era of the COVID-19 pandemic. The item analysis was conducted to improve the quality of the evaluation instruments by developing evaluation instruments that measure the participants' abilities in developing students' character at the basic education level. Item analysis is also essential to maintain and improve the quality of research instruments, especially in distinguishing the roles of teachers, parents, and school committees in student character development. Thus, the objectives of this research are to (a) analyze the involvement of teachers, parents, and school committees in the development of scientific attitudes using Rasch modeling and (b) compare the significant differences in the involvement of teachers, parents, and school committees in the development of scientific attitudes using Rasch modeling with differential item functioning (DIF).

Methodology

Research Design

The Rasch model was used as the research design (Sumintono, 2018; Van Zile-Tamsen, 2017; Widhiarso & Sumintono, 2016). Surveys are a data collection method. The definition of survey method is an approach that depicts current and past conditions (Creswell & Clark, 2011). The survey was conducted over six months, from July to December 2021.

Sample and Data Collection

The participants comprised 174 school committees, teachers, and parents. Among them were 85 elementary school teachers, 59 parents as mothers and fathers, and 30 parents serving on school committees in the regencies of Sleman and Kebumen, Indonesia. The participating teachers taught students from lower to upper grades and had been working for more than three years. In this study, a questionnaire instrument was used to measure the involvement and response of parents, teachers, and school committees in developing scientific attitudes. The demographic data of the respondents are shown in Table 1.

Table 1. Participants' Demographic Profiles

Description	Number of respondents	Percentage of respondents
Gender		
-Female	124	71.26
-Male	40	22.98
-No response	10	5.74
Influence		
-Parents	59	33.90
-School committee	30	17.24
-Teacher	85	48.85
Years of service		
- 0 - 5 years	52	29.88
- 5-10 years	68	39.08
- > 10 years	54	31.03

Instrument

The development of the instrument stemmed from an analysis of teaching and a study of scientific attitudes toward philosophical science learning. The instrument consisted of 20 statements about the involvement of parents, teachers, and school committees in strengthening scientific attitudes. Respondents selected statements with a rating of 1: never; 2: rarely; 3: sometimes; and 4: always. The components of the statements in the questionnaires about the involvement of parents, teachers, and school committees in promoting scientific attitudes with aspects such as curiosity, honesty, creativity, nationalism, religion, and independence are shown in Table 2.

Table 2. Domains/Aspects of the Involvement of Parents and School Committees in Strengthening Scientific Attitude

Scientific attitudes	Parents	Teachers	School committee
Curiosity	- Cultivate a positive thinking attitude in children. -Inviting children to care for the natural environment.	-Application of character in learning. -Involving students in conducting process skills experiments.	-Involvement in the planning process to improve the quality of education. -Planning work programs to increase curiosity (e.g., study tours).
Honesty	-Praise for children who are honest and tell dishonest actions. -Provide understanding that it is a pleasure to be honest.	- Motivate students to always be honest on exams and homework assignments	-Discussing with teachers to implement programs to improve honesty
Creativity	Children should not be taught every step, but given room to develop their imagination. -Train children to plan family activities. Children's initiatives must be respected in order to develop a positive sense of identity.	-Involving students to think critically and creatively in problem-based learning	-Several school programs in collaboration with principals and committees to improve scientific attitudes.
Religious	-Encourage children to always be thankful for God's grace. -Remind students to always pray on time.	-Start learning activities with a prayer. -Familiarize students with always being thankful	-Discuss with teachers programs that increase students' religious sense (for example).
Independence	-Allows students to see and observe every option available to them -Giving students the opportunity and confidence to carry out their activities without the accompaniment of their parents.	-Giving school assignments to do independently	-The School Committee collaborates with higher educational institutions in implementation of the improvement of the quality of learning. -Participation in the evaluation of school policies.

In this study, the involvement of teachers and parents was to ask children to take care of the environment of their home and school, to encourage curiosity, to respect children, always, to be honest, to be grateful for God's gifts, and to familiarize children with observing and taking advantage of every opportunity without interference from parents and teachers. The questionnaire on the school committee to foster scientific attitudes refers to the aspects of communication, school learning, participation in policy decisions by the school committee, and voluntary participation in all school activities. Before collecting the data, the questionnaire was first tested. The documentation was analyzed by checking moral and character education content and teaching differences. Before the documentation, experiments were conducted in three schools to correct the accuracy and consistency of the questionnaire instrument. Each response to the questionnaire was entered into the Winsteps application, and the instrument's stability was calculated using a formula. Chronbach's alpha formula was used to measure the instrument's reliability: the interaction between the person and the items. Winstep software was used to analyze the Rasch model (Creswell & Clark, 2011; Huang, 2017). The instrument's content validity was determined using a questionnaire for the assessment expert and demonstrated by the V-Aiken coefficient with three rating scales with four raters, which has a range of -1 to 1. The results of the content validity analysis with a value of 0.78 show that the instrument has high content validity. Content validity is essential for nonstandardized data collection instruments (Adams et al., 2020; Aiken, 1985).

Collecting of Data

The method used to collect data was a questionnaire on a teacher, school committee, and parent involvement in strengthening scientific attitudes in learning natural sciences (Fraenkel & Wallen, 2006). The questionnaire was used to collect quantitative data from teachers, school committees, and parents. Data collection was conducted from January to July 2021. Data were collected using a Google form.

Analyzing of Data

In this quantitative data analysis, Rasch modeling was used to assess the engagement of teachers, parents, and school committees in strengthening student character development for learning. The analytical instrument used to test the degree of accuracy and consistency is called the Rasch model. Rasch modeling also tests the fit of individuals and items simultaneously. Test the validity of the data obtained from the accuracy of item responses by obtaining the value from the Outfit Mean Square (MNSQ) $0.5 < MNSQ < 1.5$. The fit of the Z test with the accepted outfit Z standard (ZSTD) is $-2.0 < ZSTD < +2.0$, and the point-mean correlation (Pt Mean Corr) is $0.4 < Pt\ Mean\ Corr < 0.85$ (Bradley et al., 2015; Widhiarso & Sumintono, 2016). If the items of the service quality instrument meet at least one of the above components, the items of the instrument are feasible. The synthesis of the validity test is that all items of the response dimension on strengthening education met the statistical fit criteria, so the instrument could be used for this research. The results of the raw data measurement in collecting data in an ordinal scale were then converted to an interval scale using Rasch modeling with Winsteps version 3.73 software (Ling Lee & Sumintono et al., 2020). In this regard, Rasch modeling overcomes the problem of data consistency by alimenting the logit transformation by applying the logarithm to the odd ratio of raw data available from respondents. In this study, univariate analysis revealed the involvement of parents, school committees, and teachers in strengthening character education, evident from the mapping of Wright items and the map of individuals (characteristics) generated from Rasch modeling. In addition, differential item functional analysis (DIF) was used to identify participant responses based on demographic data, in this case, responses regarding teacher, parent, and school committee involvement.

Results

The Rasch model analysis results for teachers, parents, and school committees on scientific attitudes showed a perfect denomination overall. Teachers, parents, and school committees work together to promote students' scientific attitudes. However, the participation in science attitude formation was not equal, with the number of respondents (N) 174 people and the number of questionnaires 20 items. The reliability values of the person measurement with a value of .78 and the items with a value of .97 meant more than logit 0.0 and close to (1.0), where respondents tended to agree more with statements about different items.

Parents, teachers, and school committees developed a scientific attitude toward learning. Item reliability data revealed that the overall person-item interaction was very good at .82, and person reliability had a value of .78. These results mean good consistency between the respondents' answers and the instruments. Other data included the mean square of the outfit. The mean was 1.08 consecutively, indicating the same value; the ideal value was 1.00, the better. These results suggest that the actual data are consistent with the requirements of the Rasch model or that the research instrument is accurate and firm.

Table 3. Statistics on the Role of Parents and School Committees in Children's Character Development.

Psychometric properties	Person	Item
N	174	20
Outfit mean square	1.08	1.08
Mean	90.9	618.3
Reliability	.78	.97
SD	6.7	54.8
Separation	1.58	5.41
Cronbach Alpha (KR-20) Reliability	.82	

Note: ***p=0.01*

Analysis of the Rasch model resulted in a comprehensive Wright Map or person-item map. It was found that code 079O, with items approaching from 2 logits followed by 069G, 075G, 104O, and 125G, indicated that teachers and parents gave more agreed responses. Codes 015K and 09K were the most difficult to answer in agreement when responding to the instrument with a logit close to zero.

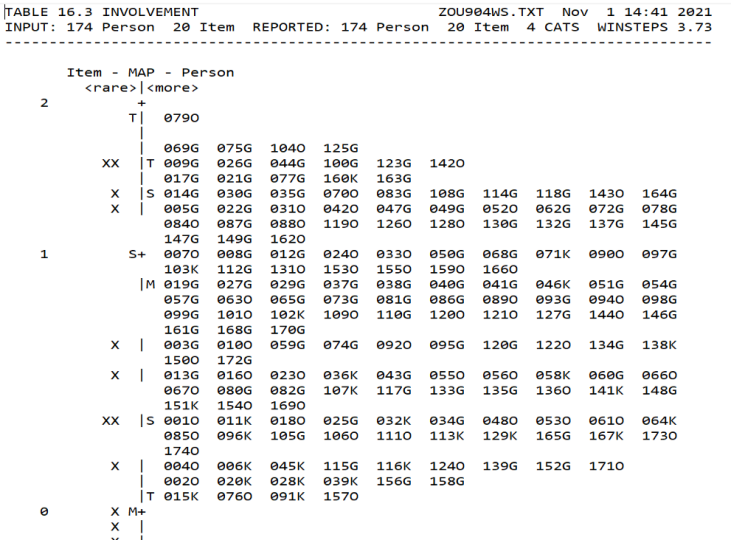

Figure 1. Overall Person and Item Map Variables

Note: Codes O: parent; K: School committee; G: Teacher

Figure 1 shows that parents (code O) and teachers (code G) were more involved in developing children's character. In contrast, the school committee (code K) played a lesser role in school policy-making regarding students' character development. The distribution of individuals with a logit of 1.58 indicates that parents played a greater role in character development than the school committee. School committees were sometimes involved in school policy, but parents were more involved in character development. To measure differences in demographic factors between teachers, parents, and school committees in developing scientific attitudes, differential item functioning (DIF) was used (Figure 2). The Rasch model can reveal differences in responses based on demographic factors. Respondents' answers indicated the presence of DIF probability with a value of less than 5% (.05). DIF also provided information about the difficulty of the items based on the criteria of the respondents, in this case, teachers, parents, and school committees on scientific attitudes.

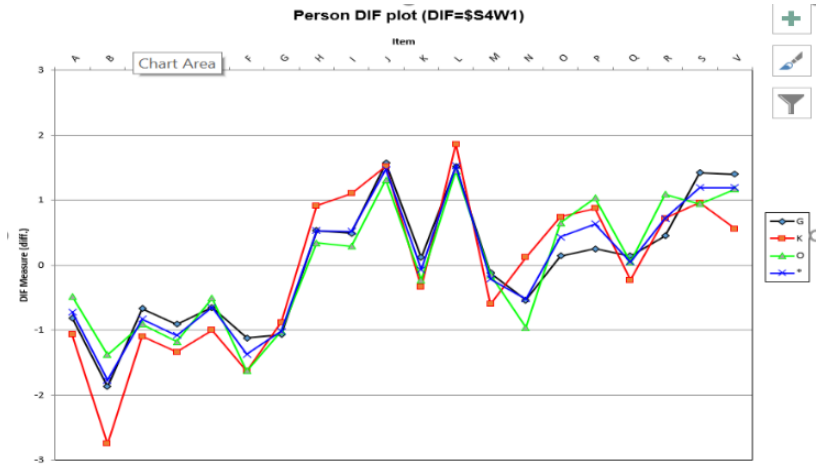

Figure 2. Overall Person and Item Map Variables

Note: Codes O: Parent; K: School committee; G: Teacher

Based on Figure 2, overall person and item map variables, the DIF plot by participants' responses to science learning attitudes. The school committee (K) participated in character development, primarily in scientific attitudes in planning, implementing, and evaluating school policies, namely items A, B, C, D, and E, with the following explanation: Item A (independent: involvement in process planning at the beginning of the new school year to improve the quality of education), item B (curiosity: planning a program of work with teachers to increase the character of curiosity (e.g., study tours), item C (independent: Participation in policy decisions in the school through the school committee), item D (independent: Communicating with the residents of the school about the importance of maintaining the environment and health in learning), item E (honesty: helping with work/time/funding when the school has activities), item Q (honesty: helping to promote the school to other parties), and V (independent: networking with all parents). For this item, it is also noticeable that the school committee (K) responded most frequently to the involvement of the development of academic attitudes than teachers and parents. However, for items G, H, L, and N, the school committee (K) was less involved. The school committee was also involved in item G (curiosity: invite children to take an interest in the natural environment), item H (honesty: fostering positive thinking in children), item L (honesty: allow students to see and observe all available options), and item N (religious: give students the opportunity and trust to do their activities without the accompaniment of parents).

For these questions, parents and teachers responded more frequently to the involvement of scientific attitudes. Parent involvement was lowest for items A, B, P, and R compared to teachers and school committees. Specifically, item A (Independent: Involvement in the planning process at the beginning of the new school year to improve the quality of instruction), item B (curiosity: planning a program of work with teachers to strengthen the character of curiosity (e.g., study trip), item P (creativity: involving students to experiment with process skills), and item R were the least likely to be answered compared to teachers and school committees.

The formation of scientific attitudes in the family concerned items F, I, and N. For item F (independent: applying character to learning), item I (creativity: training children to plan family activities), and item N (independent, religious: giving students the opportunity and trust to carry out their activities without the accompaniment of parents), parents were most often involved in the formation of scientific attitudes at home. Teachers engaged most frequently in item O (independent: applying character to learning), item P (creativity: involving students in leading experiments with process-oriented skills), and item R (creativity: involving students in critical and creative instruction in problem-based learning). Meanwhile, items S (help fund each learning activity) and V (have a network with all parents) were the least frequently involved items.

Item F (applying character to learning) found that teachers, parents, and the school committee developed a scientific attitude in the school and home environment. In addition, item K (religious: children are always thankful for God's grace) revealed a response that often played a role in the synergistic scientific attitude of teachers, parents, and school committees.

Discussion

This study examined the involvement of teachers, parents, and school committees in broadening students' scientific attitudes. The form of participation was based on each participant's role in fulfilling their responsibilities. Teacher involvement in the development of scientific attitudes tended to occur in the school setting, particularly in science learning (Berg-Nielsen et al., 2012; Birhan et al., 2021). Parents shaped students' scientific attitudes daily, while school committees were only indirectly involved because they played a role in shaping school policy (Šteh & Kalin, 2011). In addition, the study found among the categories of scientific attitudes (care for the environment, honesty, curiosity, responsibility, and respect).

Teaching honesty and responsibility is a task that parents must prioritize. Meanwhile, teachers also emphasize teaching children curious, honest, and religious behaviors. The results show that there has been a significant change in the involvement of teachers, parents, and school committees in developing students' scientific attitudes. This result is evidenced by the presence of DIF in each item, as shown in Figure 2. These twenty items contained DIF, indicating that these items had evidence of measurement bias that could affect validity. In addition, this study aims to examine the extent to which teachers, parents, and school committees are involved in developing elementary students' scientific attitudes.

In each item, character values appeared, primarily scientific attitudes developed in learning, such as involving students to care about the natural environment, being honest, working hard, being disciplined, and being independent. As a facilitator, the teacher's role is to teach students the character values of scientific attitudes in a conducive, comfortable, and pleasant classroom atmosphere. Teachers also involve students in experiments by measuring, observing, collecting data, and drawing conclusions (Erdoğan, 2015; Maryati et al., 2019). Natural science experiment activities increased scientific attitudes, including curiosity, honesty, independence, and responsibility. The involvement of teachers in using their knowledge provided a learning experience for students and a good learning situation. Based on this finding, we think that the scientific attitude that emerged was the character of hard work, creativity, discipline, and responsibility. Thus, students' cultivation of scientific attitudes can run well and optimally (Maison et al., 2020). The results also showed by Gross et al. (2004); Huang (2017); Rescorla et al. (2014); Rosnati et al. (2010) that a tendency for the role of parents and teachers to be greater in developing scientific attitudes than the involvement of school committees.

In this case, a teacher must be able to communicate with students, school committees, and parents to support the learning process. It is crucial for elementary school teachers to familiarize students with sensitivity to natural phenomena and to familiarize them with the environment and laboratory equipment (Mubarok et al., 2021; Santos et al., 2020). The teacher's role in improving scientific attitudes in science learning is to engage students in observing the environment and motivate them through positive reinforcement (Lawshe, 1975). Teachers should emphasize that learning science is not memorization, but fact-based observations lead to conclusions. Teachers can also integrate scientific attitudes into the learning process, including planning, implementation, and assessment. In addition, teachers are expected to choose learning methods and strategies that allow for the growth of positive scientific attitudes consistent with the desired skill profile. This finding was noted in items O, P, and R. The role of the school committee ranged from planning and implementation to monitoring and evaluation. In the planning phase, the school committee and the school can plan different programs that the school will implement. According to Halik et al. (2019) and Maison et al. (2020), academic attitude is part of character development. The school committee can suggest that teachers conduct science learning activities or field trips.

However, the results showed a tendency for parents to assume that science settings are the teacher's responsibility when learning occurs. In addition, some teachers believe that scientific attitudes are formed through parental character education at home. Gross et al. (2004) also agreed in their study that there are differences between parents and teachers in children's character education. In 74.3% of the cases, parents and teachers agreed that children's attitudes and behavior were normal, while 2.5% of the sample children showed problematic behavior. In addition, due to the limited time for teaching moral education in elementary school, less attention was paid to forming scientific attitudes, especially during the COVID-19 pandemic. In addition, there was a lack of cooperation with teachers, parents, and school committees in character education, especially in scientific attitudes. According to teachers, parents lacked role models for children's character development, especially regarding scientific attitudes in everyday life (Rescorla et al., 2014; Sanders & Sheldon, 2009; Santos et al., 2020).

Conclusion

The increase in scientific attitudes in elementary school was influenced by the involvement of parents, teachers, and school committees in learning. Scientific attitudes analyzed included curiosity, honesty, creativity, religion, and independence. Each instrument element was examined in more detail using the Rasch model. Study participants' role was reflected in teachers' specific involvement in learning, parents at home with their children, and school committees participating in school policy-making. In addition, instrument items for respondents' participation, particularly teachers, parents, and school committees, in the development of scientific attitudes indicated the existence of differential item functioning (DIF).

Recommendations

Thus, further research should clarify whether the findings of this study can be generalized to develop scientific attitudes in learning science across Indonesia. In addition, this study contributes to the characteristics of scientific attitudes by showing the involvement of teachers, parents, and school committees in developing scientific attitudes. Further research should involve parents, who play a more critical role than mothers or fathers in forming a child's scientific attitude. Practitioners should always consider scientific attitudes by providing positive reinforcement to students in science classes.

Limitations

This study has several limitations, including that the study was conducted in only two districts (Sleman and Kebumen). Therefore, the results cannot be generalized locally or nationally. Future researchers may consider collecting more data

and having a more extensive research area. In addition, the study focuses only on science education so that future researchers may investigate other subjects (such as mathematics, social studies, art, or others) with similar variables. Qualitative research that combines questionnaires and interview techniques will be better in future research. Since this study used only one instrument, it can be assumed that the validity of the data is less intense. This case is also a limitation of this study.

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Authorship Contribution Statement

Suryandari: Concept and design, data analysis/interpretation, data acquisition, writing. Rokhmaniyah: Editing/reviewing, drafting manuscript. Salimi: Critical revision of manuscript, technical or material support. Fatimah: Statistical analysis.

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