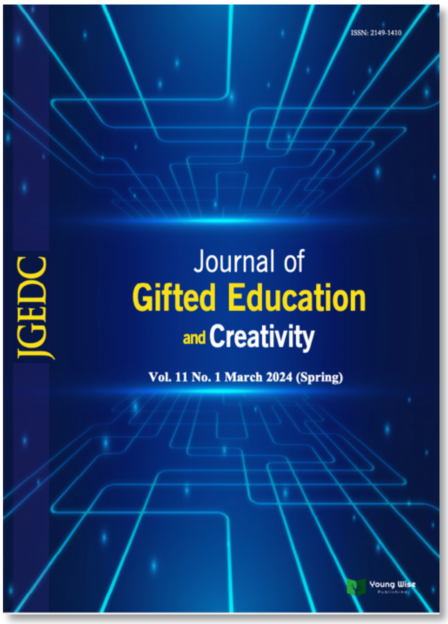
ISSN: 2149-1410

JGEDC

Journal of Gifted Education and Creativity

Vol. 11 No. 1 March 2024 (Spring)

Young Wise Publishing



Journal of Gifted Education and Creativity (JGEDC)
e-ISSN: 2149- 1410

Vol. 11 No. 1 March 2024 (Spring)

Young Wise Publishing
Genç Bilge yayıncılık

Contents

Absracting & Indexing
EBSCO (HW Wilson-Education Source Fulltext), Index Copernicus, SOBIAD, Udledge, WorldCat, ResarchBib, EZB, Asos, Google Scholar Note: You can click on them to check the status of JGEDC in indexes.

Genç Bilge (Young Wise) Publishing
Adress: Bahcelievler District 3015 St. No:9/1 Isparta, Turkiye
Web site: http://gencbilgeyayincilik.com/ E-mail: gencbilgeyayincilik@gmail.com

Journal of Gifted Education and Creativity
11(1), 1-11, March 2024
e-ISSN: 2149- 1410
jgedc.org dergipark.org.tr/jgedc

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Research Article

Peer Support Perception Scale for gifted students: a scale development study

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Article Info

Received: 30 September 2022
Accepted: 28 January 2024
Online: 30 March 2024

Keywords
Gifted student
Peer support
Peer Support Perception Scale

Abstract

The academic success of an gifted student at the junior high school level is contingent upon the peer support they receive. Peer support has a crucial role in enhancing the learning passion and concentration of gifted students on academic assignments. The development of the peer support perception scale aimed to evaluate the establishment of friendships that contribute to individuals' emotional and social development. These friendships are characterized by voluntary interactions that involve affection, the sharing of positive experiences, and mutual reciprocity. The four dimensions of the peer support perception scale encompass informational support, instrumental support, companionship support, and esteem support. The Likert approach was employed in the construction of the peer support perception scale. The primary aim of this study is to construct a peer support perception scale that demonstrates good validity and reliability. The employed methodology involved the utilization of Rasch analysis. The participants in this study consisted of 255 junior high school students who were identified as gifted. Validity instrument shown by data fit with Rasch model, the unidimensionality of the instrument is 39.8% and 20 item fit order. Reliability shown by Cronbach's alpha is 0.88, person reliability is 0.87, and item reliability is 0.98. Overall, it can be concluded that peer support perception scale have good valid and reliability so that it can be used to measure the peer support perception among gifted students of junior high school.

To cite this article:
Eva, N. (2024). Peer Support Perception Scale for gifted students: a scale development study. *Journal of Gifted Education and Creativity, 11*(1), 1-11. DOI: https://doi.org/10.5281/zenodo.10577020

Introduction

Peer support refers to a voluntary interpersonal relationship characterized by the exchange of affection, sharing of happiness, and reciprocal interactions, with the aim of cultivating friendships that positively influence individuals' emotional and social growth (Berndt, 2004). Adolescents exhibiting remarkable intellectual abilities necessitate companions who possess similar thoughts and attitudes in order to cultivate their social aptitude and obtain social assistance. During adolescence, exceptionally gifted adolescents often encounter the challenge of social exclusion by their peers. Individuals with a pronounced sense of independence often encounter difficulties in forming friendships, since they hold the belief that companionship with peers is unnecessary (Disti, 2006).

Berndt (2004) posits that during adolescence, friends play a crucial role in providing support through four distinct components. (1) Provision of evidence or substantiation for information. Social relationships have a significant role in providing individuals with guidance and support when faced with various interpersonal challenges, such as conflicts with friends, spouses, parents, or schools. Instrumental help refers to the provision of practical aid or support. Friendship entails providing assistance to individuals in various ways, including financial aid, academic support, and engagement in

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diverse activities. (3) Assistance from a companion. Individuals may depend on their peers for engaging in social activities such as participating in school events, embarking on excursions together, viewing films, engaging in recreational games, and even procuring refreshments from the school cafeteria. The provision of assistance or resources aimed at promoting and enhancing an individual's self-esteem. Peers have a crucial role in providing adolescents with emotional and practical assistance throughout favorable and unfavorable situations. In social circles, individuals engage in the act of celebrating their friends' achievements, while also providing emotional support and consolation in times of failure.

The influence of peers on talented children' motivation to engage in learning is significant. Baker et al. (2008) found that the learning activities of gifted students are highly influenced by the friends in their immediate social circles. Gifted students may exhibit reduced levels of enthusiasm for learning when they interact with peers who lack intrinsic motivation for academic pursuits. The inclination to conform to peer norms diminishes one's motivation to acquire knowledge. The association of students with peers who exhibit a lower level of motivation towards studying has a negative impact on their academic achievement.

According to Hill (2005), there is often a decline in the academic performance of gifted students as they transition to junior high school. The aspiration for intellectual achievement is often eclipsed by the aspiration for social acceptance. Hence, in order to maintain their motivation for learning and achieve academic success, gifted students require the assistance and encouragement of their other classmates.

A substantial body of research has provided evidence indicating that peer support exerts an influence on academic achievement (Gallardo et al., 2016). Previous research has established a correlation between peer selection and several educational outcomes, such as academic achievement, behavioral problems, and teacher engagement within the classroom (Benson et al., 2006; Rubin et al., 2006). Academic performance of students can be enhanced by selecting companions who prioritize and appreciate the value of education. In contrast, kids who select companions who are troublesome in nature are likely to experience a decline in academic performance and an increase in behavioral problems.

The selection of a peer group has an influence on the academic progress of gifted students. The academic achievements of gifted students may not receive priority if they lack encouragement from their peers. According to the research conducted by Reis and McCoach (2000), the academic performance of gifted students is significantly influenced by their peers. Approximately 66% of the academically gifted students reported perceiving a lack of support from their peers regarding their academic success. Gifted students often encounter the dilemma of navigating the tension between succumbing to peer influence and prioritizing their academic aspirations. According to Mawson (2002), gifted students demonstrate exceptional performance in separating themselves from the collective. During the onset of puberty at the age of 13, gifted students sometimes have conflicts arising from their need for peer recognition. Gifted students, particularly those possessing IQ scores exceeding 160, can encounter challenges in attaining social acceptability. When academically talented individuals are enrolled in traditional classroom settings, certain phenomena occur (Rimm, 2002).

The influence of peers on adolescents can be observed in three distinct domains: attitudes and values, social development, and social support (Eisenberg et al., 2006; Rubin et al., 2006). According to Kidron and Fleischman (2006), individuals within a social group engage in the exchange of viewpoints and shared beliefs in order to establish a collective understanding of moral judgments. The peer selection process has been found to have a significant impact on various aspects of the school environment, including teacher participation, disruptive conduct, and academic progress (Benson et al., 2006; Rubin et al., 2006). Research suggests that students are more likely to achieve higher academic performance when they select companions who prioritize and appreciate the significance of education.

Social Cognitive Theory

The necessity of peer support for gifted adolescents can be elucidated through the lens of social cognitive theory (Bandura, 1986; Bandura, 1999). The underlying foundation of this theory posits that the comprehension of human motivation, emotions, and acts is contingent upon the examination of social processes and cognitive processes. This theoretical framework conceptualizes human behavior as comprising several components within a model that interact with one another, including environmental factors and individual factors such as emotions and cognition. The social cognitive model incorporates a causal model that encompasses triadic reciprocal causation. The triadic reciprocal causation model is a theoretical framework that encompasses three key elements that have an impact on human behavior: the environment (E), the individual (P), and the behavior (B) itself. According to Bandura, individual conduct is influenced by a combination of external influences and personal qualities.

The provision of social support to gifted students by their peers is a behavior that is influenced by both environmental factors and personal traits. Gifted students enrolled in specialized class programs benefit from an educational setting that fosters social connections among peers who possess similar cognitive abilities. The equitable cognitive state of talented students has a beneficial influence on their social interactions. Gifted students have a preference for friendships that offer various forms of assistance, including informational, instrumental, companionship, and affirmational support. Conversely, it has been observed that gifted students with an intelligence quotient (IQ) below 160 exhibit more favorable levels of social acceptance in relation to their personality traits (Rimm, 2002). Therefore, it is imperative for gifted students to receive social support from peers who possess particular attributes. During adolescence, gifted students engage in social interactions with their peers in order to satisfy their need for companionship and camaraderie.

Problem of Study

During the transition into puberty, gifted students encounter challenges in establishing social connections with their peers due to a discrepancy between their advanced cognitive abilities and relatively less developed social skills. For gifted adolescents, the period of junior high school can be characterized by feelings of isolation and solitude. It is imperative to provide gifted students with opportunity to interact with individuals of similar intellectual abilities. However, it is important to note that mere cognitive similarities do not guarantee mutual affinity. According to Cross (2016), it is imperative to provide explicit instruction in practical social skills, especially for exceptionally intelligent and accomplished gifted students. One essential aspect of interpersonal competence in life involves the ability to provide and receive social support from one's peers. Peer support refers to a voluntary exchange between two individuals, whereby they engage in affectionate interactions and share moments of delight. This reciprocal process fosters the formation of friendship, which in turn has a good impact on the emotional and social growth of the individuals involved.

There is a scarcity of measures available to assess the perception of peer support among gifted students in junior high school. To date, scholars investigating gifted students have employed interview and observation methodologies to ascertain the extent of peer support received by this particular group. The development of a peer support perception scale is crucial in order to address the measuring requirements associated with peer support for gifted students during their tenure at the junior high school level.

The process of scale development involves the creation of a measure that is both reliable and valid, with the purpose of assessing a specific attribute of interest. The objective of this study is to examine the extent to which the peer support perception scale, which has been established, meets the criteria for being a trustworthy instrument for measurement. The primary concern pertaining to this study revolves around the validity and reliability of utilizing the peer support perception scale among gifted junior high school students. The research aims to achieve the following objectives:

- To conduct an analysis of the validity instrument and validity items.
- To assess the reliability of items, the separation of items, the reliability of person, the separation of person, and the Cronbach's Alpha coefficient will be analyzed.

Method

Research Model

The deductive approach employed by the peer support perception scale involves the utilization of existing theories and conceptualizations of constructs to develop items that fall within the scale's scope. This methodology is pragmatic in situations where the definition of the construct is well-established and sufficiently comprehensive to facilitate the creation of an initial set of items. According to Hinkin (1995), the creation of the peer support perception scale can be divided into three distinct phases: item development, scale development, and scale evaluation. The process of item development involves two primary components: identifying the relevant domain(s) and generating the initial collection of questions for a future scale, and evaluating the content validity of these questions. The second part of the study involves the building of a scale, which aims to transform individual items into a cohesive and measurable construct. This phase encompasses several steps, including pre-testing questions, sampling and survey administration, item reduction, and extraction of latent variables. The final stage of the review process, known as scale evaluation, encompasses a series of assessments including seven tests to measure dimensionality, eight tests to assess reliability, and nine tests to evaluate validity.

Participants

The population of this study was gifted students who were studying at junior high school. They were 7thgrade students at an Islamic junior high school in Malang City, East Java, Indonesia. The research sample consisted of 255 gifted students aged 13 to 15 years. The number of male gifted students was 121 (47,451%), and female gifted students were 134 (52,549%)

Data Collection Tool

Peer Support Perception Scale

The theory put forth by Berndt (2004) was that peer support comprises four components: information support, instrumental assistance, companionship support, and esteem support. This was the foundation for the development of a peer support perception scale. There is one component containing five favorable items (see Table 1). The Likert scale was used to establish the scaling procedure, which involved categorizing replies according to their level of acceptability on a continuum. The scale used five responses: almost never, very rarely, sometimes, very often, and almost always. Each item has a score of 1 to 5 (see Table 2).

Table 1. Draft version of peer support perception scale for gifted students

Dimensions	Indicator	Item	Items
Information support	Delivering information	1,2,3,4,5	5
Instrumental support	Provide direct support	6,7,8,9,10	5
Companionship support	Make time	11,12,13,14,15	5
Esteem support	Motivating	16,17,18,19,20	5
Total			20

Data was collected by directly meeting the gifted students in class, then distributing the peer support perception scale in paper form, and asking the gifted students to fill in the peer support perception scale for 30 minutes. Scoring on a Likert-type scale is as follows; almost never 1 point, very rarely 2 points, sometimes 3 points, very often 4 points, almost always 5 points.

Data Analysis

Data were analyzed using the Rasch Model to determine validity and reliability. The Rasch model of measurement provides an effective method for preparing instruments with high validity and reliability because it performs comprehensive statistical analysis (Bond & Fox, 2015). The validity analyzed was instrument validity and item validity. The reliability analysis includes item reliability, item separation, person reliability, person separation, and Cronbach alpha.

The instrument's validity was assessed based on data fit to Rash, unidimensional models, and rating scale analysis. Data fit with the rash model is shown from Infit-Outfit Mean-Square (MNSQ) (range 0.5 - 1.5) and Infit-Outfit Z-Standardized (ZSTD) (range -2.0 - 2.0). Unidimensionality was shown in the raw variance explained by the measure of more than 20% and unexplained variance in the first contrast with an eigenvalue score of less than three and an observed score of less than 15%. Rating scale analysis is shown from the Andrich threshold index between 1.4 - 5.0 logit.

Item validity was assessed based on item outliers, Standard Error of Measure (SEM), and item fit order. Outlier items can be identified from logit items > 2SD and < 2SD. SEM shows the precision of items. If SEM > 1.0 logit indicates the item is inappropriate for measuring, and SEM < 0.5 logit indicates the item was appropriate for measuring. Item fit order can be determined from Outfit MNSQ, ZSTD, and Point Measure Correlation value. If the Outfit MNSQ value was between 0.5 and 1.5, the Outfit ZSTD value was between -2.0 and 2.0, and the Point Measure Correlation value was between 0.4 and 0.85 (Sumintono & Widhiarso, 2015).

Reliability analysis includes item reliability, item separation, person reliability, person separation, and Cronbach alpha. According to Bond & Fox (2007), Cronbach's Alpha (α) acceptable reliability is between 0.71 - 0.99, and the best reliability is 71% - 99%.

Results

To determine the instrument's validity, it can be seen from the quality of the data obtained in this research that the test data must be in a fit condition for the Rasch Model. This can be seen from the MNSQ Infit-Outfit and ZSTD Infit-Outfit values. In Table 10, it is shown that the MNSQ Infit-Outfit values of the person are 1.01 and 0.99. The MNSQ Infit-Outfit values of the items are 0.99 and -0.14. The ideal MNSQ Infit-Outfit values are between 0.5 - 1.5. Based on the MNSQ infit-outfit values, the data obtained is fit following the Rasch Model. Fit data is also shown from the Infit-Outfit ZSTD values of the person and item. Infit-Outfit ZSTD of person are -0.16 and -0.20. Infit-Outfit ZSTD of the item is 0.99 and -0.13. The ideal ZSTD infit-outfit values are between -2.0 - 2.0. Based on the Infit-Outfit ZSTD values, the data obtained is fit following the Rasch model.

Table 2. Indicator of data fit to Rasch model

Person				**Item**				**Interpretation**
Infit MNSQ	Outfit MNSQ	Infit ZSTD	Outfit ZSTD	Infit MNSQ	Outfit MNSQ	Infit ZSTD	Outfit ZSTD	Data fit
1.01	.99	-.16	-.20	.99	-.14	.99	-.13	

The second indicator of instrument validity is unidimensionality. The issue of unidimensionality becomes very important in scale development. The definition of the construct to be measured is the basis for item development. All items are expected to relate to the construct in question and only this construct binds them. This is rationality in developing items. Based on this principle, the items included in a scale are expected to be able to unite differences in one basic construct. The phenomenon of unity of items and constructs explains unidimensionality. Unidimensionality was shown from the raw variance explained by measure where the score is 39.8% and unexplained variance in first contrast is 8.0%; it is not over the limit, which is 15%. See Table 3.

Table 3. Indicator unidimensionality of the peer support perception scale

Raw variance explained by measures	Unexplained variance in first contrast		Interpretation
	Observed	Eigenvalue	
39.9%	8.0%	2.8188	Unidimensional

The third indicator of instrument validity is rating scale analysis. This is shown by the Andrich threshold index between 1.4 - 5.0 logit. The scale of peer support perception has five response options for each item, namely almost never, very rarely, sometimes, very often, and almost always. Each response has a score between 1 and 5, see Table 3.

Table 4. Indicator for rating scale analysis

Index observed average	Index and rich threshold	Outfit MNSQ	Score of responses	Alternative responses
-0.53	none	1.14	1	Almost Never (AN)
-0.18	-1.3	0.98	2	Very Rarely (VR)
0.36	-1.0	0.92	3	Sometimes (S)
1.02	0.27	0.97	4	Very Often (VO)
1.86	2.02	1.01	5	Almost Always (AA)

Table 4 shows the observed average monotonically progress with categories. The observed average was in order and consistently increased monotonically (-0.53 < -0.18 < 0.36 < 1.02 < 1.86) across the step categories. This shows that, overall, respondents with lower perceptions increasingly support lower step categories, while respondents with higher perceptions increasingly support higher step categories. The results of this analysis are in accordance with the criteria that the Outfit MNSQ value is lower than 2.0. Outfit MNSQ values range from 0.92 to 1.14 indicating that the data set provides more information with lower unexplained noise.

Besides instrument validity, Rasch model analysis provides information on item validity, assessed based on outlier items, Standard Error of Measure (SEM), and item fit order. Table 6 shows that based on the logit value, it is known that only one item has a logit > 2SD, namely item number 14. The SEM value for all items is > 0.5 logit. This means that all items are correct. The third indicator of item validity was item fit order, where the item fit order of all items corresponds to the MNSQ clothing value, ZSTD clothing value, and point gauge correlation value. MNSQ clothing scores range from 0.7 to 1.35; Outfit ZSTD value between -3.94 to 2.64; and the correlation value of the measuring points was between 0.46 to 0.63. Indeed, in the ZSTD outfit value, seven items exceed the limit, but the MNSQ value takes priority to see item fit orders. Based on the outlier values, SEM, outfit MNSQ, and point gauge correlation, it can be concluded that all items are valid items.

Table 6. Indicator of validity item

IN	Measure	SEM	Outfit MNSQ	Outfit ZSTD	PMC	Interpretation
15	1.01	.07	1.23	2.64	.57	valid item
7	.95	.07	1.18	2.10	.46	valid item
10	.64	.07	1.34	3.55	.52	valid item
1	.53	.07	.94	-.70	.55	valid item
17	.47	.07	1.16	1.79	.61	valid item
5	.31	.08	1.13	1.46	.50	valid item
18	.29	.08	1.24	2.49	.53	valid item
16	.29	.08	.91	-.98	.62	valid item
4	.10	.08	.68	-3.94	.61	valid item
6	.10	.08	.84	-1.84	.55	valid item
9	.06	.08	.99	-.04	.48	valid item
3	.05	.08	.74	-3.12	.60	valid item
19	-.23	.08	.91	-.92	.63	valid item
8	-.30	.08	.90	-1.05	.43	valid item
20	-.39	.08	.91	-.94	.51	valid item
12	-.43	.08	.98	-.14	.49	valid item
2	-.52	.09	.83	-1.91	.54	valid item
13	-.83	.09	1.35	3.21	.48	valid item
11	-.85	.09	.70	-3.39	.56	valid item
14	-1.24	.01	.91	-.81	.54	valid item
Mean	0.00	.08	.99	-.1		
P. SD	0.58	.01	.20	2.2		

IN: Item No **PMC**: Point Measure Correlation

Reliability analysis includes item reliability, item separation, person reliability, person separation, and Cronbach alpha. The results of the reliability analysis are shown in Table 7.

Table 7. Result of reliability analysis

	Reliability	Interpretation	Separation	Interpretation	Cronbach Alfa	Interpretation
Item	0.98	Very good	6.89	Very good	0.88	Very good
Person	0.87	Very good	2.56	good		

The greater the value of separation, the better because it can identify a wider group of subjects (able – unable) and a wider group of items (difficult – easy). The separation value for the items in Table 7 is 6.89, and the person is 2.56. This value is relatively high, indicating that the quality of the subject and instrument is quite good.

Discussion

The development of the peer support perception measure was grounded in Berndt's (2004) theoretical framework on peer support. The peer support perception measure encompasses four dimensions: information support, direct assistance support, friendship support, and appreciation support. Every component comprises a singular indicator, with each indicator encompassing five beneficial items. The Peer Support Perception Scale is comprised of 20 items that are assessed using a five-point Likert scale ranging from 1 (almost never) to 5 (almost always).

A psychological scale of high quality has the capacity to collect empirical data and provide accurate and detailed information. Rationally, the parameters for an effective assessment encompass unambiguous guidelines pertaining to the execution, evaluation, and comprehension of the test. Additionally, it is advantageous if a test provides efficiency in terms of the time and financial resources required for its administration, scoring, and interpretation. Primarily, an effective assessment should evaluate the intended construct it aims to assess. In addition to basic logical reasoning, assessment specialists employ technical criteria to judge the quality of tests and other measurement techniques. Test users frequently discuss the psychometric integrity of tests, with reliability and validity being two crucial dimensions of concern.

The assessment of any measurement instrument necessitates the consideration of validity and reliability, which are regarded as the most crucial and important characteristics. In the conventional sense, validity pertains to the extent to which a test accurately assesses the construct it is intended to evaluate, as outlined by Cattell (1946). The notion of validity has evolved from being a quality exclusive to measuring tests to becoming an evaluative statement regarding the interpretation of test scores (DeVon et al., 2007). The research conducted using the Rasch model has revealed that the instrument employed in the peer support perception scale demonstrates good validity. The aforementioned observation is supported by the data collected, which aligns with the Rasch model. The instrument's validity is further demonstrated by the unidimensionality of the peer support perception scale. According to Fischer (1997), even if all items assess the same processes to the same extent, they can nevertheless be regarded as unidimensional. This statement suggests that the items on the peer support perception scale are measuring a common underlying construct. In addition to the appropriateness of the data for the Rasch model and the presence of unidimensionality, the validity of the instrument was established through the utilization of rating scale analysis. The findings derived from the study of the rating scale indicate that the utilization of five distinct alternative replies is effective in distinguishing individuals with contrasting levels of perceived friend support. Individuals who have a strong perception of support from their friends tend to select a response option that receives a high score. On the other hand, those who perceive assistance to be lacking tend to select a response option that is associated with a lower score.

In addition to assessing instrument validity, the Rasch model examines the validity of individual items through the identification of item outliers, the calculation of the Standard Error of Measure (SEM), and the evaluation of item fit order. The peer support perception scale initially consisted of 20 items. However, after conducting an analysis, certain items were preserved based on their ability to meet the criteria for indicating item validity. According to the outlier indicator, there was a single item that over the established threshold. However, this particular item does not possess sufficient significance to warrant its exclusion, since it adheres to both the criteria of the standard error of measurement and the item fit order. The items of the peer support perception scale align with the intended measuring objectives.

A psychological scale of high quality encompasses not only the presence of instrument validity and item validity, but also relies on empirical data to substantiate its reliability. The utilization of the Rasch model for analysis will yield several forms of dependability, including item reliability, item separation, person reliability, person separation, and Cronbach alpha. The high level of reliability exhibited by both the item and the person indicates its classification as being of excellent quality. The concept of item reliability indicates that an item possesses the ability to consistently measure a given variable. The concept of person dependability pertains to the extent to which respondents consistently supply responses that align with the established model. The categorization of things and individuals distinguishes several clusters of commodities and individuals. The peer support perception scale exhibits a notable degree of item and person clustering, with items organized into seven groups and individuals categorized into three groups. There is a positive correlation between an individual's level of detachment and their impression of peer support on a larger scale. Every item on the scale has the potential to elicit responses from individuals, regardless of whether they experience a high or low amount of peer support.

In the context of this study, the concept of item separation pertains to the extent to which the measured sample is distributed across a linear interval scale. A positive correlation exists between item separation and measurement performance, indicating that higher levels of item separation are associated with improved measurement outcomes. The purpose of this index is to facilitate the identification of the significance or meaningfulness of the concept that is being measured. In the present study, the Cronbach's alpha coefficient was computed to assess the internal consistency of the perceived peer support scale. The results indicate that the scale exhibits a high level of consistency, suggesting that the items within the scale consistently measure the construct of interest across different individuals.

Conclusion

The high instrument validity of the peer support perception scale is evidenced by its adherence to the Rasch model, the fulfillment of unidimensionality, and the effective functioning of rating scale analysis. The peer support perception scale items exhibit a high level of validity, as seen by the presence of only one outlier item, the fulfillment of the Standard Error of Measure (SEM) indicator, and the item fit order. The peer support perception scale consists of a total of 20 valid items. The peer support perception scale measure exhibited very good reliability, as evidenced by the analysis of item reliability, item separation, person dependability, and Cronbach's alpha. As for person separation, it is classified as good.

Limitations of Study

The peer support perception scale was tested on gifted students of junior high school at Islamic schools in Malang, Indonesia. Researchers think it would be better if this scale were tested in various schools with various characteristics.

Acknowledgment

The researcher would like to thank the head of the school, teachers, and students of Madrasah Tsanawiyah Negeri 1, Malang City., Indonesia. They helped collect data for this research. Ethical committee permit by Faculty Psychology, Malang State University, Indonesia. This research was carried out independently without obtaining funding from any institution.

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Appendix 1. Peer Support Perception Scale for Gifted (Indonesian Language)

Skala Persepsi Dukungan Sebaya untuk Berbakat						
1 sangat jarang, 2 jarang, 3 kadang-kadang, 4 sangat sering, 5hampir selalu						
No	**Items**	**1**	**2**	**3**	**4**	**5**
1	Teman saya mengingatkan untuk mengerjakan PR					
2	Teman saya memberi informasikegiatan sekolah					
3	Teman saya menjelaskan materi pelajaran yang tidak sayamengerti					
4	Teman saya memberikan informasi yang saya butuhkan untuk memecahkan masalah					
5	Teman saya memberikan informasi tentang media sosial yang digunakan					
6	Teman saya membantu saya menyelesaikan tugas sekolah					
7	Teman saya membagikan bekal makannya					
8	Teman saya meminjamkan alat tulisnya					
9	Teman saya meminjamkan buku pelajarannya					
10	Teman saya meminjamkan uangnya ketika saya membutuhkan					
11	Teman saya bersedia berdiskusi dengan saya					
12	Teman saya mengerjakan tugas bersama saya					
13	Teman saya pergi ke kantin bersama saya					
14	Teman saya menemani saya ngobrol jika ada waktu					
15	Teman saya bersedia menghabiskan waktu libur bersama saya					
16	Teman saya mengucapkan selamat ketika saya mendapat nilai yang bagus					
17	Teman saya mengingatkan saya untuk tetap semangat ketika hasil belajar saya menurun					
18	Teman saya mengingatkan kelebihan yang saya miliki					
19	Teman saya menghibur saya ketika saya mempunyai masalah					
20	Teman saya menghargai pendapat saya					

Appendix 2. Peer Support Perception Scale for Gifted (English Language)

Peer Support Perception Scale for Gifted						
1 almost never, 2 very rarely, 3 sometimes, 4 very often, 5 almost always						
No	**Items**	**1**	**2**	**3**	**4**	**5**
1	My friends remind me to do my homework					
2	My friends gave me information about school activities.					
3	My friends explained the material from the lesson, but I do not understand					
4	My friends provide the information I need to solve a problem.					
5	My friends provide me with information about the social media they use					
6	My friends help me with schoolwork.					
7	My friends share their lunch.					
8	My friends lend me their stationery.					
9	My friends lent me their textbooks.					
10	My friends lend me money when I need it.					
11	My friends are willing to discuss it with me.					
12	My friends do homework with me.					
13	My friends go to the canteen with me.					
14	My friends accompany me to chat when we have time.					
15	My friends are willing to spend time off together with me.					
16	My friends congratulate me when I have got a good grade.					
17	My friend reminded me to stay enthusiastic when my learning results were declining					
18	My friends remind me of the strengths I have					
19	My friends cheer me up when I have a problem.					
20	My friends sincerely value my opinion.					

Journal of Gifted Education and Creativity
11(1), 13-22, March 2024
e-ISSN: 2149- 1410
jgedc.org dergipark.org.tr/jgedc

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Research Article

Navigating science education: motivations and challenges for primary school gifted children in Chinese science museums

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Article Info

Received: 23 December 2023
Accepted: 18 March 2024
Online: 30 March 2024

Keywords
Gifted education
Out-of-school learning
Primary school
Science education

Abstract

This paper delves into the motivations and challenges faced by parents in the context of science museum visits for primary school gifted children in China. The study aims to provide insights into why parents of primary school gifted children opt for science museums and examines the factors influencing their decision-making process. Conducting interviews with parents visiting a university-affiliated science museum, the research explores three key themes about science education for primary school children: situated learning, reliable information sources, and parent-child interaction. Besides, the study identifies the challenge of museum fatigue among primary school gifted children visitors, emphasizing the importance of addressing children's limited attention spans and cognitive abilities when designing science museum exhibitions. The paper concludes by proposing strategies to enhance the quality of public education activities in science museums affiliated with primary education institutions. In essence, this research provides valuable insights into the motivations and challenges faced by parents, offering guidance for improving science education activities within the context of primary school settings.

To cite this article:
Zhou, L. (2024). Thematic analysis of studies on gifted students in the field of mathematics education. *Journal of Gifted Education and Creativity, 11*(1), 13-22. DOI: https://doi.org/10.5281/zenodo.14563118

Introduction

Elevating the comprehension of science processes holds greater significance for gifted children in primary school than mere acquisition of content knowledge(Melber, 2003). Particularly in the context of augmenting science literacy among gifted children, previous research suggests that exposure to real-world experiences and engagement with open-ended problems can offer a more enriching science education(Andre et al., 2017; VanTassel-Baska & Johnsen, 2007). However, conventional primary schools often struggle to provide the interactive environments necessary for the optimal development of gifted children. In this regard, science museums emerge as exemplary venues for cultivating the science literacy of gifted children. Equipped with professional tools and materials, alongside adept educators, these museums offer an ideal setting for fostering the intellectual growth of gifted children in the realm of science.

Recognizing the paramount importance of museum education, scholars have undertaken empirical studies to enhance the quality of public education activities in Chinese museums. A significant demographic among Chinese museum visitors consists of minors, frequently accompanied by their parents(Feng & Tang, 2021). Among the diverse array of museums, science museums have gained popularity among parents, driven by the strong emphasis on science,

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technology, engineering, and mathematics (STEM) subjects in Chinese society(Hou et al., 2014; Ji et al., 2014; Lv & Li, 2011).

Consequently, it becomes crucial to discuss what roles science museums are acting in the cultivation of gifted children, especially in the context of China. The existing literature on this topic is extensive, and focuses particularly on two themes: the design of museum education activities and the influence of museum visits on gifted children(Lucija Andre et al., 2017). A number of studies have examined the association between well-designed education activities and children's learning experience, and strategies and technologies like augmented reality, hands-on activities, interactive games, and mobile guiding systems enhance gifted children's experience in museums(Flewitt et al., 2023; Gilligan-Lee et al., 2023; Moorhouse et al., 2019; Sung et al., 2010). As for the latter focused theme, the influence of museum visits on gifted children, has been widely investigated in empirical studies. Considerable evidence has accumulated to show that museums has positive impacts on gifted children, both academically and psychologically(Lacoe et al., 2020; Ozel & Dogan, 2013).

Taken together, these studies support the notion that visiting well-designed museums benefits gifted children in all aspects. However, little is known about how to attract gifted children to visit. Since children seldom visit museums independently, it is significant to delve into the motivations and challenges faced by parents opting to take their gifted children to museums. Recent research focusing on gifted children's museum learning experience has started to take parents as another important factor, switching from' child-centred' to'family-centred'(Lucija Andre et al., 2017; Gong et al., 2020).

Therefore, this study aims to address the gap in existing literature by focusing on a crucial aspect of science museum visits for gifted children: understanding the motivations and challenges faced by parents when choosing to visit science museums with their primary school gifted children in China. By examining the motivations and challenges encountered by parents, we aim to shed light on the underlying dynamics shaping gifted children's access to science museums and the implications for public education initiatives. This research question not only contributes to a deeper understanding of the role of science museums in impacting gifted children but also offers practical insights for museum practitioners and policymakers seeking to enhance the accessibility and effectiveness of museum education programs.

Method

Research Model

To effectively explore the intricate nuances of educational motivations driving parental decisions to visit science museums with their children, a qualitative methodology was deemed indispensable. Qualitative methods offer the flexibility and depth required to delve into the multifaceted aspects of human experiences and perceptions, which quantitative approaches may overlook (Lichtman, 2012). Specifically, the utilization of open interviews without a predefined interview outline was chosen deliberately in this research. Since the research question is highly contextual, the interview should not be influenced by researchers' prior value judgments. This approach fosters a natural and unrestrained dialogue, allowing participants to express their thoughts and perspectives organically. By eschewing preconceived notions and rigid structures, the open interview method empowers participants to articulate their unique insights and motivations authentically, ultimately enriching the richness and validity of the study's findings(Cohen et al., 2002).

Context and Participants

This study took place at a science museum affiliated with a prestigious university in Beijing, China. The museum is popular among minors and their parents in this city due to its well-designed public education activities every week, and its in-depth collaboration with local schools. Annually, during July or August, coinciding with the summer vacation, the museum extends invitations to residents of the local community, particularly pupils and their parents. Interview recruitment and data collection took place in July 2022. The researchers recruited several participants who visited the science museum with their pupil kids after two large-scale public education activities. The pupils were in a special talent cultivation program, and were regarded as gifted children by their school teachers. In selecting interviewees, the study takes into account the heterogeneity of cases, aiming to cover pupils' parents and to present a comprehensive view of museum education from different perspectives. Table 1 provides basic information about the respondents.

Data Collection

Each interview was an open face-to-face interview lasting 20-40 minutes.The topic of the interviews was the educational motivation for taking children to visit science museums. The researchers did not assume any position and did not give any orientation guidance to the interviewees. After obtaining the informed consent of all respondents, the researchers obtained the original audio recording data, then converted it into text data, and encoded the text data for induction analysis. In order to verify and correct the analysis results, the researchers recorded the parent-child interaction behaviour through the participatory observation method under the premise of obtaining parents' consent. The researchers invited two more interviewees to check the theoretical saturation of current data and found that no new key information was uncovered, and existing research questions had been answered. There is no direct interest relationship between the researchers and the interviewees. Interviews were conducted one-on-one, ensuring that the responses of different interviewees would not interfere with one another.

Table 1. Basic information of interviewees

Numbering	Identity	Age of the Child	Occupation
P01	Mother	7	Writer
P02	Father	9	Engineer
P03	Mother	10	Primary school teacher
P04	Mother	10	Product Manager
P05	Mother	10	Housewife
P06	Father	12	Museum staff
P07	Father	13	University professor
P08	Mother	13	University professor
P09	Mother	13	Programmer

Data Analysis

We engaged a grounded theory approach to data analysis, to identify the motivations and challenges hidden in the interview materials. Interview transcripts were imported into qualitative data analysis software NVivo 14 for coding analysis. We adopted an open, axial, and selective coding scheme to analyze the open interview data(Corbin & Strauss, 2014). Open codes flagged the details of beliefs, norms, and practices about visiting science museums with their children. Axial codes were used to build relationships between open codes in grounded theory, flagged the subconscious motivations and considerations of the interviewees. Selective codes were used to conceptually thread together axial code relationships, building our theoretical explanation framework of the finding and discussion section(Corbin & Strauss, 2014; Leyva et al., 2021). Table 2 provides examples of codes that emerged in our analysis.

Table 2. Examples of open, axial, and selective codes

Open Codes	Axial Codes	Selective Codes
Visible objects	Situational environment	Motivation: Situated Learning
Stories or explanations		
Visitor Route		
Interaction with docent	Interaction	
Interaction with equipment		
Multi-sensory experience	Multi-sensory experience	
Trust in museums	Positive: professional presenter	Motivation: Reliable Information Resource
Trust in research universities		
Complaints about information sources like social media	Negative: complex sources	
Shared topics	Communication	Motivation: Parent-child Interaction
Equal relationship		
Compensation for busy work	Time together	
Public behaviour		
Creating delightful memories	Family leisure	
Absent-minded	Psychological	Challenge: Museum Fatigue
Information-overloaded		
Tired	Physical	

Findings and Discussion

We organize our findings in four sections according to the selective codes of the qualitative data analysis(Table 2). Three sections address the motivation of parents visiting science museums with gifted children, including situated learning, reliable information resource, and parent-child interaction. The last section addresses the challenge the interviewees meeting during their visit.

Motivation 1. Situated Learning

Most interviewed parents emphasised that science museums offer ideal opportunities for situational learning, surpassing the traditional confines of textbooks. Situated learning theory asserts that knowledge is an activity that emerges from social situations, rather than a static object. It is an interactive process that develops through the dynamic interplay between individuals and their environment(Sawyer, 2005). Science museums provide an immersive environment conducive to situational cognition and informal science learning. A significant aspect of situational learning is the incorporation of narratives, which play a vital role in knowledge transmission and discovery. Stories aid children in documenting the path of the discovery process and provide a meaningful framework for retaining learning content(McLellan, 1994). Popular science explanations within science museums often revolve around the historical background of the exhibits or anecdotes about renowned scientists. Through these narratives, children absorb scientific knowledge and swiftly assimilate, establish connections, and apply that knowledge. One interviewed father aptly expressed:

A few days ago, I watched a documentary about the Cambrian period with my son. There are trilobites, strange shrimp and hallucigenian. While all the children were screaming, my son whispered to me that we had seen their fossils at the science museum yesterday （another science museum in a university）. After watching the documentary, my son told me that we would go to the science museum again in a few days. At that time, he did not understand the hallucigenian. After watching the documentary, he remembered and suggested that we should go to see the fossil again to confirm.(P02)

The science museum played a pivotal role in facilitating the acquisition of situational knowledge in the field of palaeontology for the son. Through his visit to the museum, he immersed himself in a context that allowed him to grasp this knowledge in a tangible and practical manner. Subsequently, when he encountered a new context while watching a documentary, he seamlessly made connections and effectively applied the scientific knowledge he had previously acquired.

Another significant aspect of situational cognition is the concept of legitimate peripheral participation. According to the perspective of certain anthropologists, learning is a process of legitimate peripheral participation within a community of practice(Lave & Wenger, 1991). In the case of children's visits to science museums, they are not mere passive recipients of information. Instead, they actively engage and participate to some extent in the community of practice established by the "Science Museum Exhibition." Through interactions with knowledgeable docents and their involvement in science-related activities provided by the museum, children become integral participants in this vibrant learning community. As expressed by one of the interviewed mothers:

"Look, listen, touch and think" is not only the best magic weapon for children to understand works and art in museum exhibitions, but also the four necessary skills for their future study -- careful observation, patient listening, feeling with body, thinking with heart... The child enjoyed answering the questions of the docents. During this process, she was very excited and proud. She could feel that she had participated in the exhibition process.(P01)

The girl had legitimate peripheral participation by interacting with docents. Although her scientific knowledge did not yet support her participation in the community of practice of science fairs as a centre member, this participation helped her engage in active learning.

Motivation 2. Reliable Information Source

Another compelling motivation identified among the interviewed parents for their visits to science museums with their children is the museums' ability to provide high-quality professional information, which plays a crucial role in fostering children's scientific literacy and honing their information processing skills. Remarkably, this parental viewpoint aligns with the findings of numerous researchers. Several scholars emphasise the significance of information as a fundamental component of scientific literacy and recognise it as a legitimate objective of science museums. This recognition stems from the fact that science exhibits within museums present information in a coherent and comprehensive manner(Levinson, 2010; Navas Iannini & Pedretti, 2022). For example, the case museum interacts very closely with the Department of the History of Science at the university. Since its opening, a number of permanent exhibitions and special exhibitions have been curated by faculties from the Department of the History of Science. In addition, students from the School of Materials, the School of Fine Arts, and the School of Architecture of this research university also participated in museum activities such as the restoration of scientific instruments and the exhibition of scientific photography. The participation of these professors and college students in the design of the case science museum's exhibitions enhances the credibility of the information.

When discussing the pursuit of science literacy, scholars put forth four primary arguments. These arguments include the practical argument (acknowledging the necessity of basic scientific knowledge for navigating everyday life in our technology-driven society), the democratic argument (highlighting the importance of citizens' ability to engage with complex science-related issues), the cultural argument (recognising science as an integral part of humankind's cultural heritage), and the economic argument (emphasising the essential nature of science literacy for various professional roles)(Henriksen & Frøyland, 2000). Of particular relevance to visiting science museums is the cultural argument, which centres on the development of children's science literacy. Engaging with science exhibitions can profoundly influence children's understanding of culture and its intersection with scientific concepts, as expressed by one of the interviewed mothers:

The Science Museum welcomes all the people in the world who seek the unknown with an inclusive attitude as much as possible. It provides a three-dimensional and intimate aesthetic scene of freedom. The diversified cultural power and rich content are enough to nourish children spiritually. In this process, children will not only experience the accumulation of *knowledge imperceptitiously, but will have more and more of their own thinking, and constantly try to use more diversified ways to understand the world.(P08)*

Science museums are widely recognised as reliable sources of information on science-related topics, particularly compared to the vast and often unfiltered content available on the Internet. Several parents expressed concerns about the quality and reliability of information found online, particularly for children who may lack the necessary discernment skills. These parents emphasised the importance of exposing their children to information that has been carefully curated and vetted by professionals. The case museum holds museum salon activities from time to time, inviting scholars in the fields involved in the exhibition to give popular science lectures. The salon is conducted online and offline simultaneously. Offline visitors can visit the exhibits after listening to the salon, while online visitors can easily understand scientific knowledge without space restrictions. As one father aptly noted, science museums affiliated with universities are particularly trusted sources of information:

Thanks to the development of the Internet, all kinds of information is readily available. But there is so much wrong and misleading information in the mix that it can be difficult for a child to sort out what is trustworthy from various websites and apps. Even I might intentionally turn out for my daughter to rely less on the Internet; her life turns and knowledge pools could easily be mixed out with mixed information. I like to bring her to the Science Museum. Long-term exposure to this kind of scientific knowledge will bring subtle help to improve her ability to information discrimination and judgment, which is of great significance to her lifelong development.(P07)

In conclusion, parents widely recognise science museums as a trusted and valuable source of information, believing that continuous exposure to scientific knowledge contributes to the enhancement of their children's scientific literacy. Additionally, science museums also play a subtle yet crucial role in fostering information literacy, a vital skill in the digital era dominated by the Internet. By engaging with the exhibits and educational activities, children develop critical thinking and information evaluation skills that are essential for navigating and making informed judgments in the vast sea of online information. Hence, science museums serve as catalysts for scientific and information literacy, equipping children with the necessary tools to thrive in the modern age of technology and information abundance.

Motivation 3. Parent-child Interaction

Nearly all interviewed parents expressed their belief that visiting museums provides a high-quality avenue for parent-child interaction. The dynamics of parent-child interaction within the museum context are influenced by various tangible and intangible factors, some of which may be unforeseen. Factors such as exhibit design, learning support activities, teaching techniques, technical assistance, and others can potentially impact the effectiveness of parent-child interaction(Bourque et al., 2014). Researchers have suggested that elements like the positioning of exhibit instructions, the height of display stands, and the incorporation of interactive elements can influence the quality of parent-child interaction in museums. For instance, when carrying out the exhibition of Da Vinci's flying machinery, the case museum organized parent-child painting activities about spaceflight, inviting parents and children to create paintings according to their own understanding of the exhibits. Furthermore, studies have analysed the positive effects of guidebooks, supplementary instructions, and games on fostering meaningful engagement between parents and children(Gutwill & Allen, 2010). A father interviewed reported:

My wife and I are very busy at work. On weekdays, my child's grandparents take care of him. We thought a visit to the Science Museum would be a better way to spend our weekends than shopping and eating in a crowded mall. When we visit a museum, we reach a more equal state with our children. We are both curious about science. Then the exhibits also give us something to talk about, and sometimes on the way home, we will keep exchanging our feelings about the visit.(P02)

Parents firmly believe that museum visits offer valuable opportunities to spend quality time and enhance parent-child interaction. Museum visits have proven to have a positive impact. In fact, museums are regarded as' places where all families are welcome and learn together through play and hands-on activity' by some scholars and professionals(Willard et al., 2019). Science museums provide an environment where families can develop their own'juicy questions' that no one knows the answer to, and facilitate elaborative talk between parents and children(Fender & Crowley, 2007; Gutwill & Allen, 2010).

Besides, parents interviewed believed that visiting a science museums is an good opportunity to teach children how to behave themselves at public sites.

During museum visits, I teach my daughter to be quiet, to raise her hand when appropriate, and not to touch the exhibits. I think it is necessary for a well-mannered modern citizen to behave in public. Sometimes I verbally teach her to do this at home, and she doesn't take it very well. When we returned from our last visit to the science museum she told me she understood why I had asked her to be as quiet as possible in the museum, because her experience had been greatly affected by two young boys fighting loudly. Through this personal experience, she learned to adjust her own behavior and to be considerate of other people's feelings.(P05)

The statement provided by the interviewee highlights a crucial aspect of parental motivations for visiting science museums with their primary school gifted children: the opportunity to instill important behavioral lessons in a public setting. By setting clear expectations for behavior during museum visits, such as being quiet, raising hands, and refraining from touching exhibits, the interviewee demonstrated a commitment to fostering responsible citizenship and respect for public spaces. Moreover, the interviewee's reflection on her daughter's learning experience following a disruptive incident involving other visitors underscores the value of experiential learning in reinforcing behavioral norms(Rossano, 2012). Through this personal encounter, the interviewee's daughter not only gained insight into the consequences of disruptive behavior but also developed empathy and consideration for others' feelings. Overall, this testimony elucidates the role of science museums not only as venues for intellectual enrichment but also as settings for social and behavioral education, wherein children learn valuable lessons in civility and respect for others.

Challenge: Museum Fatigue

Museum fatigue refers to the subjective experience of decreased interest, mental or physical fatigue, or boredom reported by visitors during or after viewing an exhibition(Bitgood, 2009). This phenomenon has been a topic of concern among museum scholars worldwide, particularly in relation to children. There are several factors contributing to museum fatigue in children. Firstly, children have limited information processing capacity during cognitive processes, making it challenging for them to sustain attention for extended periods(Falk, 2006). For instance, studies on museum fatigue have indicated that adult visitors' interest tends to decline after 30-45 minutes of viewing(Falk et al., 1985), while children's attention spans may be even shorter. Reflecting on this, one interviewed father shared his perspective:

My son is always very energetic and curious at the beginning of the exhibition. But if the time is too long, his mind will wander and he will get bored. Once, when we visited an exhibition with a tour guide, the guide lasted for more than one hour. My son simply did not follow the docent and sat on the ground in a corner by himself.(P06)

The interviewee's narrative provides a vivid illustration of the challenges posed by museum fatigue, particularly in the context of children's limited attention spans. The interviewee's son initially exhibited enthusiasm and curiosity upon entering the exhibition, which aligns with typical behavior observed in children at the outset of museum visits. However, as the duration of the exhibition extends beyond the child's cognitive threshold, signs of fatigue and disengagement become apparent. The interviewee's description of their son's wandering attention and eventual withdrawal from the tour group resonates with existing research on museum fatigue, which highlights the role of exhibition duration and content complexity in influencing visitors' cognitive load and attentional resources(Kim et al., 2020).

In addition to limited knowledge reserves, children often have a partial understanding of the contents presented in museum exhibitions. This lack of comprehension can lead to feelings of boredom, as the exhibits fail to provide the necessary intellectual stimulation.

The science museum exhibit was too much for my son. He had no basic knowledge of physics or chemistry, and except for a few questions deliberately prepared by the docent to appeal to the pupils, everything was completely beyond his comprehension. He is reluctant to visit the science museum again.(P04)

The interviewee's account highlights the critical role of children's prior knowledge and comprehension levels in shaping their museum experiences. The statement underscores the challenges encountered by children who lack foundational understanding in scientific concepts, such as physics and chemistry, when navigating complex museum exhibits. Without a solid grasp of the subject matter, children may struggle to engage meaningfully with the content presented, leading to feelings of frustration and disinterest(Maxwell & Evans, 2002). This narrative underscores the importance of providing supplemental resources and guided experiences to support children's understanding and engagement in museum settings, thereby fostering more enriching and rewarding learning experiences for all visitors.

Conclusions

Through in-depth analysis and interpretation of empirical data, we have uncovered a nuanced understanding of the factors influencing parental decisions to engage in museum visits with their gifted children, particularly within the context of China. Through in-depth analysis and interpretation of empirical data, we have uncovered a nuanced understanding of the factors influencing parental decisions to engage in museum visits with their gifted children, particularly within the context of China.

The findings emphasize that science museums, such as the case museum in our study, serve as valuable spaces for situational learning, contributing to children's knowledge expansion and understanding through hands-on exhibits and interactive activities. The reputation of the case museum, located in a research-intensive university, ensures the quality of information provided to visitors. Moreover, the involvement of professors from the university in the design of exhibitions, along with the majority of docents being faculty members or graduate students, further enhances the quality of public education within the museum. This collaboration between top-tier research universities and science museums strengthens the credibility and accuracy of the scientific content presented, attracting more parents and visitors.

While our research acknowledges the numerous benefits of science museum visits, it also highlights a significant challenge reported by parents, known as museum fatigue. The overwhelming number of exhibits and information can be exhausting, particularly for young children. To address this challenge, we suggest that science museums, including the case museum, consider implementing strategies such as selectively covering exhibits that align with children's understanding and providing breaks or resting areas to alleviate fatigue.

Based on our empirical findings, we propose several recommendations to enhance the public education activities of science museums, including those affiliated with research-intensive universities. Strengthening collaboration with schools to align informal learning experiences with the formal curriculum will reinforce key concepts for children. Furthermore, ensuring the quality and validity of scientific content presented in science museums, in collaboration with renowned research universities, will provide visitors with reliable and trustworthy knowledge. The high level of scientific literacy possessed by museum staff and docents, who are faculty members or graduate students, contributes to effective information conveyance and enables them to answer visitors' questions more comprehensively.

In summary, our research provides valuable insights into the motivations and challenges faced by parents during visits to science museums, including the case museum located in a research-intensive university. These insights can inform science museum practitioners, educators, and policymakers in creating more engaging and accessible experiences for families, ultimately fostering a deeper appreciation for science and learning among gifted children. By advocating for evidence-based strategies to mitigate museum fatigue and enhance visitor experiences, our study provides actionable recommendations for scholars and policymakers. From a theoretical perspective, our study contributes by underscoring the potential of science museums not only as venues for knowledge dissemination but also as platforms for fostering scientific literacy and enthusiasm among diverse audiences, including gifted children and their families. From a policy perspective, our findings underscore the importance of strategic partnerships between educational institutions, museums, and policymakers to optimize the impact of informal learning experiences on children's cognitive development and scientific understanding.

Limitations

However, it is important to acknowledge the limitations of our study, as the findings are based on a specific sample of parents from one science museum in China and may not be generalizable to other populations or cultural contexts. Future research could expand the scope to include a larger and more diverse sample, encompassing various regions and cultural backgrounds, to obtain a comprehensive understanding of the motivations and challenges faced by parents visiting science museums worldwide.

Acknowledgment

This project received no financial support for the research. There is no conflict of interest for the research.

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Journal of Gifted Education and Creativity
11(1), 23-35, March 2024
e-ISSN: 2149- 1410
jgedc.org dergipark.org.tr/jgedc

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Review Article

Gifted education in Turkiye from the perspectives on Science and Art Centers (SAC)[1] : issues and suggestions

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Article Info

Received: 7 February 2024
Accepted: 30 March 2024
Online: 30 March 2024

Keywords
Education models for gifted
Gifted
Gifted education in Turkiye
Gifted student
SACs

Abstract

There are substantial expectations from gifted students while countries design the framework of their long-term programs. In this sense, developing countries like Turkey tend to comprehensive investments in gifted education. However, there is still no comprehensive content related to this field that boosts gifted student talents significantly, especially in science education. In this respect, it is crucial to develop inclusive content that can fully satisfy the needs of these students. In this direction, SACs were established in 1995 to bring to life practice-based education for special students in three domains: painting, music, and general talent. Training is carried out in four stages; resource education, recognizing individual talents, enhancing special talents, and project-based programs. These stages proceed in parallel with the student's grade level. In-course applications are provided to students in the form of small-group studies. Despite satisfying gains, there is a risk that these institutions are gradually losing ground and turning into ordinary formal education institutions parallel to their increasing prevalence. It is important to renovate these institutions, which each administration shapes within the framework of its perspective, by presenting a comprehensive vision. Since it is not fully determined the essence of why SACs were established and the ultimate goal of these institutions, they are currently oscillating between being closed and being developed. In this context, a review study was carried out on certain controversial issues and the aim was to express the basic deficiencies in these institutions from the perspective of a SAC teacher. Within the scope of this study, the problem areas are summarized under five frames; diagnosis, teacher, student, content, and institution. Additionally, some suggestions are introduced and an educational model is described to inform policymakers.

To cite this article:
Paçacı, Ç. (2024). Gifted education in Turkiye from the perspectives on Science and Art Centers (SAC): issues and suggestions. *Journal of Gifted Education and Creativity, 11*(1), 23-35. DOI: https://doi.org/10.5281/zenodo.14563132

Introduction

Science and Art Centers (SACs) are firstly established in Ankara in 1995 to provide supplementary education to talented students. These institutions have been formed by the 3rd paragraph of the 8th article of the 1739 National Education Basic Law, "Special measures are taken to raise children in need of special education and protection". These institutions are official institutions affiliated with the Ministry of Education that contribute to especially talented students outside of formal education, from the second grade until they finish their high school education. Today, more than 75.000 students receive education in a total of 379 SACs in every city and many districts.

Students are placed through a 3-stage process as a result of diagnosis, intelligence test, and interview. Students have the right to pursue their education until the end of the 12th grade. In these institutions, the content is applied theoretically and practically. Course coordinators make updates every year to enhance the content. These coordinators are selected within the SAC teachers and have completed their academic postgraduate education. They both work in the institution, coordinate the studies, and try to update the programs annually.

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SACs are very significant centers for hands-on applications that students donot perform during their formal education period. The primary aim is not to teach theoretical knowledge but to provide them with a wider scientific vision. Students are trained in four stages, respectively: resource education training (RET), individual talent recognition program (ITRP), special talents development program (STDP), and project-production and management program. In these programs, while students are theoretically expected to carry out certain studies, in practice they are carried out in parallel with the grade level. In resource education classes, they take manual dexterity courses, English, and informatics lessons. At ITRP, they learn basic course contents such as Science, Turkish, social studies, Maths, and technology design, and at STDP, they learn specialized course contents such as Physics, Chemistry, Biology, History, Literature, informatics, Maths, and aircraft technologies. At the project level, students are expected to do project studies. Every year, a significant number of willing students participate in projects such as TÜBİTAK, Teknofest, e-Twinning, and ERASMUS. In addition, patent, utility models, and design studies are also carried out. Compared to other institutions, teachers have more practice time, they do not have to spend time for exam preparation and evaluation, they do not prepare students for LGS or YKS exams, they do not have a curriculum to complete, and they can implement projects with activity-based education. Students come to these institutions during their remaining time from their schools. In this sense, course do in the evenings and on weekends. It is more accurate to view these institutions not as institutions where gifted students receive education, but as institutions that provide environments where successful students can do extracurricular scientific work.

In addition to all these gains, the risk that these institutions are gradually losing ground, that they will turn into ordinary formal schools as a result of their increasing prevalence, and that the diagnostic exam will turn into an achievement exam, carries the debate to the present day that these institutions are now educating lower profile students. However, these institutions, which have serious problems in terms of implementation, have not yet achieved the desired efficiency. In addition to all this, when we look at the practices in the world, the process of identifying gifted individuals is still a serious problem area. However, it is thought that the educational contents applied are extremely inadequate and cannot adequately support these students. It is argued that graduated students not the expected level and that there is no field where they can directly use their gains. Especially developing countries such as Saudi Arabia, Qatar, China, Indonesia, and Brazil tend to invest more in this field than other countries. Our country is one of the countries that has made the most serious investments in the world in this field. Currently, SACs have reached a significant point in number and these institutions have serious problem areas.

Possible problematic issues encountered in SACs

This is a review study that aims to disclose the possible controversial issues on the SACs. Since these students are specifically identified, the Ministry of Education is careful not to share data with the public. Thus, we do not have sufficient and up-to-date statistical data about these institutions. Although the problem areas revealed below are common to all SACs, each SAC also has specific issues related to the field. In addition, many suggestions and limitations can be discussed, but primarily, a comprehensive framework is aimed to draw for the scope of the study.

Problems with defining of the term gifted student

One of the most controversial issue in SACs is the theoretical and practice-based inconsistencies brought by the term "gifted student" which also affects every process, including education and student selection. This term causes to raise questions about how much the applied tests, and educational content appeal to these students and the observation made by the classroom teachers in their proposal process. Researches imply that gifted individual identification is a really difficult process, that this definition is related to environment, culture, and time, and therefore the definitions and diagnosis methods are not consistent with each other (Freeman, 1979; Pfeiffer, 2003). The American National Association for the Gifted and Talented (2010) defines gifted individuals as individuals with high achievement abilities in a specific academic field or areas such as intellectual, creative, artistic, and leadership capacity. Contrary to what is thought, these individuals have better social adaptation capacity than other individuals and they comply with social norms more (Bracken & Brown, 2006; Sumpter & Sternevik, 2013).

Although gifted individuals have many aspects, IQ tests are primarily highlighted (Phelps et al., 2023). Generally, a grouping as in Table 1 is made in the literature. This grouping has been seriously criticized in the literature because it limits individuals' capacities only to IQ tests (Gallagher, 2008; Hampshire et al., 2012; Setiawan & Septiarti, 2018). However, Callahan et al. (2017) emphasize that gifted individuals do not only have academic success alone, but the individual must also have an intellectual aspect along with this feature. Hodges et al. (2018) have performed a comprehensive meta-analysis study to underline the issue that IQ tests do not give comprehensive knowledge about giftedness.

Table 1. Grouping of gifted people (Bakioğlu & Levent, 2013)

Level	Intelligence scale	Prevalence Rate
Mindly gifted	115-129	1:40
Moderately gifted	130-144	1:40 – 1:1000
Highly gifted	145-159	1:10.000
Exceptionally gifted	160-179	1:10.000 – 1:1 million
Profoundly gifted	180<	Less than 1:1 million

Problems with the diagnosis process

The student diagnosis process, which has evolved in various ways until today, currently takes place in three steps. Initially, it begins with the proposal of the classroom teachers in the first grade. This process is executed by school guidance commissions. The classroom teachers have the right to propose up to 20% of the students at each grade level. In fact, this is a diagnostic process and a major problem area. In this process, it is very difficult for classroom teachers to reliably identify gifted students. Şahin and Çetinkaya (2015) concluded that there are serious differences in definition between teachers who received training on this subject and teachers who did not during the proposal process. Therefore, it is not sensible to accept the proposing process as a reliable application.

The diagnostic method must be up-to-date and compatible with the curriculum (Kurnaz & Ekici, 2020). But, it was not practicle to use the IQ tests that was not reflect our curriculum and social norms (Sak & Shaughnessy, 2020). Starting in 2019, the Anadolu-Sak Intelligence Scale (ASIS) intelligence test, developed by the UYEP Center research team with the support of Anadolu University and the Ministry of National Education of Turkiye (MoNET), is applied to the proposed students. This test is an IQ test with proven validity and reliability (Köprü & Ayaş, 2020; Tamul et al., 2020). The test, which was conducted on approximately 7000 samples for the 4-12 age group, includes visual and verbal questions and consists of seven subtests (Sak & Shaughnessy, 2020). This test appeals to a very large group and thousands of students take this test every year. For this reason, it is repeated a lot and its validity decreases as its prevalence increases, but a comprehensive study has not yet been conducted in this field. This situation is seen observed more clearly in exam results. In other words, as the grade level increases, the SAC placement rate also increases. According to 2019 MEB data, 20,263 students were entitled to be placed in the centers. Eventhough the number of student at each grade very close, the number of student that got enough point was 4,414 in 1st-grade, 7,299 in 2nd-grade, and 8,550 in 3rd-grade (URL-3). Therefore, more students get sufficient scores every year. Students who score above the annually determined threshold in this test are eligible to enter the interview. The interview process is carried out by the Guidance and Research Center. Students are presented with a series of theoretical and practical situations that they are expected to fulfill during the interview process. In this process, it is observed how the student finds a solution to the problem situation.

The main problem area of this process is the incompatibility between the practice and the predefined directions. According to the Ministry of Education Directive (MoNET, 2024), students should be determined according to each grade level, but in practice, there is a tendency to offer 20% of students from each grade. Or, if the students who were offered in the first year do not win, there may be situations where they are not offered in the second year. For this reason, problems occur in classes where the number of bright students is high. Schools are seriously criticized by parents on this issue.

As an alternative method, it may be appropriate to use more concrete data such as students' grade point averages in certain courses when determining 20% of the students in this process. In this sense, it would be more accurate to reconsider the definition of gifted and use the term bright or successful instead of this definition.

Problems with diagnosis students at once

Student diagnosis is done once for SAC students. No further diagnosis is made until they graduate. This situation leads to raise two issues. First of all, we do not have sufficient information on whether SACs are effective or not because up-to-date data about student development is not gathered. On the other hand, The Ministry of Education consumes a serious budget for each student. Considering that this budget includes constantly spent consumable tools and laboratory materials, a much larger budget is consumed on these students compared to normal schools. For this reason, these institutions should be more useful and they are serious investments that cannot be considered as ordinary activity centers. A more realistic approach is to observe the results of such a large investment more concretely.

A second problem is that a single diagnosis causes one to ignore the development of the individual. Studies reveal that, as the age of the individual changes, IQ scores vary incredibly depending on many factors. (Clarke & Clarke, 1976; Hedman, 2013; Shenk, 2017; Svendsen 1983). This change can be positive or negative. In this sense, failure to observe student development at later ages is a serious problem for these institutions. Laili et al. (2020) state that the results of intelligence tests conducted at the 3rd grade or below level are quite incompatible with the results of the tests conducted at the college level. Therefore both the exclusion of students with potential and the questioning of the competence of students within the institution are an increasingly deepening problem area. SAC teachers, on the other hand, think that the incoming student profile is getting worse every year. Regarding this issue, it is thought that the rate of less bright students is increasing in these institutions due to certain reasons (such as the selection process, the number of students selected, the awareness of the test applied, etc.). Although there is not enough data on this subject, a significant portion of the students currently come from schools that accept students at the high school level without examination. In addition, behavioral problems are increasing and it is thought that the rate of students with low interest in science is increasing. On the other hand, a certain portion of the students who continue their education state that they came just to carry this badge or under pressure from their parents.

The basis of this problem lies primarily in the use of the "gifted student" term. In order to eliminate the problem, students must be re-diagnosed at further grade levels and detailed student portfolios should be prepared. Observing student development may allow students to check themselves, enable them to measure the effectiveness of these institutions more concretely, give a chance to students who could not take this exam in the first years, and enable more students to receive education from these institutions. However, to make such a continuous diagnosis, it is necessary to take into account the success and IQ level together and exams must include both intelligence and achievement tests.

Capacity problems in SACs

More than 30.000 students enroll in SACs every year. Nowadays, many SACs give education to over 1000 students. When these institutions were established, they were planned much lower than normal school capacities and groups consisted of 2-3 students. Today, there are serious problems in the number of workshops and classrooms. Today, SACs transformed into centers that try to organize activities with groups of up to 15 students, where teachers try to control the students rather than trying to provide an effective learning environment and face serious discipline problems. According to the 2024 Ministry of Education Directive; the upper limits in groups are determined for RET up to 15, ITRP up to 11, STDP up to 8, and proje groups up to 6 students. Since the capacity of the institution is not sufficient, the number of students in the groups is close to these values. In this sense, doing a project with 6 students at the same time or doing manual dexterity work with 15 students causes both material problems, control problems, and content-related problems. Student recruitment is based on the number of students who demonstrate certain qualifications, not the capacity of the institutions. In this sense, since the number of students taking the exam increases rapidly every year, the number of students in institutions has approximately doubled in the last 4 years. The main reason for this situation is the application of norm-based intelligence tests in student diagnosis. Therefore, with such a definition, the capacity problem of SACs is getting deeper. To reduce this problem, the number of these institutions has been rapidly increased. However, this has caused the quality problem to increase in SACs and is not a sustainable solution.

As a solution proposal, if these institutions recognize and select successful students, not gifted students, and in this sense, if recruitment is made by taking into account the capacity of the institutions rather than norm-based, both the capacity problem and the problem of unqualified students can be reduced. Unpredictable student numbers force these institutions to transform into ordinary schools. As a result, teacher quality, student quality, and education quality are gradually decreasing.

Problems with teacher quality

Teachers in these institutions are undoubtedly expected to be competent in special student pedagogy, hands-on applications and project development. In this sense, it is inevitable for teachers to have a certain level of qualifications. Nevertheless, there is only one criterion for candidate teachers which is to have completed their compulsory teaching period. Three times the number of empty positions are nominated for interview and the selection is made under the supervision of MoNET department heads. However, there are serious problems in practice, especially in rural areas. Teachers have prejudices against these institutions regarding additional course fees and late-hour working times. For this reason, very few teachers prefer to work in SACs. Especially in high school subject domains, many teachers are nominated by choosing among 1 or 2 teachers. The main problem here is that teachers are nominated without considering the prerequisites such as, pedagogical knowledge, classroom control ability, and communication ability with children for classroom teachers, or pedagogical content knowledge, laboratory practice ability, and project management ability for science teachers. Additionally, postgraduate education, ceritificates and language level should be added as part of the selection criteria. Admitted teachers to these institutions without meeting any of these criteria cause serious quality problems.

Although selection criteria for teacher quality is the easiest method, it is not sustainable since these institutions are not preferred by teachers anyway. Since these institutions do not have support and training course and teachers cannot complete thirty course hours, the additional course fee is quite less compared to other schools. In this sense, evaluating TÜBITAK and Teknofest and Erasmus projects within the scope of extracurricular activities or DYK rather than in-course activities, will increase the teacher income and raise the attractiveness of these institutions.

It can be suggested that SAC teachers need to gather a certain number of points in their field for three years. According to their performance, teachers may be recommended or not preferred to work in SACs again. This score can be measured by variables such as the number of projects completed, the number of studies and activities, degrees received, teacher educational background, and student-parent satisfaction.

There are a significant number of teachers with doctoral degrees in SACs, and this number is rapidly increasing day by day. Since project studies are given importance in SACs, there is a need for teachers who use academic backgrounds. However, it is known that teachers who complete their doctorates have a low desire to stay in these institutions. The main reason for this is that teachers are prevented from doing academic studies with students in these institutions by procedures and the infrastructure in which teachers can do academic work has not been established. To eliminate this situation, university libraries, programs, and databases must first be open to SAC teachers. This situation can be solved with common protocols.

Problems with subject domain incompatibility

One of the main problem areas in SACs is the inability to provide in-depth education. These institutions aim to provide students with deeper learning in addition to their regular schools. But courses are not designed in this way. For example, secondary school students receive education from a science teacher, and high school students receive education from a physics teacher. These teachers are theoretically trying to implement the same educational content as in the regular school. This situation works more like a process of completing the missing laboratory or application studies done at school, rather than deep learning.

In this sense, subject domains need to be reorganized. It can have a serious impact if students at every level are educated by an instructor of a higher level. Although this situation may seem problematic in terms of educational psychology, it is a fact that instructors specialized in a certain field are needed to provide a deep learning environment. Students' scientific interests, especially at high school levels, cannot be adequately met. Thus developed countries in the field of special education are implementing similar practices. In this sense, institutions in America, Russia, and Europe, university faculty members provide the educational practices even at primary level grades in partnership with universities, provide continuous teacher training and content updating that emphasizes in-depth learning (Grigorenko, 2017; Reid & Horváthová, 2016; Reid, 2015).

In this sense, branch updating should be done not with classroom teachers in resource education room classes, but with instructors who are more specialized in their fields, such as science, primary school mathematics, and informatics teachers, physics, chemistry, biology, and history geography teachers in middle school subjects, electronics, computers, software, mechanics and solid-state physicists in high school subjects. In this sense, it is more appropriate for these institutions to have both in connection with the Ministry of Education and universities.

Another problem in SACs is the insufficient curriculum of the project management students. The basis of this situation lies in the fact that SACs have insufficient educational content for high school students. With the regulation in 2020, students are in grades 9-12. accepted as Project development level students. In this respect, it is very important to update the subject domains in depth. Project students are expected to do a project in at least one subject. The project implementation is theoretically suitable, but it has serious problems in practice. In particular, it is unclear what students courses that they donot have to do project. This situation not only triggers student absenteeism but also causes SACs to not benefit sufficiently by these students during the period when the student can be most productive in terms of intelligence and knowledge.

As a suggestion; students can do activities and projects at 9-10 grades and only make projects in the 11th grade. Additionally 12th grades should be accpeted as graduated if they complete prequisite courses. Such a regulation can both reduce the problem of student absenteeism and enable BILSEMs to be more productive by deeply enriching the content.

Insufficient educational outcome problem

As instructional content, each SAC has its specific hands-on activities, unlike formal schools. These vary depending on the material, physical infrastructure and the teachers qualifications. The activities can be defined as in physics; pressure-force experiments, electronic applications, construction of simple engine mechanisms, the establishment of original experimental equipment, construction of simple generators, measurements... in chemistry; battery making, candle making, obtaining elemental compounds, making detonators, electrolysis, combustion-pressure experiments... in biology; determination of living characteristics, content analysis, use of microscope, plant and animal observations, mathematics; theorems and proofs, geometric applications, analytical applications, author-work applications in literature, story novel poetry writing applications, reading studies, book analysis... in history; examining old documents, examining historical events, ruins and finds, historical legends, analysis of events, reading documents... Games, applications, use of web tools, e-Twinning, Erasmus project applications related to reading, writing, listening, and speaking skills in English... pictures, and studies such as applications directly related to the field of music are included. In addition, longer-term and comprehensive applications such as projects, patents, utility models, design registrations, and olympic studies are carried out. Students generally enjoy to attend the activities and there are not many attendance problems for the students involved in the intermediate grade levels.

However, none of these projects and activities are recorded in students' portfolios and students do not officially benefit directly from these studies. However, they spend serious effort and time for about 10 years. When we look at the practices in the world, this situation is seen as a general problem (Anuruthwong, 2017; Grigorenko, 2017). Although there are serious studies on student diagnosis, the process and the outcomes of gifted education are extremely unclear and inadequate. In this sense, regulating educational outcomes is an important step. There is no field yet where the graduation diplomas issued by these institutions are used. For this reason, especially at the high school level, students' willingness to participate is quite low and their absenteeism is high.

As a suggestion, education should be Baccalaureate style and include a foreign language at a level that will allow internationally recognized students to settle in an institution abroad. In this sense, a program should be prepared that will provide the possibility of going abroad where at least three basic courses are taught in English. Teacher selection should also be made on the qualifications that can provide this training.

Absenteeism problem in 12th and 8th grades

These institutions are non-formal education institutions that support formal education. Student attendance is optional. There are no exams, grades, homework, a fixed curriculum, or even course duration. Courses can be applied in blocks or separate, for one hour, fifty or fourty minutes. Teachers act as mentors rather than instructor, and instead of a teacher-student relationship, there is a mentor-student relationship. Students do not have grade or exam anxiety. In addition, the attendance limit is set at 30%. Students who exceed the attendance limit may or may not be dismissed at the end of the year, depending on the initiative of the institution. Parents can also follow the absences through mebbis system with the latest updates. While student absenteeism did not pose much of a problem until recent years, the desire to dismiss has also increased with the increasing number of students. 10 years ago, SACs were institutions preferred by teachers who could not find the norm or who were waiting for retirement, had a number of students well below their capacity, and had attendance problems. Bakioğlu & Levent (2013) stated that SACs operated with a high absenteeism rate and worked at 47% capacity in 2010. Today, there are serious efforts to become the favorite institution of the Ministry of Education.

MoNET gives more importance to absenteeism due to the institutional capacities are already above the desired level and it is meaningless to prepare course schedules for absent students. Therefore, the attendance problem will be felt more seriously in the near future. However, students' dismissing process should be standardized, and should not be left institution's initiative. A second issue is that especially in the 8th and 12th grades, the desire to attend is very low. They feel obliged to continue SAC due to attendance problem so their willingness to participate in the activities is very low. While this situation is a serious motivation problem for teachers, it is also problematic for the efficiency of SACs. In this sense, serious regulations are needed. Especially students who are 12th grade should be excepted graduated. Otherwise, thousands of students are left to the initiative of the institutions regarding their expulsion. Increasing the attendance limit in 8th grade may be a temporary solution.

Essentially, in order to solve this problem, the graduation certificate received from these institutions must be a useful document. This only requires a change in its content and students graduating from here must have a portfolio that will allow them to be accepted into a university even abroad.

Problems with administrator quality

Graduated students from SACs are expected to be trained in a way that will shape the country's policies, and these institutions were established with this vision. This is exactly the purpose of countries investing in these students. Despite this, there is a serious vision problem in SACs. These institutions have turned into institutions that only need to carry out a certain number of projects and patent studies. Rather than the content of the activities, it is focused on which the number of competitions and projects teachers participate in. The main reason is that the administrators of the institutions are not visionary and competent. The fact that administrators try to manage these institutions like the formal education institutions. This approach makes these institutions seriously inefficient. In this context, there are very good institutions in Europe and Asia that place a significant portion of their students in the best universities in the world. Almost all of these institutions are managed with a system that uses university resources directly, institutional administrators are appointed by the university, and the transactions in the institution are carried out by the institution manager working in these institutions.

In order for SACs to provide quality academic education, their administrators are expected to be qualified and prone to academic studies. As a matter of fact, currently, the majority of SAC principals consist of primary school teachers. In this sense, it would be a more appropriate practice for the administrators of these institutions to be direct academicians and people working in the field of special education. While one leg of these institutions should be in the MoNET and the other in the university, the department to which SACs are affiliated should also be organized in connection with Higher Education Council of Turkiye in this way. However, it is known that the management approach in Turkiye is not flexible enough for a hybrid application in this context.

Problems with unplanned expenditure

The quality of applications in SACs is related to the materials they have as well as the qualifications of the teachers. The unpredictably increasing number of students seriously strains these institutions in terms of material needs. It is inevitable for every student to consume a lot of course tools, especially as long as they do hands-on activities such as art and science. It is a fact that students have the perception that these institutions provide free education, which causes the materials to be used carelessly. In this sense, teachers are trying to overcome this situation by simplifying the activities they do, increasing theoretical practices, and turning to cheaper materials such as paper, pencils, and scissors. As a matter of fact, the applications have been simplified to that extent.

The materials sent by the MoNET are not capable of supporting current applications rather the materials provided to normal schools with the same content as 30 years ago. Institutions try to solve the problem of outdated and insufficient materials with the provided annual budget. At this point, the problem of spending the budget unbalanced in a short time arises. Units cannot purchase enough consumables, the impression is given that the budget must be spent in a short time, and if the relationship with the administration is not very good, serious material problems occur.

To reduce this problem, the budget should come to the institution on a unit-specific basis rather than in general. This problem can be reduced by informing the expenses and making payments against the invoice. It is known that in many SACs, even the institution is in serious need of materials, some of the incoming budget goes back unspent. However, it is often discussed that the budget that comes with it is too small for laboratory studies. This unplanned use of this very limited budget is a serious problem.

Problems with insufficient infrastructure

Today, SACs are not institutions that provide education to gifted or highly talented students. Activities are carried out on a group base, not individually. Although there are students with very different capacities, interests, and behavioral characteristics in each group, all students are exposed to the same procedures and contents. Laboratory studies, which cannot be done frequently in normal schools, are tried to be implemented in a more planned way. Nevertheless, each SACs implements different practices regarding their opportunities.

SACs carry out many studies to prepare students for scientific research competitions such as TÜBİTAK and Teknofest. Serious materials and equipment are needed. However, SACs do not have sufficient infrastructure in this regard. Although the majority of SACs buildings have been renovated, the existence of such a problem shows that this problem will continue for a long time. SACs laboratories are delivered even less equipped than normal schools. Physics, chemistry and biology classes have many unique equipment such as electrical parts, fume hood systems or microscope connections, but these institutions are not delivered with such ready-made equipment. In addition, although there must be a small observatory or material room for astronomy studies, very few SACs have observatories.

The main reason for this is that SACs are designed and built like normal schools. In order to solve this problem, very serious projects need to be created and budgets must be allocated.

Results and Suggestions

Problem areas and suggestions are summarized in Table 2. These problem areas can be examined under 5 headings. These are problems related to the diagnosis process, students, teacher qualifications and branches, education content, and the institution. It is clear that each question is related to other problem areas. Highlighting the problems in BILSEMs in certain areas and ignoring some problem areas will prevent the development of these institutions. While some problems may require more than one solution, some problems can be solved more isolated and in a shorter period.

The main solution to problems related to diagnosis is to reconsider the term "gifted student". In this sense, the IQ test and the student's in-class success should be evaluated together during the diagnostic process. Additionally, the efficiency of institutions can be enhanced by performing a new diagnostic process.

In addition to the suggestions in the diagnosis process in solving student-related problems, student groups should be made smaller and recruitment should be made according to the capacity of the institution. In terms of the absenteeism problem, it may be suggested that a regulation regarding attendance be introduced in the 8th grade and that the 12th grade be given graduate status. In this sense, an international program needs to be implemented to break students' prejudices against these institutions and being a BILSEM student more attractive. Moreover, not every gifted student is at the same level and BILSEMs are not suitable for students at very high levels, so full-time institutions need to be expanded for these students.

Teacher quality is an important variable in BILSEMs. In this sense, in order to make these institutions more attractive, project management courses should be considered as additional courses that provide extra fee for teachers. In addition, laboratories should be developed and protocols that allow teachers to use university infrastructures more functionally should be implemented centrally.

There are serious problems with the content in these institutions also. First of all, the instruction content does not enough comprehensive and interesting for gifted students. More specifically, the content is insufficient, especially in high school groups.Therefore, in addition to better equipped laboratories, the content must be regulated by both course domain regulations, teacher selection, and a valid diploma. In addition to these measures, realistic and comprehensive student portfolios should be prepared in a more useful way.

Besides, there are also institutional problems. The main problems are insufficient and unplanned budget expenditures. To alleviate this problem, a budget needs to be planned for each course unit. Additionally, the capacity of the institution should be predictable, so students should be admitted according to the capacity of the institution. The managerial application can be carried out through an institution manager appointed by the university and a coordinator manager appointed by the MoNET. This application is also widely used in the world. If the processes of leaving the institution and severing ties are carried out centrally rather than from the institution, arbitrary practices will decrease and the corporate culture can improve.

Table 2. Issues and suggestions in SACs

Related fields	Issues	Suggestions
	Issues in the student proposal process	[2]
Diagnostic	Diagnosis only in the first 3 years	[2], [3]
	Increasing prevalence of diagnostic tool	[1], [2], [17]
Student	Increasing number of unsuccessful students	[1], [2], [3], [14]
	No individual training	[2], [4]
	Groups are crowded	[4], [14]
	Absenteeism	[3], [5], [16]
	Unwillingness problem in 8th and 12th grades	[3], [5], [6], [16]
	Failure to diagnose at later ages	[1], [2], [17]
	Lack of institutions suitable for students with very high talent	[18]
Teacher		
	Unqualified teacher issue	[6], [7], [8], [10]
	Courses are incompatible for gifted student	[6], [8]
	Insufficient additional lesson fee issue	[10]
	Lack of opportunities for academic studies	[9], [11]
Content		
	Education quality is not appropriate for gifted students	[6], [8], [9], [11]
	Lack of use for SAC graduation diplomas	[6]
	Not creating student portfolios	[12]
	Insufficient content in high school groups	[4], [6], [8], [9], [11]
Institution		
	Insufficient budget	[9], [13], [14]
	Unplanned use of the budget	[13]
	The equipment list is not update	[11], [13]
	Lack of laboratory infrastructure	[11]
	Lack of physical capacity of SACs	[11], [14]
	Insufficient managerial vision	[15]
	The dismissal process is at the initiative of the institution	[16]

Evaluation

As a result of the study, a model for the SACs diagnosis and training process was described (Figure 1). Although the problem areas are clear, suggestions and training models can be created in different ways. In this study, certain problem areas and solution suggestions are expressed. The identified main problem areas (Table 2) and recommendations (Table 3) have been tried to be briefly summarized. While some of these problems can be easily resolved, some require serious changes or even a vision change. Since it is not clear in our country exactly why SACs were established, they are currently oscillating between being closed or developed. It is important to transform these institutions, which each administration shapes within the framework of its perspective, by presenting a broader vision. Still, our country is one of the few countries in the world that makes such large investments for gifted individuals. Although the results of the investments cannot be directly observed, they provide serious gains to students and teachers. These institutions, where students and teachers are examined from different perspectives, are important to identify deficiencies in formal education. It is important for those who produce and manage policies to examine these institutions, which host thousands of project studies and millions of application studies every year, from a more comprehensive perspective. Within the scope of this study, an attempt was made to compile the shortcomings and important aspects of these institutions from an insider's perspective. All these problem areas are common problems in both central and provincial

SACs. To solve these problems, accurate information, a common mind, and more importantly, managers with vision and conscience are needed.

Table 3. Suggestions for issues

No	**Suggestions**	**Related field**
1	IQ test and course success level should be used together in student selection.	Diagnosing, student
2	Using “successful” term instead of “gifted”	Diagnosing, student
3	Diagnosis should be made at the beginning of each stage rather than once	Diagnosing, student
4	Should be worked with smaller groups	Student
5	Flexible attendance in 8th graders should be applied, additionally 12th graders should accept as graduates if they fulfill the requirements	Student
6	Implement an international program that has validity across countries	Student, teacher, content,
7	Increasing teacher selection criteria for BİLSEMs.	Teacher
8	The courses should be regulated for more subfields to provide in-deep learning environment	Teacher, content
9	Making comprehensive protocols for using the university opportunities (library, central laboratories, programs)	Content, institution
10	Evaluating competition activities as additional fee to work at BİLSEMs more advantageous	Teacher
11	Improving laboratory equipment	Content, institution
12	Completion of digital infrastructure for portfolios	Content
13	A course-based budget should be introduced to ensure a more planned expenditure	Institution
14	The number of students to be admitted should be determined according to the current capacity of the institution	Content, institution
15	The institution manager must be appointed by the university, and the co-director must be appointed by the Ministry of Education	Institution
16	The dismissal process of students should be done by the Ministry of Education rather than BİLSEM management	Institution, student
17	Data in the diagnostic process needs to be clearer to researchers and the public	Institution, diagnosing, content
18	Full-time educational institutions should be established for highly gifted students	Institution, diagnosing, student

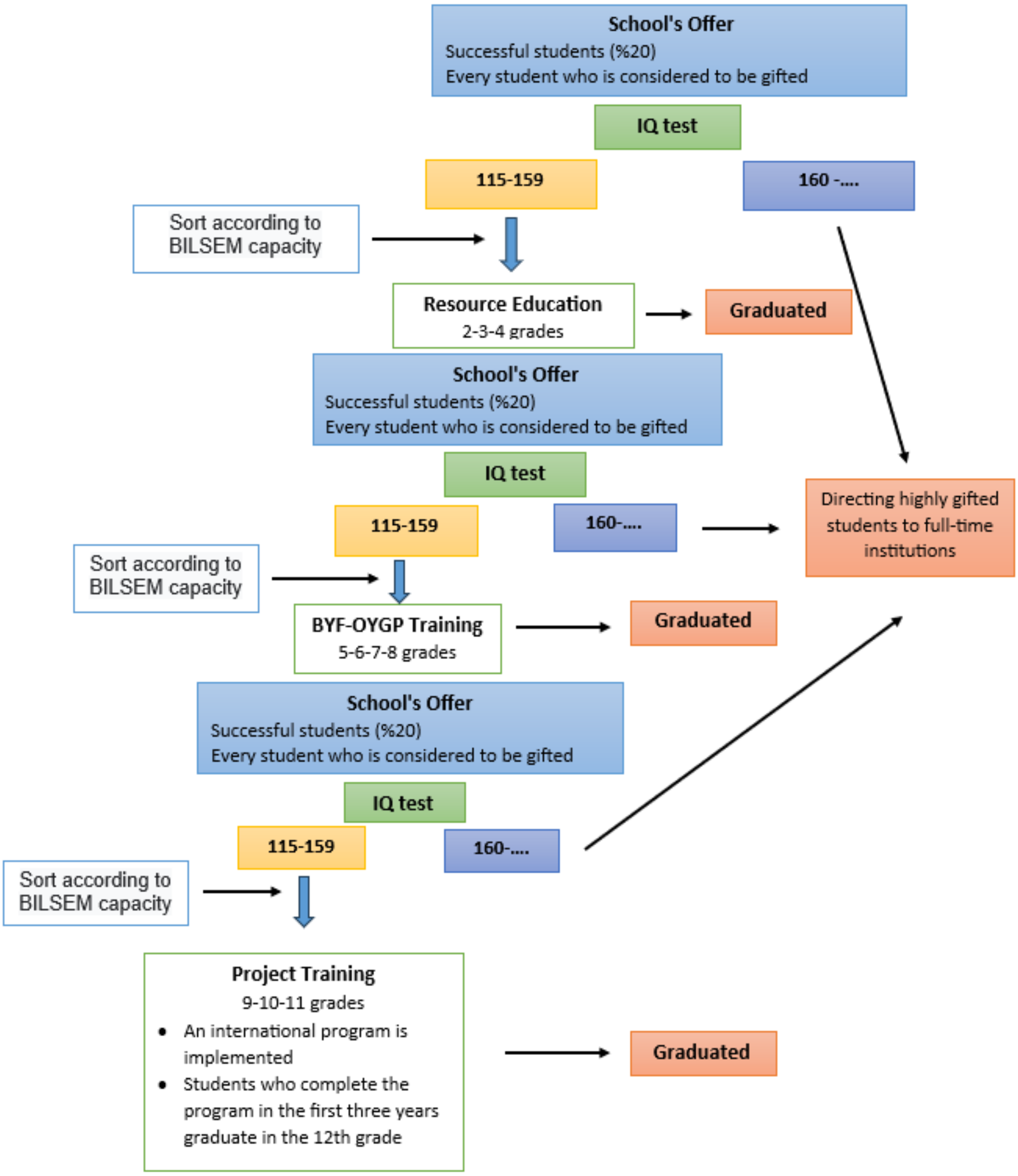

Figure 1. Diagnosis and training process model

Limitations of Study

The limited statistical data is available on gifted students by the MoNET. Therefore, researcher has attempted to ensure study validity just by using literature. Secondly, this study does not provide comprehensive evidence due to the nature of the design. Dominantly researcher's perspective is taken into consideration for the evaluation process so that needs to be coutious for generalization.

Acknowledgment

This project received no financial support for the research. There is no conflict of interest for the research. I assure you that this study has not been published anywhere or is not in the process of being published.

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Journal of
Gifted Education
& Creativity

Young Wise
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ISSN: 2149-1410