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Scientific Competition Programs for Child-Friendly Schools: Development, Implementation, and Educational Impact

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Abstract: Higher-order thinking skills (HOTS) and scientific academic culture are important aims of secondary education, but their development requires learning opportunities that extend beyond preparation for academic competitions. This study describes the competition-related and research-oriented programs reported by the principal of SMA Negeri 3 Semarang and discusses their possible relationship to scientific academic culture and child-friendly school principles. A descriptive qualitative approach was used. Data were collected on April 1, 2026, through a semi-structured interview with the school principal. The interview guide covered leadership, teacher and staff evaluation, curriculum, flagship academic programs, and learning facilities. Observation was limited to the school location and the interview activity, while photographs documented the setting and data collection. The interview data were analyzed using the interactive model of data analysis developed by Miles, Huberman, and Saldaña (2014), comprising data condensation, data display, and conclusion drawing and verification. No institutional document analysis, direct observation of program activities, or assessment of students' HOTS was conducted. According to the principal, the school provides research activities and scientific writing, olympiad coaching and special academic classes, a school scientific journal, collaboration with university experts, and technology-supported learning. The principal also described the use of a deep-learning approach in curriculum development and the requirement for students to produce scientific work as part of academic progression. These accounts suggest that the school intends to connect competition preparation with broader academic activities. However, the study cannot establish how consistently these programs are implemented or whether they improve students' HOTS, scientific literacy, or well-being. The findings represent one informant's perspective and should be interpreted as a contextual description rather than an evaluation of program effectiveness.

Keywords: Competition development program; Scientific academic culture; Scientific literacy; Higher-order thinking skills; Child-friendly schools

Introduction

Twenty-first-century education requires schools to equip students with critical thinking, creativity, collaboration, effective communication, and scientific problem-solving skills. Higher-order thinking skills (HOTS) are important because they involve analyzing information, evaluating evidence, and formulating solutions through complex cognitive processes. Developing HOTS among secondary school students remains a challenge and requires educational strategies that offer meaningful intellectual experiences (Liu et al., 2024). HOTS is also associated with informed decision-making and independent thinking (Purwanto, 2024). In science education, inquiry-based approaches can provide opportunities to investigate phenomena, interpret evidence, and construct arguments (Furtak et al., 2012). These studies provide a conceptual rationale for examining school programs that include research and academic competition activities; they do not, by themselves, demonstrate the outcomes of a particular school program.

The development of HOTS is closely associated with learning approaches that emphasize active participation and knowledge construction. Student-centered learning allows students to develop their understanding through exploration, discussion, inquiry, and problem-solving, while teachers serve as facilitators who provide academic guidance. A systematic review reported that student-centered learning is associated with increased student engagement, autonomy, and independence in learning (Mat & Jamaludin, 2024). Furthermore, inquiry-based learning, the flipped classroom approach, the Question Formulation Technique (QFT), and technology-enhanced learning have been reported to support HOTS by engaging

students in meaningful scientific activities (Irdalisa et al., 2024; Liu & Zhang, 2022). A meta-analysis of inquiry-based science instruction also found positive effects on learning outcomes, with stronger effects observed when inquiry activities were guided by teachers (Furtak et al., 2012). Taken together, these findings suggest that developing scientific competencies requires not only effective instructional practices but also an academic environment that consistently provides opportunities for meaningful scientific learning.

Such an environment can be cultivated through a strong scientific academic culture. Scientific academic culture refers to the values, routines, and practices within educational institutions that encourage inquiry, research, scientific communication, academic discussion, and evidence-based thinking. The situated cognition perspective emphasizes that knowledge develops and acquires meaning through the activities and cultural contexts in which it is used (Brown et al., 1989). From this perspective, scientific academic culture provides a context in which students learn to participate in scientific practices rather than simply receive scientific content. Schools with a strong scientific academic culture provide opportunities for students to conduct investigations, produce scientific work, communicate academic ideas, and develop independent learning habits. Accordingly, academic development should not be assessed solely through examination results or competition achievements, but also through the extent to which schools cultivate an environment that nurtures scientific thinking and sustained intellectual growth.

One strategy that may contribute to the development of scientific academic culture is the implementation of competition development programs. Although such programs are commonly associated with preparing students for academic competitions, well-designed programs can serve broader educational purposes by integrating olympiad coaching, research activities, scientific writing, academic discussions, and problem-solving exercises. Through these activities, students are encouraged to explore scientific concepts in greater depth, develop analytical abilities, and strengthen their scientific reasoning. From the perspective of talent development, academic potential flourishes when students have access to challenging learning opportunities, mentoring, and support for psychosocial skill development (Subotnik et al., 2011). Thus, competition development programs have the potential to transform competition-oriented activities into sustained academic practices that support students' intellectual growth.

Previous studies have shown that competition coaching and research-oriented learning activities can support students' cognitive development when accompanied by appropriate mentoring strategies and supportive learning environments. In a descriptive study involving five senior high school students receiving mathematics olympiad coaching, Hidayatulloh et al. (2024) reported that students with high levels of self-regulated learning demonstrated all indicators of HOTS when solving algebra problems, whereas students with moderate levels of self-regulated learning reached only the evaluation stage. Project-based learning has also been reported to influence students' HOTS (Setyowati et al., 2024), while the RADEC learning model has been found effective in improving HOTS in science education (Widhyahrini & Biantoro, 2024). However, much of this research has examined competition coaching or specific instructional models primarily as strategies for improving academic achievement or preparing students for particular competitions. Their role as part of a broader academic ecosystem for strengthening scientific academic culture remains comparatively underexplored.

SMA Negeri 3 Semarang was selected as the research setting because the principal described several academic initiatives relevant to competition development and scientific academic culture. As reported in the interview, these initiatives include olympiad coaching, research activities, scientific writing, special academic classes, technology-supported learning, and collaboration with higher education institutions. The principal also reported that students are required to produce scientific work as part of academic progression. Because these details derive from one interview, they are presented in this article as the principal's account rather than as independently verified descriptions of school-wide practice.

Beyond academic considerations, competition development programs should also be examined within the framework of child-friendly schooling. In Indonesia, the implementation of child-friendly schools is guided, among other resources, by the Child-Friendly School Guidelines issued by the Ministry of Women's Empowerment and Child Protection of the Republic of Indonesia (Kementerian Pemberdayaan Perempuan

dan Perlindungan Anak Republik Indonesia [KemenPPPA], 2015). The implementation of these principles at the school level has also been examined in previous research (Fitriani & Qodariah, 2021). The principles of inclusion and equity in education (Shaeffer, 2019) require academically oriented programs to provide equitable access, support meaningful student participation, and avoid placing excessive pressure on students. Therefore, it is important to examine how competition development programs can strengthen scientific academic culture while remaining consistent with these principles.

Against this background, this study describes the competition-related and research-oriented initiatives reported by the principal of SMA Negeri 3 Semarang, identifies the institutional supports and challenges mentioned in the interview, and discusses the possible relationship of these initiatives to scientific academic culture and child-friendly school principles. The study does not assess program effectiveness or measure student outcomes; its contribution is a context-specific account of the principal's perspective and the implications that can cautiously be drawn from it.

Methods

Research Design

This study employed a descriptive qualitative approach to describe the principal's account of competition development programs and their perceived contribution to strengthening scientific academic culture at SMA Negeri 3 Semarang, Indonesia. A qualitative approach was appropriate because it enables researchers to explore participants' perspectives and understand educational phenomena within their specific contexts (Creswell & Poth, 2018). The study focused on the programs described by the principal, including their objectives, management practices, and perceived relevance to the school's academic development. The research was descriptive in nature and did not aim to measure program effectiveness or establish causal relationships.

Research Site and Informant

The study was conducted at SMA Negeri 3 Semarang, a public senior high school in Indonesia. The principal was selected as the sole interview informant because of the principal's leadership responsibilities and involvement in school-level planning, program management, and academic development. The principal was considered a relevant informant for obtaining information about the school's academic initiatives and institutional priorities (Creswell & Poth, 2018).

However, the data represent the principal's perspective and should not be interpreted as a comprehensive account of the experiences of all school members. Teachers and students were not interviewed; therefore, their perspectives on the implementation of competition development programs and the development of scientific academic culture were not directly examined.

Data Collection Techniques

Data were collected through a semi-structured interview and limited observation. The research activities were conducted on April 1, 2026. The interview was conducted with the school principal using an interview guide comprising five main topics: leadership practices, the evaluation of teachers and staff, curriculum implementation, flagship academic programs, and school facilities. These topics provided a framework for exploring the principal's account of school management practices and academic development initiatives while allowing follow-up questions to clarify relevant information.

The interview transcript served as the primary source of data for the research findings. Accordingly, information concerning competition development programs, academic mentoring, curriculum practices, institutional support, and other school initiatives was treated as information reported by the principal rather than as independently verified evidence of program implementation. This distinction was maintained when interpreting and presenting the findings.

Observation was limited to examining the school location and the interview activity. Field documentation consisted of photographs of the research activities and the school setting. These

observations and photographs provided contextual information about the research setting and documentation of the data collection process. They were not used as evidence of classroom practices, student participation, mentoring activities, or the implementation and outcomes of the reported programs. No institutional document analysis was conducted. Consequently, the findings were based primarily on the interview transcript, supplemented by limited contextual observations and field photographs.

Data Analysis

The interview data were analyzed using the interactive model developed by Miles, Huberman, and Saldaña (2014), which involves data condensation, data display, and conclusion drawing and verification. The model was used to organize the principal's account systematically while keeping the analysis within the limits of the available data.

During data condensation, the researcher reviewed the available interview transcript or interview record and selected information relevant to the research objectives. Relevant statements were coded and grouped under the five topics in the interview guide: leadership practices, the evaluation of teachers and staff, curriculum implementation, flagship academic programs, and school facilities. This process focused the analysis on information directly related to the study rather than on unrelated details.

For data display, the condensed information was organized into thematic descriptions and a summary table linking the initiatives reported by the principal with cautious interpretations and evidence boundaries. Conclusion drawing involved identifying recurring points and relationships across the five topics and interpreting their possible relevance to scientific academic culture and child-friendly school principles. Verification consisted of checking whether the descriptions and interpretations were consistent with the available interview record and the study objectives. Because no additional informants, direct observation of program activities, or institutional documents were used to corroborate the account, this verification did not constitute independent confirmation of program implementation or effectiveness. The principal's statements were therefore distinguished from the researcher's interpretations throughout the presentation of findings.

Research Credibility and Limitations

Several measures were taken to maintain transparency in the research process. The use of a semi-structured interview guide provided a consistent framework for collecting information across the five research topics. In addition, the distinction between the principal's statements and the researcher's interpretation helped clarify the evidential basis of the findings.

Nevertheless, the study had several methodological limitations. First, the principal was the only interview informant, meaning that the findings predominantly reflected one institutional perspective. Second, observation was limited to the school location and the interview activity, so it could not independently verify the implementation of the reported programs. Third, the study did not include institutional document analysis, and the field photographs served only as contextual documentation. Therefore, methodological triangulation sufficient to corroborate the reported program practices was not established.

The findings should consequently be understood as a descriptive account of the principal's perspective within a single-school context. Further research involving teachers and students, direct observation of program activities, and analysis of relevant institutional documents would provide a more comprehensive basis for examining the implementation of competition development programs and their relationship to scientific academic culture

Results and Discussion

The interview portrays competition development at SMA Negeri 3 Semarang as part of a wider set of academic initiatives rather than as olympiad preparation alone. According to the principal, the school supports student research and scientific writing, provides olympiad coaching and special academic classes,

maintains a school scientific journal, collaborates with university experts, and uses technology-supported learning. These findings are based primarily on the principal's account. The field observation was limited to the school location and the interview activity, so it did not provide direct evidence of classroom practices or program implementation.

The principal also reported that students are required to produce scientific work as part of their academic progression and that the school allocates dedicated time for research and scientific writing. Special classes reportedly include olympiad, tahfidz, and flagship classes with additional learning hours, while extracurricular activities include structured olympiad coaching. These descriptions indicate the range of activities that the school leadership says it supports, but the study did not independently verify their frequency, reach, or implementation across student groups.

Taken together, the interview suggests an institutional intention to connect competition preparation with research, scientific communication, and broader academic development. This can be interpreted as a potential foundation for scientific academic culture. However, because no program sessions were observed and no institutional documents were analyzed, the data do not establish whether these activities operate as a consistently integrated system or what effects they have on students.

Table 1. Summary of Reported Initiatives and Evidence Boundaries

Research focus	Initiatives reported by the principal	Cautious interpretation	Evidence boundary
Academic enrichment	Olympiad coaching, special academic classes, and structured extracurricular coaching.	The school leadership reports offering several forms of academic enrichment.	No coaching session was observed; participation and frequency were not verified.
Research and scientific writing	Dedicated time for research and writing; scientific work reportedly required for academic progression.	These arrangements may provide opportunities for research-oriented learning.	Student work, supervision, and learning outcomes were not examined.
Scientific academic culture	School scientific journal and collaboration with university experts, as reported by the principal.	The initiatives suggest an institutional intention to connect competition preparation with broader academic practices.	School-wide routines and student experiences were not independently established.
Institutional support	Reported leadership practices, curriculum development, staff evaluation, facilities, and counseling.	These are institutional supports identified in the principal's account.	No records, staff perspectives, or facilities audit were used for verification.
Child-friendly school implications	Counseling and academic initiatives were described; equity and student well-being were not directly investigated.	The relationship to child-friendly school principles is a question for further study.	No student/parent interviews or direct measures of access, workload, or well-being.

Note: Activities listed in the table are based on the principal's interview account. The study did not independently verify program implementation or measure student outcomes.

The table separates reported activities from cautious interpretations of the available evidence. In particular, the presence of research and writing activities does not demonstrate that students' HOTS or academic achievement have improved. The findings describe the program's reported orientation and

institutional context, not its measured effectiveness.

Conceptual Mapping of the Reported Program

Figure 1 presents a conceptual mapping developed by the authors from the principal's interview account. It groups the reported institutional supports, activities, possible outputs, and the broader aim of scientific academic culture. This figure is an interpretive framework, not an official school program chart or a verified sequence of implementation. Specific operational details such as selection procedures, coaching frequency, monitoring indicators, and program responsibilities were not established by the data available for this study.

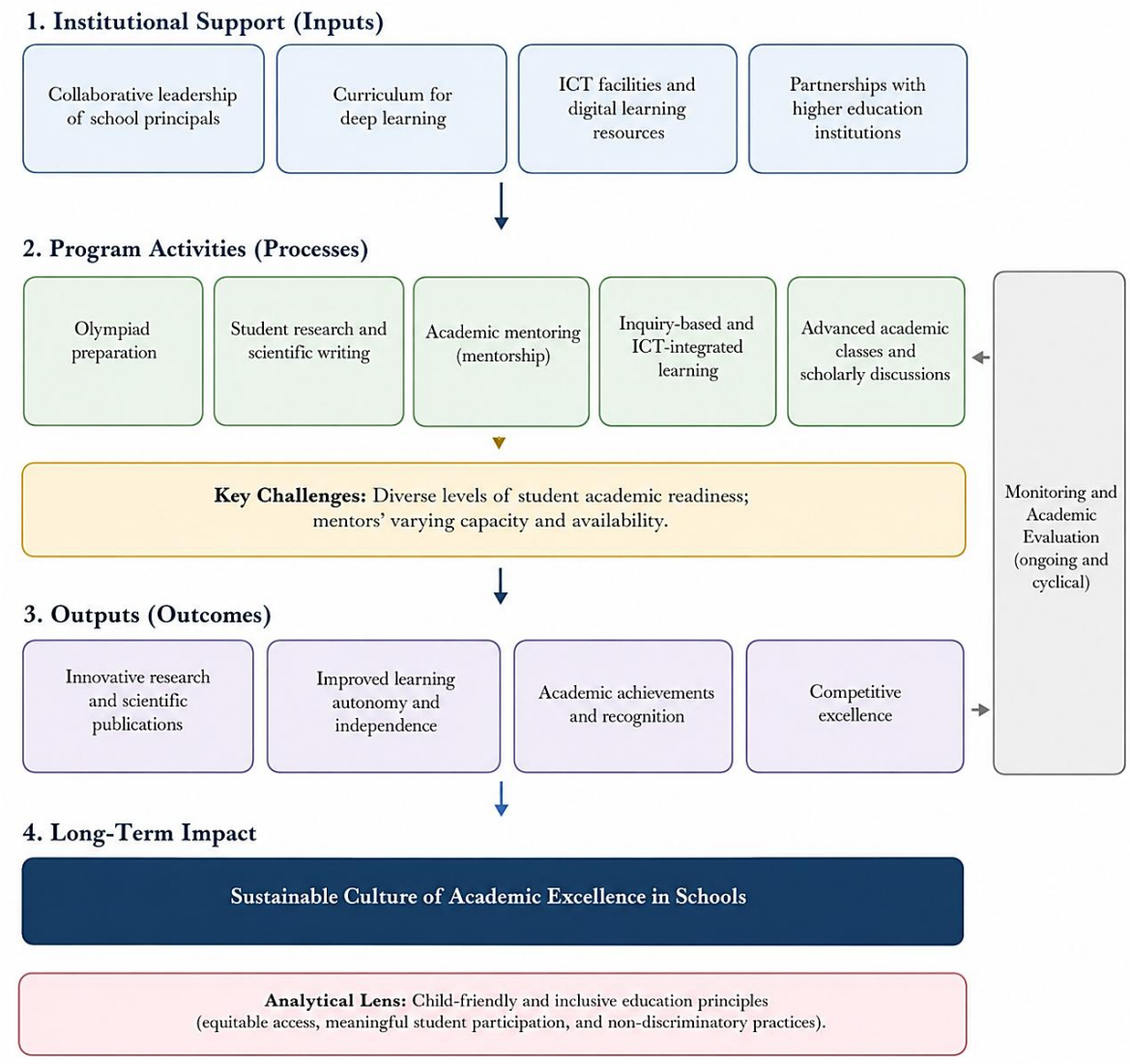


Figure 1. Conceptual mapping of the competition development initiatives reported by the principal (authors' interpretation of interview data)

The interview guide did not collect sufficient operational detail to reconstruct a verified implementation sequence. Accordingly, Table 2 summarizes the five areas covered in the interview rather than presenting an unverified technical model of program implementation.

Table 2 reflects the structure of the data collection instrument. It should not be read as evidence that every area was independently observed or documented. Details requiring confirmation, such as selection criteria, the frequency of coaching, the number and background of mentors, and formal evaluation indicators, remain outside the scope of the available evidence.

Table 2. Interview Domains and the Scope of Available Information

Interview domain	Information reported in the interview summary	Evidence boundary
Leadership	Collegial and delegative approach; task distribution; involvement in planning and evaluation.	Principal's account; no staff interviews or leadership records were reviewed.
Teacher/staff evaluation	Use of e-kinerja and monitoring of field performance, dedication, integrity, participation, mentoring, and achievements.	Evaluation records and teachers' experiences were not independently examined.
Curriculum	National curriculum reportedly developed through a deep-learning approach, teacher training, and policy adaptation.	Classroom implementation was not observed.
Flagship academic programs	Research and scientific writing; olympiad coaching; special classes; school scientific journal; collaboration with university experts.	Frequency, participant reach, selection criteria, and program outcomes were not verified.
Facilities and student support	Multimedia classrooms, internet access, computers linked to library resources, air-conditioned rooms, ICT-supported and bilingual learning, and counseling.	No facilities audit or student/parent interviews were conducted.

Reported Academic Initiatives and Student-Centered Learning

According to the principal, the school's academic initiatives include research, scientific writing, olympiad coaching, and special classes with additional learning time. Such activities may create opportunities for students to explore academic topics in greater depth when they are supported by appropriate guidance. However, the interview did not directly examine teaching practices in these activities, and the study did not include interviews with teachers or students. Therefore, it is not possible to conclude from these data that the program consistently applies student-centered or inquiry-based learning.

Observation was limited to the school setting and the interview itself. No classroom discussions, student problem-solving, research supervision, or olympiad coaching sessions were observed. Claims about students' active participation or the teaching strategies used during program activities therefore cannot be made on the basis of observation in this study.

The literature offers a useful framework for interpreting the possible educational value of these initiatives. A systematic review associated student-centered teaching with engagement and learner autonomy (Mat & Jamaludin, 2024), while studies of inquiry-based and technology-supported approaches have examined their relationship to HOTS and learning outcomes (Furtak et al., 2012; Irdalisa et al., 2024; Liu & Zhang, 2022). These studies provide background for future evaluation; they do not establish that the reported initiatives at SMA Negeri 3 Semarang have produced the same outcomes.

Accordingly, the principal's account supports the conclusion that the school reports offering several forms of academic enrichment. Whether these initiatives are implemented through student-centered teaching, how students experience them, and whether they strengthen independent learning require direct evidence from program observations and from teachers and students themselves.

Research Activities and the Potential Relationship to HOTS

The principal reported that the school provides dedicated opportunities for research and scientific writing and that producing scientific work is a requirement for students' academic progression. The principal also described a school scientific journal and collaboration with university experts. These practices are relevant to research-oriented learning because they provide an institutional structure in which scientific work is expected or supported. Nevertheless, the study did not review student papers, observe research supervision, or assess students' research skills.

Research and scientific writing can involve complex cognitive processes such as identifying questions, evaluating information, interpreting evidence, and communicating arguments. In principle, these activities may offer opportunities to practise HOTS. Self-regulated learning is also relevant to how learners plan, monitor, and reflect on their work (Zimmerman, 2002). In this study, however, these are conceptual implications drawn from the nature of the reported activities, not observed or measured outcomes for students at the school.

Previous research has examined relationships between olympiad coaching and students' HOTS in mathematics (Hidayatulloh et al., 2024), project-based learning and HOTS (Setyowati et al., 2024), and learning models intended to support higher-order thinking (Gradini et al., 2025; Widhyahrini & Biantoro, 2024). These studies contextualize why research and enrichment activities merit further investigation. They cannot be used as direct evidence that the initiatives reported in the present interview improve HOTS.

The available interview summary does not provide sufficient evidence to characterize students' research difficulties, differences in academic readiness, or the distribution of mentoring support in detail. These issues should therefore be treated as questions for follow-up research rather than as established findings of this study. Future work could examine student work, observe mentoring sessions, and use appropriate HOTS assessments to investigate the relationship between participation in the programs and students' learning.

Competition Development and Scientific Academic Culture

The principal's account connects olympiad coaching with research activities, scientific writing, a school scientific journal, special academic classes, and collaboration with university experts. This combination suggests that school leadership describes academic development as extending beyond competition results. The presence of research and scientific communication in the account is consistent with a broad conception of scientific academic culture, which emphasizes engagement with inquiry and the communication of ideas.

The study cannot, however, confirm that these activities have become routine practices for students throughout the school. No student interviews, direct observations of academic activities, or analyses of student publications and school documents were conducted. The situated cognition perspective argues that learning is shaped by participation in meaningful activities and contexts (Brown et al., 1989); here, that perspective serves as a theoretical lens for discussing the reported initiatives, not as proof that a school-wide scientific culture has been achieved.

The contribution of this study is therefore exploratory: it documents how one principal describes a set of competition-related and research-oriented initiatives and identifies their potential connection to scientific academic culture. Further research is needed to establish how these initiatives are organized in practice, who participates, and how students and teachers experience them.

The principal described a collegial and delegative leadership approach, with task distribution, involvement in planning and evaluation, and a combination of formal and humanistic management. The principal also reported ongoing evaluation of teachers and staff through e-kinerja and monitoring of field performance, including dedication, integrity, participation, student mentoring, and achievements. These statements indicate the leadership and evaluation practices as understood by the informant. The study did not interview teachers or inspect evaluation records, so the implementation and effects of these practices could not be independently confirmed. The principal further reported that the national curriculum is

developed through a deep-learning approach and that teacher training and adaptation are part of curriculum implementation.

Possible Implications for Child-Friendly School Principles

The child-friendly school framework in Indonesia emphasizes a school environment that respects children's rights and supports safe, participatory, and inclusive learning (KemenPPPA, 2015). Previous research has examined the implementation of child-friendly school models (Fitriani & Qodariah, 2021), while scholarship on inclusive education highlights the importance of equity and social justice (Shaeffer, 2019). These sources provide a conceptual framework for considering how academically selective or demanding enrichment programs should be designed.

The interview provides limited information for assessing alignment with child-friendly school principles. The principal reported the availability of counseling for each student and described academic initiatives and learning facilities, including multimedia classrooms and internet access. These details may be relevant to institutional support, but they do not establish whether students experience the programs as safe, inclusive, participatory, or psychologically supportive. No students or parents were interviewed, and no direct measure of well-being or equitable access was collected.

As a practical implication, schools developing competition programs should consider transparent access, differentiated academic support, reasonable learning demands, and ways for students to participate in decisions affecting their learning. Talent-development literature emphasizes the role of opportunity and support in developing academic potential (Subotnik et al., 2011), while inclusion frameworks highlight equitable participation (Ainscow, 2020). These are recommendations informed by the literature, not claims that the present study has established the school's performance on each principle.

The extent to which the reported initiatives align with child-friendly school principles remains an open question. Further research should collect students' and parents' perspectives and examine access, workload, participation, counseling, and well-being directly before drawing conclusions about this alignment.

Reported Institutional Supports and Areas for Further Investigation

The principal described school leadership as collegial and delegative, with clear task distribution and involvement in planning and evaluation. This account suggests that leadership coordination is regarded by the principal as an important part of school management. Research on school leadership provides a broader rationale for examining the relationship between leadership practices and school development (Leithwood et al., 2020), but the present study did not assess the effect of leadership on program outcomes.

The principal also reported that the school provides multimedia classrooms, internet access described as available 24 hours, computers connected to library resources, air-conditioned classrooms, ICT-supported learning, bilingual instruction in Indonesian and English, and counseling services for students. The principal further mentioned collaboration with university experts in relation to academic development. These are reported institutional resources and arrangements; the study did not conduct a facilities audit or verify the scope and frequency of external collaboration.

The interview guide covered teacher and staff evaluation, but the available data do not support a detailed assessment of teacher mentoring competence or student readiness for research. Further investigation could examine how teachers are prepared to supervise research and coach olympiad participants, how mentoring is allocated, and whether students with different levels of readiness can access support. Literature on scaffolding in inquiry- and problem-based learning may inform the design of such follow-up work (Hmelo-Silver et al., 2007).

The principal's description of evaluation through e-kinerja and monitoring of field performance points to both administrative and practical dimensions of staff evaluation. However, no evaluation records or teacher accounts were collected. Claims about the consistency, fairness, or consequences of this evaluation process would therefore exceed the available evidence. Future studies could compare leadership accounts

with teachers' experiences and relevant school records.

Overall, the interview identifies several initiatives and institutional resources that may provide a basis for academic enrichment and research-oriented activity. The study does not establish program effectiveness, improvements in HOTS, or the extent to which a scientific academic culture is experienced by students. These questions require evidence beyond a single interview, including direct observation, student and teacher perspectives, and relevant program documents.

Research Limitations

This study has several limitations. First, it was conducted at one school and involved only the principal as an interview informant. The findings therefore reflect one institutional perspective and are not intended for statistical generalization. The descriptive account may be useful for comparison with similar contexts, but transferability requires readers to consider contextual differences (Creswell & Poth, 2018).

Second, observation was limited to the school location and the interview activity. It did not include classroom instruction, research supervision, olympiad coaching, or other program activities. Third, no institutional document analysis was conducted; photographs served only as contextual documentation. Consequently, the study did not establish methodological triangulation sufficient to verify the principal's account.

Fourth, the study did not interview teachers or students, review student scientific work, assess HOTS, or measure academic achievement, student participation, or well-being. Statements about program practices are therefore presented as reports from the principal, while discussion of their possible educational significance is interpretive and informed by relevant literature. The study cannot demonstrate causal effects or establish the consistency of implementation over time.

Future studies could include principals, teachers, students, and parents; observe program activities on multiple occasions; examine relevant planning and evaluation documents; review student research products; and use suitable assessments of HOTS and student experience. Such evidence would allow a more robust assessment of implementation, access, educational outcomes, and alignment with child-friendly school principles.

Conclusion

This study describes competition-related and research-oriented initiatives at SMA Negeri 3 Semarang as reported by the school principal. The interview account includes olympiad coaching, special academic classes, research and scientific writing, a school scientific journal, collaboration with university experts, and technology-supported learning. The principal also described a collegial and delegative leadership approach, staff evaluation practices, curriculum development using a deep-learning approach, and a range of learning facilities and student counseling support.

These findings indicate that the school leadership presents competition development as part of a wider set of academic initiatives. However, because the study relied on one interview, limited contextual observation, and field photographs—and did not include document analysis, direct observation of program activities, or student outcome measures—it cannot establish the consistency of implementation or demonstrate effects on HOTS, scientific literacy, independent learning, or student well-being. The connection to child-friendly school principles should likewise be regarded as a topic for further examination rather than a confirmed outcome.

The study's value lies in documenting the principal's perspective and identifying questions for subsequent research. Future studies should include teachers and students, examine program documents and student work, observe activities directly, and assess access and learning outcomes. This broader evidence base would help determine whether and how competition development initiatives contribute to scientific academic culture in ways that are inclusive and consistent with child-friendly school principles.

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