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EVALUATING THE COMPUTER BASE NATIONAL SCIENCE OLYMPIAD IMPLEMENTATION AT SENIOR HIGH SCHOOL LEVEL: A CIPP MODEL ANALYSIS

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Abstract

The digital transformation in education has encouraged changes in national evaluation systems and academic competitions, including the implementation of the online-based National Science Olympiad (OSN). This study aims to evaluate the implementation of the online National Science Olympiad at the senior high school level using the CIPP (Context, Input, Process, Product) evaluation model. The study employed a mixed methods approach by collecting data through questionnaires, interviews, observations, and documentation studies. The participants consisted of student contestants, supervising teachers, school operators, and school management representatives. The findings indicate that, from the context aspect, the program is relevant to the needs of educational digitalization and implementation efficiency. From the input aspect, disparities were still found in infrastructure, internet network quality, and digital competencies among schools. From the process aspect, the program implementation generally ran well despite several technical constraints and variations in supervision quality. From the product aspect, the program improved accessibility and efficiency; however, it also generated perceptions of unfairness among some participants. The study concludes that the implementation of the online OSN is relatively effective, but it still requires improvements in infrastructure, technical standardization, and the integrity of the evaluation system. These findings contribute to the development of fairer and more sustainable digital academic competition policies.

Keywords: program evaluation, CIPP model, online OSN, educational technology, academic competition

1. Introduction

The development of digital technology has driven major transformations across various sectors, including education. Educational digitalization not only affects the learning process but also influences systems of evaluation, assessment, and the management of academic competitions. The integration of technology in education enables evaluation processes to be conducted more flexibly, efficiently, and across wider geographical areas compared to conventional systems[1]. In addition, digital technology integration is considered capable of improving data management effectiveness and accelerating assessment processes within modern educational systems [2].

The digital transformation of education accelerated significantly during the COVID-19 pandemic. This global emergency forced educational institutions to adopt online systems rapidly in order to maintain academic continuity[3]. These changes affected not only learning activities but also national evaluation systems and academic competitions. According to Williamson, Eynon, and Potter[4], the pandemic became a major catalyst for educational digitalization, fundamentally changing the paradigm of educational service delivery worldwide. Even after the pandemic, many institutions continued to maintain digital systems because they were considered more efficient and adaptive to technological advancement.

One example of this digital transformation can be seen in the implementation of the National Science Olympiad (OSN), which previously relied on face-to-face formats but later shifted to an online system. As a national academic competition, the OSN plays a strategic role in identifying high-achieving students while also mapping the quality of science education in Indonesia. Therefore, the transition from offline to online implementation requires comprehensive evaluation because it directly relates to competition validity, implementation effectiveness, and participants' perceptions of fairness.

Online-based academic competitions offer several advantages, including cost efficiency, implementation flexibility, and expanded participant access from various regions [5]. Digital systems also enable faster and more integrated data management and assessment processes,[6] through a systematic review of 114 publications, explained that online assessment has strong potential to improve evaluation effectiveness through systems that are more flexible, interactive, and digitally integrated. However, the success of online assessment implementation is highly influenced by instructional support, clarity of assessment criteria, and the quality of the evaluation system used. Nevertheless, the implementation of online competitions also presents several challenges, particularly related to technological infrastructure gaps, internet network quality, system security, and the digital literacy readiness of participants and schools [7]. In the context of educational evaluation, such conditions may affect the validity and reliability of competition results if not properly managed.

In addition to technical issues, concerns regarding integrity and supervision in digital academic competitions have become increasingly important. Online evaluation systems require supervision mechanisms capable of ensuring fairness and credibility in assessment outcomes [8]. emphasized that digital assessment systems must be designed with high standards of security and validity so that evaluation results truly represent participants' abilities. Without adequate supervision, online academic competitions may generate doubts regarding the legitimacy of selection results.

Previous studies have generally focused on online learning, e-learning, and computer-based assessment [3], [4]. Meanwhile, studies specifically evaluating the implementation of online national academic competitions remain limited, particularly within the context of secondary education in Indonesia. In fact, academic competitions possess characteristics that differ from online learning because they require stricter standards of measurement validity, assessment objectivity, and selection legitimacy. This limitation highlights an important research gap that deserves further investigation.

To address this need, the present study employed the CIPP (Context, Input, Process, Product) evaluation model developed by Stufflebeam and Shinkfield[9]. The CIPP model was selected because it enables comprehensive program evaluation, ranging from policy relevance and resource readiness to implementation processes and program outcomes. The use of this model allows a systematic analysis of the effectiveness of online OSN implementation at the senior high school level.

This study aims to evaluate the implementation of the online OSN in terms of context, input, process, and product aspects, while also identifying major challenges encountered during implementation. Furthermore, this study is expected to contribute theoretically to the development of digital education program evaluation studies and provide practical recommendations for developing more effective, equitable, and sustainable online academic competition systems.

2. Method

This study employed an evaluative research approach using a mixed methods design to evaluate the implementation of the online National Science Olympiad (OSN) at the senior high school level. This approach was selected because program evaluation requires the integration of quantitative data to measure program effectiveness and qualitative data to explore the experiences, perceptions, and challenges faced by stakeholders during program implementation. Creswell and Plano Clark (2018) explained that a mixed methods approach enables researchers to obtain a more comprehensive understanding through the integration of numerical and contextual data within a single study.

Research Design

The study adopted the CIPP (Context, Input, Process, Product) evaluation model developed by Stufflebeam. This model was chosen because it allows comprehensive program evaluation, ranging from policy background and resource readiness to implementation processes and program outcomes. According to Stufflebeam and Shinkfield[9], the CIPP model was designed to provide systematic information for decision-making and continuous improvement in educational programs.

The context evaluation focused on the relevance of online OSN policies and the needs of educational digitalization. The input evaluation assessed the readiness of infrastructure, technological devices, internet connectivity, and the digital competencies of both participants and schools. The process evaluation analyzed program implementation, supervision mechanisms, technical coordination, and operational challenges. Meanwhile, the product evaluation examined program effectiveness, participant satisfaction, perceptions of fairness, and the overall benefits of the program.

Participants and Research Setting

The study was conducted in several senior high schools that had participated in the online OSN. Participants were selected using purposive sampling based on their direct involvement in the program. The participants consisted of OSN student contestants, supervising teachers, school operators, and school management representatives. Involving respondents from different stakeholder groups was intended to obtain more comprehensive perspectives regarding the implementation of the program.

Data Collection

Data were collected through four primary techniques: questionnaires, interviews, observations, and documentation studies. Questionnaires were administered to obtain quantitative data regarding respondents' perceptions of the effectiveness of the online system, facility readiness, and implementation satisfaction.

Semi-structured interviews were conducted with supervising teachers, school operators, and selected students to explore their implementation experiences, technical challenges, and perceptions of system fairness. Observations were carried out to examine the readiness of school facilities and the availability of technical support during program implementation. Documentation studies involved reviewing OSN technical guidelines, implementation schedules, school reports, and related policy documents.

Instruments

The research instruments consisted of Likert-scale questionnaires, interview guidelines, observation sheets, and document review formats. Instrument development was based on the indicators of the CIPP model to ensure alignment

with the evaluation objectives. Prior to data collection, the instruments underwent expert validation to assess item clarity, content suitability, and indicator relevance.

Data Analysis

Quantitative data were analyzed using descriptive statistics, including mean scores, percentages, and score categorizations, to describe the level of program implementation effectiveness across each evaluation component. Meanwhile, qualitative data were analyzed through data reduction, data display, and conclusion drawing.

The integration of quantitative and qualitative findings was conducted through triangulation to strengthen the interpretation and comprehensiveness of the research findings.

Validity and Trustworthiness

The validity and trustworthiness of the data were ensured through source triangulation, method triangulation, member checking with key informants, and peer debriefing. These procedures were conducted to enhance the credibility, consistency, and reliability of the study findings.

Ethical Considerations

All participants received clear explanations regarding the objectives of the study and participated voluntarily. Respondents' identities were kept confidential, and all collected data were used solely for academic purposes. The study was conducted in accordance with ethical principles in educational research.

3. Research results

The findings of this study are presented based on the CIPP (Context, Input, Process, Product) evaluation framework to provide a comprehensive overview of the implementation of the online National Science Olympiad (OSN) at the senior high school level. The findings were obtained through questionnaires, interviews, observations, and documentation studies.

Context Evaluation

The context evaluation revealed that the implementation of the online OSN was considered relevant to the needs of educational digital transformation. Most respondents perceived the online system as an effective solution for maintaining the continuity of academic competitions in the post-pandemic era while simultaneously expanding participant access from various regions.

However, several respondents stated that the transition to the online system had not been fully accompanied by equal and comprehensive technical socialization, particularly in schools with limited digital experience.

Context Indicators	Mean Score	Category
Program relevance to the digital era	4.32	Very Good
Suitability with school needs	4.08	Good
Clarity of program objectives	3.95	Good
Policy dissemination	3.71	Good

The main finding indicates that the program was considered highly relevant, although policy communication and technical dissemination still need further improvement.

Input Evaluation

The input evaluation showed that resource readiness varied considerably among schools. Schools located in urban areas generally possessed better computer facilities, internet connectivity, and technical operators compared to schools in suburban or remote areas.

Several participants also emphasized that digital literacy competencies played an important role in ensuring smooth participation during the competition.

Input Indicators	Mean Score	Category
Availability of computer devices	4.01	Good
Internet network stability	3.54	Moderate
Competence of school operators	4.12	Good
Participants' digital literacy	3.76	Good
Examination room readiness	3.88	Good

The main finding highlights that internet stability and disparities in technological facilities remain the greatest challenges in implementing the online OSN.

Process Evaluation

The process evaluation demonstrated that the implementation of the online OSN generally proceeded smoothly, although technical issues were still encountered in several locations, including network disruptions, login difficulties, and delays in data synchronization.

Some supervising teachers considered digital supervision helpful, although it had not yet fully replaced the effectiveness of direct face-to-face supervision.

Process Indicators	Mean Score	Category
Smoothness of examination implementation	3.89	Good
Ease of platform use	4.05	Good
Responsiveness of technical support	3.81	Good
Effectiveness of supervision	3.42	Moderate
Coordination between organizers and schools	3.97	Good

The main finding suggests that the system operated relatively well overall; however, supervision and monitoring remain important issues requiring further improvement.

Product Evaluation

The product evaluation showed that the online OSN provided substantial benefits, including cost efficiency, broader participation opportunities, and faster result processing. Nevertheless, several respondents still questioned the equality of examination conditions among schools.

Product Indicators	Mean Score	Category
Implementation efficiency	4.36	Very Good
Expansion of participant access	4.28	Very Good
Participant satisfaction	3.84	Good
Perceived fairness of the system	3.39	Moderate
Program sustainability	4.11	Good

The main finding indicates that although the program offers significant benefits, perceptions regarding fairness and equality of examination conditions still need improvement.

Overall Evaluation Results

Overall, the implementation of the online OSN achieved a "Good" category with a total mean score of 3.92. These findings indicate that the program is sufficiently effective to be continued, although several strategic improvements are still necessary.

CIPP Components	Mean Score	Category
Context	4.02	Good
Input	3.86	Good
Process	3.83	Good
Product	3.99	Good
Overall Mean	3.92	Good

Based on the evaluation results, three major findings emerged. First, the online OSN is aligned with the direction of national educational digitalization and has improved implementation efficiency. Second, disparities in infrastructure and internet quality remain major obstacles. Third, issues related to supervision integrity and perceptions of competition fairness require serious attention in future policy development.

4. Discussion

The findings demonstrate that the implementation of the online National Science Olympiad at the senior high school level generally falls within the "Good" category, with an average score of 3.92. These findings indicate that digital transformation in national academic competitions can be implemented effectively, although several aspects still require further improvement. The results reinforce the notion that educational digitalization is relevant not only for learning processes but also for systems of evaluation and academic achievement selection. [1] argued that technology integration in education can improve flexibility, efficiency, and accessibility of educational services on a broader scale. The present findings also support [2] view that modern educational systems increasingly depend on digital technologies in managing assessment and evaluation processes.

From the context aspect, the study found that the online OSN was perceived as highly relevant to the needs of education in the digital era. The shift from offline to online implementation demonstrates the ability of educational systems to adapt to external environmental changes, especially after the COVID-19 pandemic. These findings align with

[3], who explained that the pandemic accelerated educational digital transformation through the massive implementation of online learning and evaluation systems. [4] also emphasized that the pandemic became a turning point in global educational digitalization, permanently transforming the paradigm of educational service delivery. Thus, the online OSN is no longer viewed merely as an emergency policy but has evolved into a technology-based educational innovation.

However, the study also found that policy socialization had not yet been optimally implemented. Several schools still experienced limitations in accessing technical information and understanding procedural changes. This finding supports policy implementation theory, which argues that communication among stakeholders is a crucial factor in the success of educational programs[10]. Even well-designed programs may encounter implementation barriers if communication and coordination processes are ineffective.

From the input perspective, the study identified disparities in infrastructure readiness among schools, particularly regarding internet quality and device availability. These findings are consistent with [11], which reported that technological access inequality remains one of the main challenges in implementing digital education worldwide. Selwyn (2016) also emphasized that educational digital transformation often creates new inequalities if not accompanied by equitable access to technology and adequate infrastructural support. This finding is further reinforced by [12], whose systematic review of 77 studies found that geographical factors, socioeconomic status, and internet access are key dimensions of the educational digital divide in technology-based education.

Schools with stronger resources tended to be better prepared to participate in online competition systems than schools with limited facilities. This condition indicates that the success of digital programs is strongly influenced by the social and economic context of educational institutions.

From the perspective of educational technology, these findings demonstrate that technology is not entirely neutral. Access to technology may create unequal opportunities among students. Without affirmative policies, the digitalization of academic competitions may actually widen educational opportunity gaps[13]. Explained that limited digital infrastructure, low technological literacy, and unequal access in developing countries may exacerbate educational inequity within online learning and evaluation systems. This implication is particularly important because the OSN is a national competition that should uphold principles of meritocracy and equal opportunity for all participants.

Regarding the process aspect, the study found that although the implementation generally proceeded smoothly, supervision effectiveness received the lowest score among all indicators. These findings are consistent with [8], who argued that digital assessment systems must maintain high standards of security, validity, and reliability to ensure trustworthy evaluation results. [4] also emphasized that the legitimacy of online evaluation systems is strongly influenced by users' trust in the security and integrity of implementation processes.

Within the context of academic competitions, supervision is not merely a technical issue but is directly connected to the legitimacy of selection outcomes[14]. further explained that the implementation of online proctoring in digital examinations often faces challenges related to privacy, user trust, and supervision effectiveness. Therefore, online evaluation systems require transparent and credible supervision mechanisms.

The limitations of digital supervision generated doubts among some participants and teachers regarding competition fairness. This finding can be explained through[15]concept of evaluation validity, which states that assessment quality is determined not only by the instruments used but also by the validity of implementation processes and interpretation of results [16]. Added that digital evaluation systems must ensure procedural consistency so that assessment outcomes genuinely represent participants' competencies[17]. Explained that fair online assessment design requires systems capable of minimizing cheating opportunities while maintaining equal examination conditions for all participants. Therefore, improving proctoring systems, supervision standardization, and technical audits has become an essential requirement for the future development of the online OSN.

From the product aspect, the study found that the primary advantages of the online OSN include cost efficiency, broader participation, and faster result processing. These findings support [5], who argued that digital evaluation systems reduce travel, logistics, and administrative costs while expanding participant access from diverse regions. For an archipelagic country such as Indonesia, these benefits are particularly significant because they enable students from remote areas to participate in national competitions without major geographical barriers.

Nevertheless, perceptions of system fairness remained at a moderate level. This indicates that technical success has not been fully accompanied by psychological and social acceptance. Participants need assurance that all schools participate under equal conditions through systems free from disruptions and manipulation. If perceptions of fairness remain low, program legitimacy may decline despite smooth administrative implementation. These findings reinforce[4] argument that user acceptance of digital evaluation systems is strongly influenced by perceptions of transparency and implementation integrity.

Based on the CIPP framework, the study demonstrates that the success of the online OSN cannot be evaluated solely through outputs but must instead be understood as an interconnected relationship among context, input, process, and product components. Weak infrastructure at the input stage may reduce process quality and ultimately affect perceptions of the product. These findings strengthen [18] conclusion that the CIPP model is effective for evaluating digital educational programs because it comprehensively analyzes relationships among program components [9]. Also emphasized that the CIPP model was specifically designed to support decision-making and continuous program improvement.

Practically, the findings provide three important implications. First, the government should strengthen the equitable distribution of digital infrastructure in schools, especially in underdeveloped regions. Second, organizers need to improve technology-based supervision systems to make them more credible and transparent. Third, schools should enhance students' and teachers' digital literacy as part of preparation for modern academic competitions.

[19]Explained that the success of educational technology implementation is influenced by perceived usefulness, perceived ease of use, and users' psychological readiness to accept digital systems. Therefore, strengthening digital competencies involves not only technical skills but also the development of positive attitudes toward sustainable educational technology use. These findings align with[19], who emphasized the growing importance of inclusive policies and equal technology access interventions in reducing digital educational inequality. Similarly, [20]found that strengthening digital literacy is an important factor supporting the successful implementation of educational technology in Indonesia, particularly in digital learning and evaluation contexts.

Academically, this study contributes to the development of research on digital academic competition evaluation, which remains relatively limited compared to studies on online learning. The findings indicate that competition digitalization involves unique dynamics because it requires a balance among system efficiency, measurement validity, and social legitimacy. Therefore, evaluations of this type of program remain highly important in the context of twenty-first-century educational transformation. Within the Indonesian context, [21] also found that digital-based learning contributes positively to students' learning motivation and digital literacy, particularly when supported by adequate technological readiness and learning environments.

5. Conclusion

This study concludes that the implementation of the online National Science Olympiad at the senior high school level generally falls within the "Good" category and is sufficiently effective in supporting national academic competitions in the digital era. Based on the CIPP evaluation model, the context aspect indicates that the program is relevant to the needs of educational digital transformation and implementation efficiency. The input aspect reveals that infrastructure readiness, technological devices, and digital competencies still vary among schools. The process aspect shows that the program implementation generally proceeded smoothly, although digital supervision and technical constraints remain major concerns. The product aspect confirms that the program successfully improved accessibility, cost efficiency, and result processing speed, although perceptions of system fairness have not yet reached an optimal level.

These findings indicate that the success of the online OSN is determined not only by the technology employed but also by the overall readiness of the educational ecosystem. Equitable infrastructure, credible supervision systems, and strong digital literacy among participants and schools are essential factors in ensuring the quality of competition implementation.

Practically, this study recommends three major actions. First, the government should strengthen the equitable distribution of digital facilities and internet network quality across schools. Second, organizers should improve system security and supervision standards to ensure greater competition integrity. Third, schools should provide digital competency development for students and teachers as part of preparation for technology-based academic competitions.

Academically, this study contributes to the development of digital education program evaluation studies, particularly in the field of national academic competitions. Future studies are recommended to involve broader regional coverage, longitudinal approaches, and comparative analyses between offline and online systems in order to develop more effective, equitable, and sustainable digital academic competition models.

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