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Integrating Graphic Design into Library-Based STEAM Education: A Case Study from MTsN 1 Bener Meriah toward Society 5.0

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ABSTRACT

This study aims to describe and analyze the planning of the Library Intertainer Program at MTsN 1 Bener Meriah, which adopts a graphic design–based STEAM Center concept. Employing a qualitative descriptive method, this research explores the processes of pre-action planning, implementation, observation, and reflection that constitute each cycle of program development. The participants consisted of teachers and students of MTsN 1 Bener Meriah, selected purposively based on their active involvement in STEAM Center activities.The program's planning stage began with identifying the initial conditions of the library environment and pedagogical needs. The study emphasizes that program planning serves as a strategic framework to enhance educational quality in the Society 5.0 era through the integration of graphic design within the STEAM paradigm. This approach not only fosters creativity and innovation among students but also aligns educational practices with 21st-century competencies. The research findings contribute to a deeper understanding of how library-based STEAM initiatives can promote interactive, technology-driven, and design-oriented learning environments in secondary education.

Key words: Library entertainer program, STEAM Center, Graphic design, educational planning, Society 5.0

ABSTRAK

Penelitian ini bertujuan untuk mendeskripsikan dan menganalisis perencanaan Program Intertainer Perpustakaan di MTsN 1 Bener Meriah, yang menerapkan konsep STEAM Center berbasis desain grafis. Dengan menggunakan metode deskriptif kualitatif, penelitian ini mengeksplorasi proses perencanaan pra-tindakan, pelaksanaan, pengamatan, dan refleksi yang membentuk setiap siklus pengembangan program. Partisipan dalam penelitian ini meliputi guru dan siswa MTsN 1 Bener Meriah yang dipilih secara purposif berdasarkan keterlibatan aktif mereka dalam kegiatan STEAM Center. Tahap perencanaan program dimulai dengan identifikasi kondisi awal lingkungan perpustakaan dan kebutuhan pedagogis. Hasil penelitian menunjukkan bahwa perencanaan program berfungsi sebagai kerangka strategis untuk meningkatkan kualitas pendidikan di era Society 5.0 melalui integrasi desain grafis dalam paradigma STEAM. Pendekatan ini tidak hanya mendorong kreativitas dan inovasi peserta didik, tetapi juga menyesuaikan praktik pembelajaran dengan kompetensi abad ke-21. Temuan penelitian ini berkontribusi terhadap pemahaman yang lebih mendalam mengenai bagaimana inisiatif STEAM berbasis perpustakaan dapat mendorong pembelajaran yang interaktif, berbasis teknologi, dan berorientasi desain dalam konteks pendidikan menengah..

Kata Kunci: Program intertainer perpustakaan, STEAM Center, Desain grafis, Perencanaan pendidikan, Society 5.0

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1. INTRODUCTION

Education serves as a foundational pillar in shaping a nation's intellectual and moral character, preparing students to adapt and thrive in an era of rapid technological transformation (UNESCO, 2021). In Indonesia, this imperative is reflected in the Ministry of Education and Culture Regulation No. 12 of 2016, which mandates that the learning process be conducted interactively, motivationally, and creatively to enhance students' independence and innovation (Kemendikbud, 2016). The essence of education in the Society 5.0 era lies in its ability to merge human-centered learning with technological innovation, fostering critical, creative, and ethical citizens capable of responding to complex societal challenges (Fukuyama, 2018; Shiroishi et al., 2018).

One promising educational paradigm that aligns with these objectives is the STEAM approach Science, Technology, Engineering, Arts, and Mathematics. STEAM represents an evolution of the earlier STEM framework by integrating artistic creativity and design thinking into scientific inquiry and technological innovation (Yakman & Lee, 2012). This integration enhances learners' ability to think critically and divergently, fostering innovative problem-solving skills that are essential in 21st-century education (Perignat & Katz-Buonincontro, 2019). Studies have demonstrated that STEAM-based learning not only strengthens conceptual understanding but also improves students' motivation and engagement by bridging theoretical and practical domains (Beers, 2011; Guyotte et al., 2014).

Within the Indonesian educational landscape, the implementation of STEAM learning has gained considerable momentum. Research indicates that STEAM can effectively enhance students' creative thinking, collaboration, and interdisciplinary understanding across science and art-based subjects (Mulyani, 2019; Mahesta, 2021). Recognizing these benefits, several institutions have initiated STEAM Centers to facilitate experiential and project-based learning environments (Maulana, 2022). These centers provide opportunities for students to apply cross-disciplinary skills through creative media such as graphic design, which serves as a bridge between artistic expression and technological competence (Suganda et al., 2021).

The MTsN 1 Bener Meriah Library stands out as an early adopter of this pedagogical innovation, establishing a STEAM-based learning hub to cultivate students' creativity through the integration of graphic design principles. By positioning the library as a STEAM Center, the institution seeks to transform traditional reading spaces into dynamic learning ecosystems that promote exploration, innovation, and digital literacy. Through its Library Intertainer Program, MTsN 1 Bener Meriah aims to prepare students to meet the intellectual and creative demands of the Society 5.0 era while fostering lifelong learning habits and 21st-century competencies.

The present study focuses on the planning phase of the Library Intertainer Program at MTsN 1 Bener Meriah. It aims to analyze how a structured, graphic design–based STEAM approach can be effectively integrated into library programming to enhance students' creativity, collaboration, and technological fluency. The study further explores how the library, as an educational institution, can function as an interdisciplinary learning center that supports national educational goals through innovation-driven, student-centered learning practices.

2. THEORETICAL FRAMEWORK

2. 1 The STEAM Education Paradigm

The STEAM approach an expansion of the STEM framework—integrates Arts into Science, Technology, Engineering, and Mathematics to create a holistic learning model that bridges analytical reasoning with creativity and design thinking (Yakman & Lee, 2012; Perignat & Katz-Buonincontro, 2019). By encouraging learners to combine logical inquiry with artistic expression, STEAM education develops multidimensional problem-solving skills relevant to 21st-century challenges (Beers, 2011; Guyotte et al., 2014).The inclusion of the arts dimension introduces the principles of aesthetics, innovation, and critical interpretation into the scientific process. This integration enables learners to generate more human-centered, innovative solutions while maintaining technical accuracy (Herro & Quigley, 2017). Empirical studies have demonstrated that STEAM-based pedagogy increases students' engagement, enhances their scientific reasoning, and supports the acquisition of creative competencies crucial for Society 5.0 (Yakman & Lee, 2012; Narváez Rojas et al., 2021).

2.2 STEAM Centers as Learning Ecosystems

A STEAM Center functions as an innovative educational environment designed to promote collaborative, project-based learning and experiential engagement (Maulana, 2022). These centers encourage interdisciplinary exploration through activities that connect theory and practice. According to Mulyani (2019), implementing STEAM in schools helps learners move from passive knowledge acquisition toward active experimentation and inquiry. In Indonesia, STEAM Centers are increasingly integrated into school infrastructures such as libraries, science laboratories, and digital classrooms (Mahesta, 2021). Libraries, in particular, serve as accessible hubs for interdisciplinary learning, providing the resources and space necessary for creative experimentation with digital media, including graphic design tools. This aligns with global trends in education that emphasize digital literacy, design skills, and creativity as essential components of modern curricula (UNESCO, 2021).

2.3 Graphic Design as a STEAM Learning Medium

Graphic design acts as a bridge between technology and art within the STEAM framework (Suganda et al., 2021). It allows students to visualize complex concepts through digital media and to express abstract ideas in tangible forms. Through the use of tools such as Canva, Adobe Spark, and other visual design platforms, learners can engage with scientific ideas while exercising creativity and aesthetic judgment (Frey & Osborne, 2017). In the context of library-based education, integrating graphic design into STEAM activities transforms the library into a creative learning laboratory rather than a passive information repository. This approach promotes information literacy, visual communication, and digital competence key aspects of Society 5.0, where knowledge is co-created through human-technology collaboration (Shiroishi, Uchiyama, & Suzuki, 2018; Fukuyama, 2018). Therefore, employing graphic design as part of the Library Intertainer Program not only enhances the educational appeal of the library but also empowers students to engage actively in interdisciplinary inquiry, fostering creativity, collaboration, and technological adaptability.

3. METHODOLOGY

This study employed a qualitative descriptive research design to analyze and describe the planning process of the Library Intertainer Program at MTsN 1 Bener Meriah, based on the STEAM Center model with a focus on graphic design. A qualitative approach was chosen because it enables an in-depth understanding of social and educational phenomena in their natural context (Creswell & Poth, 2018). The research sought to explore participants' experiences, perceptions, and involvement in the development of a creative, STEAM-based library environment. The descriptive qualitative method provides systematic, factual, and accurate depictions of observed phenomena (Thabroni, 2022). It emphasizes narrative data, observation, and interpretative analysis rather than numerical measurement. Through this approach, the study aimed to construct a detailed understanding of how planning, action, observation, and reflection were operationalized within the Library Intertainer Program cycles. The study was conducted at MTsN 1 Bener Meriah, a secondary Islamic school in Indonesia that has pioneered the integration of STEAM-based learning in its library setting. The research participants consisted of teachers and students who were actively involved in the school's STEAM Center programs. The participants were selected using a purposive sampling technique, in which individuals are chosen based on specific criteria relevant to the study's objectives (Etikan, Musa, & Alkassim, 2016). The inclusion criteria included:

1. Students who regularly participated in library-based STEAM activities;
2. Teachers or facilitators responsible for implementing graphic design–related projects; and
3. Administrators overseeing the STEAM Center operations.

The total number of participants was determined by information saturation, meaning data collection ceased when no new insights emerged (Guest, Bunce, & Johnson, 2006). Data were collected through observation, interviews, and documentation.Observation was used to monitor the implementation of the program and record participants' engagement in STEAM activities (Merriam & Tisdell, 2016). Semi-structured interviews allowed for flexible dialogue to capture participants' views regarding program planning, challenges, and perceived benefits. Document analysis included reviewing planning documents, program schedules, design materials, and photographs related to library activities. These multiple data sources were triangulated to ensure the validity and credibility of findings (Denzin, 2012). The research was organized into four cyclical stages, adapted from the action research model of Kemmis and McTaggart (1988):

1. Planning: Identifying initial conditions of the library, assessing needs, and designing STEAM-based activities involving graphic design.
2. Action: Implementing the designed activities within the library setting under the guidance of trained facilitators.
3. Observation: Monitoring participant interactions, engagement levels, and outcomes using field notes and photographic documentation.
4. Reflection: Evaluating results to identify strengths, limitations, and areas for improvement, leading to adjustments for subsequent cycles.

This cyclical process ensured continuous improvement and adaptability of the Library Intertainer Program to the school's educational context.Data analysis followed the Miles, Huberman, and Saldaña (2014) framework, involving three concurrent stages:

1. Data reduction, through coding and categorizing qualitative data into thematic clusters;
2. Data display, using visual matrices and narrative summaries to identify patterns and relationships; and
3. Conclusion drawing and verification, ensuring findings were coherent, credible, and aligned with research objectives.

4. Triangulation, member checking, and audit trails were employed to enhance trustworthiness, following the criteria of credibility, dependability, confirmability, and transferability (Lincoln & Guba, 1985).

4. Results and Discussion

4.1 Results

4.1.1 Planning Phase

The planning phase of the Library Intertainer Program at MTsN 1 Bener Meriah was designed as a strategic response to the challenges of integrating interdisciplinary learning in the Society 5.0 era. This phase began with a comprehensive situational analysis aimed at identifying pedagogical needs and existing capacities within the library setting. Teachers, students, and administrators collaboratively assessed how the library could serve as a STEAM Center that nurtures creativity and innovation through digital literacy and graphic design activities.

Findings from interviews and document analysis revealed that the planning process was underpinned by the principle of design-based education, emphasizing creativity, experimentation, and reflection (Anderson & Shattuck, 2012). The program's conceptual framework combined graphic design tools such as Canva and Adobe Spark with scientific exploration, thereby transforming abstract STEM concepts into visual and aesthetic representations. This aligns with findings by Herro and Quigley (2017), who observed that incorporating creative digital media into STEAM curricula enhances student motivation and conceptual understanding.

To ensure coherence and inclusivity, the planning committee developed detailed instructional modules and facilitator guidelines. The modules outlined activity sequences, expected learning outcomes, and digital competencies aligned with the national curriculum standards. Facilitators underwent targeted training to strengthen their pedagogical and technical skills in STEAM-based instruction. Such pre-implementation training echoes best practices in educational innovation, ensuring that instructors are adequately prepared to lead interdisciplinary, technology-driven learning experiences (Quigley, Herro, & Jamil, 2017).

The logistical planning also included a detailed resource allocation plan, specifying the budget for software subscriptions, hardware maintenance, and learning materials. Importantly, the team established a timeline for implementation that synchronized library operations with classroom schedules to avoid overlap. This systematic and collaborative planning process reflects the framework of participatory educational design, in which stakeholders collectively co-create educational programs that are contextually relevant and sustainable (Cousins & Whitmore, 1998).

4.1.2 Implementation and Student Engagement

During the implementation phase, the Library Intertainer Program was operationalized through project-based learning sessions within the STEAM Center. Students were encouraged to engage in collaborative graphic design projects that visualized scientific and mathematical concepts. For instance, they designed digital posters illustrating principles of energy transformation, ecosystems, and geometry using graphic design software. These activities encouraged both analytical thinking and creative expression, reinforcing the dual aims of STEAM education (Perignat & Katz-Buonincontro, 2019).

Observational data indicated that students displayed a high level of engagement and enthusiasm throughout the sessions. They interacted actively with facilitators, exchanged design ideas, and reflected on how their visual outputs could communicate scientific ideas more effectively. This finding supports Guyotte et al. (2014), who emphasized that transdisciplinary learning environments enhance creativity through social collaboration and artistic exploration. Furthermore, students' ability to apply aesthetic judgment in representing scientific information suggests the development of what Yakman and Lee (2012) call integrated cognition—a synergy between artistic intuition and logical reasoning. The interactive use of digital tools provided an authentic context for students to practice digital literacy skills, a critical component of 21st-century education (UNESCO, 2021). Facilitators noted a noticeable improvement in students' confidence and communication skills as they presented their projects to peers. These presentations cultivated peer-to-peer learning and reflective dialogue, encouraging students to critique and refine their creative outputs. Similar outcomes were observed in other STEAM implementations, where project-based learning and reflective critique led to deeper cognitive engagement (Beers, 2011; Maulana, 2022).

4.1. 3 Observation and Evaluation Findings

The observation stage focused on monitoring the implementation's effectiveness and documenting behavioral and cognitive changes among participants. Observers reported that the integration of visual design significantly enhanced students' conceptual retention and ability to connect abstract theories with real-world applications. This supports the argument by Narváez Rojas et al. (2021) that interdisciplinary and technologically mediated learning approaches foster deeper learning in the Society 5.0 context. Four primary indicators were identified during the observation phase:

1. Student Interaction: Learners actively collaborated during design tasks, indicating the emergence of co-constructive learning communities.
2. Conceptual Understanding: Students demonstrated increased comprehension of STEAM concepts, as reflected in their ability to integrate scientific and artistic elements into visual representations.
3. Technological Competence: The use of digital design software improved students' proficiency with information and communication technologies.
4. Feedback and Reflection: Learners provided constructive feedback during discussions, showing their capacity for critical evaluation and metacognitive reflection.

Evaluation was conducted using structured observation sheets and student reflections, complemented by facilitator reports. The triangulated data confirmed that the Library Intertainer Program effectively fostered creative engagement, collaboration, and technological fluency. These results align with findings by Suganda et al. (2021), who demonstrated that STEAM-based interventions significantly enhance students' creative-thinking skills through multidisciplinary exposure.

4.2 Discussion

The findings of this study reveal that the Library Intertainer Program at MTsN 1 Bener Meriah represents a strategic innovation in integrating the STEAM (Science, Technology, Engineering, Arts, and Mathematics) framework into school-based library activities. The transformation of a traditional library into a STEAM-centered learning ecosystem demonstrates the institution's responsiveness to the evolving demands of the Society 5.0 era, which emphasizes the fusion of human creativity and technological advancement (Fukuyama, 2018; Shiroishi, Uchiyama, & Suzuki, 2018).

The results underscore that effective program planning, which combines educational theory, design thinking, and technology, can reshape the role of libraries from passive information repositories into active innovation hubs. This transition aligns with the constructivist perspective, which posits that learning occurs through social interaction and hands-on experience (Vygotsky, 1978). The planning process's participatory nature engaging teachers, students, and facilitators supports the view that collaborative educational design enhances ownership, motivation, and contextual relevance (Cousins & Whitmore, 1998).

From a pedagogical standpoint, the study validates that integrating graphic design as a learning medium within the STEAM approach enhances both cognitive and creative competencies. Students' engagement in visualizing scientific and mathematical concepts through digital platforms such as Canva and Adobe Spark encouraged higher-order thinking, problem-solving, and aesthetic awareness. These findings align with previous research emphasizing that artistic integration in STEAM enhances conceptual understanding and fosters divergent thinking (Perignat & Katz-Buonincontro, 2019; Guyotte et al., 2014).

Moreover, the observed increase in student collaboration and communication reflects the social learning dimension of STEAM education (Riza 2022). The program facilitated a culture of peer feedback, reflective discussion, and project-based collaboration elements that are essential to cultivating creativity and teamwork (Herro & Quigley, 2017; Quigley, Herro, & Jamil, 2017). This collaborative process also allowed students to connect theory and practice, consistent with the experiential learning model proposed by Kolb (1984), which emphasizes learning through reflection on doing.

The findings also illustrate the potential of libraries to function as democratized learning spaces, where all students regardless of background or ability can engage with technology and design-based learning. By leveraging freely accessible digital tools, the Library Intertainer Program promoted inclusivity and digital literacy. This is particularly relevant in resource-limited contexts, where school libraries can provide equitable access to technological and creative opportunities (UNESCO, 2021).

From an educational innovation perspective, the integration of design and science aligns with the authentic learning framework, which emphasizes real-world problem-solving, creativity, and interdisciplinary inquiry (Lombardi, 2007). Students' engagement in authentic design tasks that connected science to visual communication fostered both epistemic curiosity and intrinsic motivation. These learning outcomes are consistent with the findings of Narváez Rojas et al. (2021), who highlight that Society 5.0 education should cultivate adaptability, innovation, and digital empathy.

Furthermore, the success of the program underscores the importance of professional capacity building among teachers and facilitators. The preparatory training they received not only improved their digital competencies but also reinforced their pedagogical confidence in integrating arts-based methodologies. As suggested by Anderson and Shattuck (2012), professional development is a critical determinant in sustaining educational innovations, particularly those that combine creativity and technology. In summary, the discussion affirms that the Library Intertainer Program effectively operationalizes STEAM principles through a graphic design–based approach that merges creativity, technology, and interdisciplinary learning. This integration enhances students' 21st-century

skills, promotes lifelong learning, and redefines libraries as interactive learning laboratories. Beyond MTsN 1 Bener Meriah, these findings have broader implications: they demonstrate that even modest educational institutions can transform their learning culture through thoughtful planning, collaborative practice, and innovation-driven pedagogy. As the education system advances toward Society 5.0, school libraries can play a pivotal role as centers of creativity, innovation, and digital empowerment.

5. CONCLUSION

This study concludes that the Library Intertainer Program at MTsN 1 Bener Meriah, conceptualized through a graphic design–based STEAM Center model, effectively transforms the school library into a dynamic, interdisciplinary learning environment. The program's structured planning encompassing situational analysis, participatory design, and reflective evaluation—demonstrates that integrating arts and technology within science education can significantly enhance students' creativity, collaboration, and digital literacy. The findings affirm that libraries are no longer passive spaces for information retrieval but can evolve into innovation ecosystems that nurture 21st-century competencies aligned with the Society 5.0 vision.

Pedagogically, the program operationalizes constructivist learning principles, emphasizing experiential, collaborative, and technology-mediated inquiry. By engaging students in authentic graphic design projects linked to STEAM content, the initiative strengthens their cognitive flexibility and aesthetic reasoning. Furthermore, the involvement of teachers and facilitators as co-designers underscores the value of professional collaboration and continuous capacity building in sustaining educational innovation. From a theoretical perspective, the research contributes to the growing discourse on STEAM-based library education, positioning libraries as catalysts for interdisciplinary and creative learning. It also reinforces the role of design thinking as a pedagogical bridge between science and art, enabling students to connect conceptual knowledge with real-world applications. Recommendations arising from this study include; 1). Scaling the Library Intertainer Program to other schools as a model for STEAM integration; 2). Providing ongoing training for educators in design-based pedagogy; 3). Strengthening digital infrastructure to support creative learning activities; and, 4) Conducting longitudinal studies to measure the long-term cognitive and affective impacts of STEAM-centered library programs.
In essence, the Library Intertainer Program offers a replicable and sustainable model of educational transformation one that bridges creativity, technology, and learning in pursuit of a human-centered, innovation-driven future.

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