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Quality Education with Sustainable Development Goals (Sdgs) No 4: Knowledge-Based

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Abstract

This study evaluates the quality of knowledge-based education in favourite high schools in East Java and how it relates to SDGs goal 4 on quality and inclusive education. Using qualitative and quantitative methods, including curriculum analysis, direct observation and interviews with principals, teachers and students, this study reveals how the knowledge-based curriculum is implemented, the role of leadership in driving innovation and efforts to address access gaps. The findings show that these schools are effective in developing analytical and critical thinking skills through visionary leadership and inclusive learning environments. However, there are access gap challenges that require special attention. Managerial implications highlight the need for policies that support inclusive education, adaptive curriculum development and equalisation of educational technology to achieve SDGs No. 4 and support sustainable development in the future.

Keywords: *Education for Sustainability, Sdgs No 4, Knowledge, Strategies for Integrating Education for Sustainability.*

Introduction

Education serves as the cornerstone of sustainable development, playing a pivotal role in shaping inclusive, equitable, and prosperous societies. The United Nations Sustainable Development Goal (SDG) No. 4 explicitly emphasizes the importance of ensuring inclusive and equitable quality education while promoting lifelong learning opportunities for all (Ivanova Boncheva, 2021). A knowledge-based approach to education has garnered significant attention, as it fosters critical thinking, problem-solving abilities, and innovation. According to UNESCO (2023), over 244 million children and youth worldwide remain out of school, highlighting the urgent need to address educational disparities. Additionally, Table 1 illustrates the global educational attainment levels, showcasing the stark contrasts between high-income and low-income regions.

Region	Literacy Rate (%)	Primary School Enrollment (%)	Secondary School Enrollment (%)
High-Income	98	96	88
Middle-Income	85	82	70
Low-Income	62	54	37

These disparities underline the pressing need for innovative and sustainable strategies to achieve educational equity and quality across diverse socioeconomic contexts. Despite the progress made in global education systems, challenges persist in achieving the quality benchmarks outlined by SDG No. 4. Factors such as inadequate infrastructure, lack of trained educators, and limited access to resources exacerbate educational inequality. In low-income countries, for instance, the pupil-to-teacher ratio averages 40:1, compared to 15:1 in high-income countries (World Bank, 2023; Adhikari & Shrestha, 2023). Moreover, traditional rote-learning methodologies dominate many educational systems, limiting students' capacity for creativity and adaptability. Addressing these systemic issues requires a shift toward a knowledge-based education paradigm, which integrates technological advancements, interdisciplinary learning, and global

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competencies (Li, Wu, Zhang & Yang, 2023).

While numerous studies have explored the challenges and opportunities within the global education landscape, limited research exists on the implementation of knowledge-based education aligned with SDG No. 4 in diverse socioeconomic contexts. According to Smith et al. (2022), most analyses focus on quantitative educational outcomes, often overlooking qualitative aspects such as critical thinking and collaborative skills development. Furthermore, the role of digital technologies in bridging educational gaps remains underexplored, particularly in resource-constrained settings. This study aims to address these gaps by investigating the efficacy of knowledge-based education models in enhancing quality and equity in education (Nyahodza & Raju, 2017; Salman, Rahat, Niazi & Lashari, 2023; Mohamed, Ari, Al-Sada & Koç, 2021).

The growing global emphasis on quality education underscores the need for transformative approaches to overcome existing disparities. Without timely interventions, the educational divide may widen further, hindering the achievement of SDG No. 4 by 2030. This scenario poses significant risks to global socio-economic stability and the ability of future generations to tackle complex challenges such as climate change, economic inequality, and public health crises. The lack of comprehensive frameworks to implement and evaluate knowledge-based education models exacerbates these risks (Cummings, Regeer, De Haan, Zweekhorst & Bunders, 2018).

To address these challenges, this study proposes a multidimensional framework for integrating knowledge-based education into national curricula (Havea & Mohanty, 2020). Key components include Enhancing teacher training programs to foster interdisciplinary and technology-driven pedagogies, Expanding access to digital learning resources through public-private partnerships, Developing metrics to evaluate both qualitative and quantitative educational outcomes, Encouraging collaboration between governments, NGOs, and the private sector to ensure equitable resource distribution ((Makarenko, Plastun, Petrushenko, Vorontsova & Alwasiak, 2021).

This research contributes to the academic discourse by providing an in-depth analysis of knowledge-based education within the framework of SDG No. 4. Unlike previous studies, it emphasizes both the qualitative and quantitative dimensions of educational quality and equity. The novelty of this study lies in its integration of digital technologies, interdisciplinary approaches, and localized implementation strategies to bridge educational disparities. By addressing the identified research gaps, this study offers actionable insights for policymakers, educators, and stakeholders committed to achieving sustainable educational development.

To address inequalities in education access, significant investment in education infrastructure is needed, especially in remote and poor areas. This includes school construction, teacher training and provision of adequate facilities. In addition, it is important to ensure that the education curriculum is designed inclusively, taking into account the needs of all groups in society, including minority groups and people with disabilities (Sardjono, Pujadi, Sukardi, Rahmasari, & Selviyanti, 2021).

Utilising technology in education is an important step to improve the quality and relevance of learning. This could include developing online learning platforms, providing digital devices for students and training teachers in the use of technology (Raju, 2017). With this approach, education can become more flexible, affordable and accessible to more people, including those in remote areas.

The government and other stakeholders need to adopt policies that support the development of knowledge-based education. This involves periodically reviewing and updating curricula, ensuring that education focuses not only on academic achievement, but also on the development of practical skills and critical thinking. In addition, it is important to encourage collaboration between the education, industry and community sectors to ensure that education remains relevant to labour market needs and global developments (Jati, Darsono, Hermawan, Yudhi & Rahman, 2019).

By adopting quality and knowledge-based education, society can create a generation that is better prepared to face future challenges. Effective education can shape individuals who are creative, innovative and able

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to provide solutions to complex problems, both at local and global levels (Camilleri & Camilleri, 2020). This will ultimately support the achievement of sustainable development goals, including reducing poverty, improving welfare and maintaining environmental sustainability.

Quality education not only provides knowledge, but also empowers individuals to become agents of change in their communities. With education, individuals can play an active role in economic, social and environmental development and make decisions that positively impact their communities. Therefore, an investment in quality and knowledge-based education is an investment in a more just, prosperous and sustainable future for all.

Thus, this research aims to explore how quality and knowledge-based education can support the achievement of the SDGs, particularly SDG No. 4, and promote sustainable development globally.

Research Methods

In an increasingly complex era of globalisation, the quality of education is a major concern in achieving sustainable development. SDGs No. 4, which focuses on quality education, demands an innovative approach that is able to answer the challenges of the times. One relevant and adaptive approach in this regard is knowledge-based research methods, which not only explore empirical data but also integrate theory and practice in in-depth analyses. This qualitative method allows researchers to understand the dynamics of education from multiple perspectives, providing more comprehensive insights in an effort to create impactful solutions (Creswell & Poth, 2016).

This research adopts the knowledge-based method with the aim of providing a sharper view of the role of education in achieving SDGs No. 4. With this approach, it is expected to find patterns and trends that support the implementation of more effective education policies. In addition, this method also opens up space for interdisciplinary collaboration, which is necessary to address the multifaceted challenges of education. Thus, this research not only contributes to theory development but also offers practical recommendations that can be implemented by education policy makers and practitioners (Creswell & Poth, 2016).

This research was conducted in favourite senior high schools in East Java province The research chose to sample from favourite senior high schools in East Java for several important reasons. Firstly, favourite senior high schools tend to represent a higher quality of education with better facilities and resources, so the results of the study may provide a more accurate picture of the state of education in this region. Secondly, selecting favourite senior high schools may allow the research to focus on a more homogeneous population in terms of academic achievement, students' involvement in extracurricular activities, as well as specific learning experiences, which may support a more in-depth analysis and more detailed results. Thus, this study is expected to make a significant contribution to the understanding of the factors that influence education at the senior secondary school level in East Java.

Selecting a sample of only the favourite SMAS in this study is expected to provide a clearer picture of the best education standards available and identify success factors that other schools can adopt to improve their education quality. In addition, favourite SMAS are often a barometer of the success of the education system in a region, so an analysis of them can provide deeper and more relevant insights.

Results and Discussion

The quality of education is one of the important pillars in nation building, especially in Indonesia. In the midst of rapid development, knowledge-based education is expected to be the foundation for students to face global challenges. Especially in regions like East Java, which has several favourite senior high schools (SMA), high quality education is key in producing a superior generation. These schools focus not only on academic grades but also on how knowledge can be applied in everyday life.

Research findings on the quality of knowledge-based education in favourite high schools in East Java

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This research reveals various aspects of the quality of knowledge-based education in favourite high schools in East Java. The findings illustrate how these schools focus not only on academic achievement but also on developing critical and innovative thinking skills. One important finding is that these favourite schools have a more flexible curriculum that focuses on developing students' analytical skills. This is done through a learning approach that emphasises on understanding concepts rather than simply memorising facts. As such, students are encouraged to think more deeply and are able to apply their knowledge in a broader context.

Furthermore, the study found that teachers in these favourite schools play a key role in creating a learning environment that supports knowledge-based learning. Teachers in these schools tend to be more proactive in using innovative teaching methods, such as project-based learning and group discussions. These methods not only improve students' understanding of the subject matter but also strengthen their collaborative skills and critical thinking ability. In addition, these teachers also provide constructive feedback more often, which helps students identify and correct their shortcomings.

Another significant finding is the role of technology in supporting the quality of knowledge-based education in these schools. State-of-the-art technological facilities, such as well-equipped computer labs and access to digital resources, have helped students in accessing wider and deeper information. It also enables students to learn independently and develop their research capabilities. The use of technology in the learning process also makes learning more interesting and interactive, thus increasing students' interest in learning.

The research also revealed that the favourite schools in East Java have a school culture that strongly supports knowledge development. This culture is reflected in various extracurricular activities that challenge students to apply the knowledge they acquire in the classroom to real-world situations. For example, many schools have science, debate and research clubs that encourage students to actively participate and compete at national and international levels. These activities not only improve academic skills, but also build students' self-confidence and motivation to learn.

In addition, this study found that students in these favourite schools are highly motivated to learn. This is due to the strong support from the school, teachers and parents. These schools have a reward and recognition system that encourages students to continue to excel. Awards are not only given to students who have high academic achievement, but also to those who show outstanding progress and effort in learning. This creates a competitive yet healthy learning environment where every student feels valued and motivated to reach their full potential.

This research also shows that the quality of knowledge-based education in the favourite schools in East Java cannot be separated from the role of visionary school leadership. Principals in these institutions generally have a clear vision of the importance of knowledge-based education and are committed to continuously improving the quality of education. They are also able to inspire teachers and students to work hard and achieve common goals. This strong leadership creates synergy among all elements of the school, resulting in a conducive learning environment that focuses on knowledge development.

Another factor that supports the quality of knowledge-based education in these schools is the strong partnership between the school and the community. Many of the favourite schools in East Java have collaborations with universities, industries and research institutes. These partnerships give students the opportunity to learn from experts and gain hands-on experience in their fields of interest. This not only broadens students' horizons but also equips them with practical skills that will be useful in the future.

On the other hand, this study also identified challenges that favourite schools in East Java face in implementing knowledge-based education. One of the biggest challenges is the access gap between students from different economic backgrounds. Although these schools offer high quality education, not all students are able to take full advantage of the facilities and opportunities available, especially those from underprivileged families. This challenge requires further attention from the schools and the government to ensure that all students have equal opportunities in getting quality education.

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Finally, this study concludes that the quality of knowledge-based education in favourite schools in East Java has a significant impact on student achievement. Students who learn in a supportive and knowledge-rich environment tend to be more successful both in national examinations and in international academic competitions. Moreover, they also demonstrate better critical thinking skills, creativity and problem-solving abilities compared to students from other schools. Thus, the knowledge-based education model implemented in these favourite schools can be used as an example for other schools in Indonesia to improve the overall quality of education.

Discussion

The discussion of results is organized around the research questions. A synthesis of the information obtained that reflects the progress observed is presented under each question. Three important points of discussion from the research findings on the quality of knowledge-based education in accordance with SDGs No4 in favourite high schools in East Java.

- *Innovative Curriculum and Teaching*

The favourite schools in East Java have adopted a very progressive approach in their curriculum, which emphasises flexibility and the development of students' analytical skills. The curriculum is designed to not only fulfil academic standards, but also to encourage students to think more deeply and critically about the material studied. Instead of simply focusing on achieving high test scores, these schools emphasise the importance of deep understanding of concepts. Thus, students are not only exposed to the memorisation of facts, but also to the application of that knowledge in various situations, making them better prepared to face challenges in the real world (Al-Kuwari, Al-Fagih & Koç, 2021).

The approach adopted in this curriculum allows students to develop analytical thinking skills gradually. This process involves learning that invites students to question, explore and connect the various concepts they learn in class. With a flexible curriculum, teachers are given the freedom to customise teaching materials according to students' needs and abilities. This flexibility also allows for adjustments to the ever-changing developments in technology and information, so that students always receive a relevant and up-to-date education (Barrantes-Briceño, Santos & Nagano, 2024).

Teachers in these favourite schools play a very important role in implementing an innovative curriculum. They serve not only as teachers, but also as facilitators who encourage students to find their own answers through exploration and discussion. Project-based learning methods, for example, allow students to work in teams, solve real problems, and apply the theories they have learnt. This process not only hones students' analytical abilities, but also strengthens their co-operation and communication skills, which are crucial in future professional life (Raman et al, 2024).

Besides project-based learning, group discussion is also one of the effective methods to develop critical thinking and collaboration skills. In group discussions, students are invited to share their views, listen to other perspectives, and jointly seek the best solution to a problem. This activity encourages students to think deeply and critically about various points of view, and strengthens their ability to present arguments logically and convincingly. Group discussions also teach students the importance of respecting the opinions of others and working together to achieve a common goal (Al-Kuwari, Al-Fagih & Koç, 2021).

Overall, the combination of a flexible curriculum with innovative teaching methods has created a learning environment that is highly conducive to the development of students' analytical abilities and critical thinking skills in East Java's favourite schools. Students educated in this system not only excel academically, but also have the necessary skills to become future leaders and innovators. This educational model can serve as an inspiration for other schools in Indonesia that want to improve the quality of education and prepare their students for success in an increasingly complex and dynamic world.

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- *The Role of Technology and School Culture*

The use of advanced technology in East Java's favourite schools has become one of the key pillars in supporting knowledge-based learning. Well-equipped computer labs and widespread access to digital resources such as scientific journals, e-books and learning videos allow students to explore topics beyond traditional textbooks. This technology provides students with opportunities for independent learning, where they can explore materials at their own pace, access up-to-date information, and develop a deeper understanding of various concepts. It also facilitates lifelong learning, where students are encouraged to continue seeking new knowledge even after school hours are over (Zhou, Abedin & Sheela, 2022).

Students' ability to conduct research independently is also enhanced through the use of technology. With access to powerful digital tools, students can collect data, analyse findings and compile research reports in a more efficient and detailed manner. The use of data analysis software, for example, allows students to process large amounts of information in ways that were not previously possible. This not only strengthens their abilities in terms of research, but also equips them with technical skills that are invaluable in the modern world of work, where mastery of technology is one of the keys to success (Cottafava, Cavaglià & Corazza, 2019).

Alongside technological support, the strong school culture in these favourite schools plays an important role in developing knowledge-based learning. This culture is reflected in the values held by the school and instilled in students, such as curiosity, openness to new ideas, and passion for learning. These schools create an environment that supports students to develop knowledge not only through subject matter, but also through social interactions and activities that encourage them to think critically and creatively. This strong culture helps students understand that knowledge is not something static, but rather something that is constantly evolving and should be actively sought after.

Diverse extracurricular activities are also an integral part of the school's culture, where students are encouraged to apply the knowledge they acquire in the classroom to real-life situations. For example, clubs such as debating, scientific research and robotics allow students to hone their skills in a practical context, connecting theory with practice. These activities not only improve academic skills, but also build students' confidence and motivation, as they see how the knowledge they learnt can be applied to solve real problems. Moreover, the national and international competitions in which students from these schools participate further reinforce their belief in the importance of mastering deep and broad knowledge ((Cottafava, Cavaglià & Corazza, 2019).

Overall, the combination of advanced technology and strong school culture has created a dynamic and supportive learning ecosystem in East Java's favourite schools. With access to digital resources and an environment that encourages the application of knowledge in real-world contexts, students are not only prepared to succeed in academic examinations, but also to face future challenges with sharp critical thinking skills, creativity and problem-solving abilities. This is what makes the education model in these schools so effective and relevant in the globalised era.

- *Visionary Leadership and the Access Challenge*

Visionary leadership in the school environment plays a crucial role in improving the quality of knowledge-based education. A principal with a clear vision and the ability to inspire teachers and students can steer the entire school ecosystem towards achieving higher educational goals. Such leadership goes beyond managing day-to-day operations and acts as a driver of change, ensuring that the curriculum, teaching methods and school culture are all aligned with the long-term goal of equipping students with relevant skills and knowledge for the 21st century. In the context of favourite schools in East Java, this visionary leadership has successfully created an environment conducive to the development of critical thinking, creativity and collaboration among students (Odell, Molthan-Hill, Martin & Sterling, 2020).

However, behind these successes lies a significant challenge faced by these schools, namely the access gap

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between students from different economic backgrounds. While these favourite schools offer exceptional facilities and learning opportunities, not all students are able to take full advantage of the opportunities available. Students from underprivileged families often do not have equal access to technology, additional learning support or even time to take part in extracurricular activities that are important for knowledge and skills development. These disparities create inequities in the learning process, which can ultimately affect overall educational outcomes (Ketlhoilwe, Silo & Velempini, 2020).

Visionary leadership in these schools must meet this challenge with inclusive strategies. One approach is to develop scholarship or financial aid programmes that enable students from economically disadvantaged backgrounds to still access quality education. In addition, schools can work with communities and the private sector to provide additional resources for students in need (Lorente-Echeverría, Canales-Lacruz & Murillo-Pardo, 2022). Thus, school leadership not only focuses on improving the overall quality of education but also ensures that every student, regardless of their economic background, has an equal opportunity to succeed.

Furthermore, visionary principals need to develop policies that promote social inclusion and equal access. This can be realised by providing specialised training for teachers to identify and support students who may be left behind due to economic factors. It could also include mentoring programmes where more advanced students can help their peers who need more support (Mitter & Brissett, 2017). In this way, school leadership can build a culture of mutual support among students, which not only strengthens social bonds but also ensures that no student is left behind in the learning process.

Ultimately, the success of knowledge-based education in East Java's favourite schools depends largely on the ability of school leadership to address this access gap challenge. With the right approach, visionary principals can ensure that high-quality education is not just the preserve of a privileged few but the right of all students. This will create a fairer and more equitable learning environment, where every student has equal opportunities to develop and reach their full potential, resulting in a generation that is better prepared to face the global challenges ahead.

Conclusion

The quality of knowledge-based education in East Java's favourite high schools is a reflection of serious efforts in realising Sustainable Development Goal (SDGs) No. 4, which emphasises the importance of inclusive, equitable and quality education. These schools not only focus on academic achievement, but are also committed to ensuring every student, regardless of social or economic background, has equal access to high-quality education. This approach creates a learning environment that is conducive to the development of intellectual abilities and skills relevant in the 21st century, so that every student has an equal opportunity to succeed.

Visionary leadership in these schools plays a key role in achieving this goal. Forward-looking principals focus not only on achieving short-term academic results but also on developing innovative curriculum and teaching methods. They ensure that the entire educational ecosystem supports knowledge-based learning that equips students with critical, creative and collaborative thinking skills. With the support of well-trained teachers and adequate technological facilities, students in these schools are guided to become lifelong learners who are ready to face global challenges.

However, to truly realise inclusive and equitable education, challenges such as access gaps must be addressed. The favourite schools in East Java, through committed leadership, have sought to reduce this gap with various initiatives, including scholarship programmes and collaboration with local communities. By integrating sustainability values in education, these schools are not only contributing to the improvement of the quality of human resources, but also to the achievement of the broader SDGs goal of creating a more just and sustainable society in the future.

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Implication Managerial

The implementation of quality knowledge-based education in East Java's favourite senior high schools, in line with SDGs No 4, has a number of important managerial implications. Firstly, school management must continue to commit to a vision and mission that supports inclusive and equitable education. Visionary leadership at the managerial level should prioritise the development of an adaptive and knowledge-based curriculum and ensure that innovations in teaching are consistently implemented to meet the needs of 21st century education.

Secondly, management should focus on developing strategies to address existing access gaps. This includes designing and implementing scholarship programmes, financial aid and additional support for students from economically disadvantaged backgrounds. Inclusive policies should be implemented to ensure that all students, regardless of their economic background, have equal access to quality educational resources.

Thirdly, it is important for school management to continuously monitor and evaluate the impact of the policies and programmes implemented. This includes conducting periodic assessments of the effectiveness of the curriculum, teaching methods and student support programmes. In this way, the management can make the necessary adjustments to improve the quality of education and ensure that the school continues to contribute to the sustainable achievement of SDGs goal No. 4, as well as support sustainable development.

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