

A comprehensive review of Project-Based Learning (PBL): Unravelling its aims, methodologies, and implications

**Nazula Silma¹, Ikrima Maulida², Adisti Primi Wulan³,
Joyce Merawati⁴, Md. Kamrul Hasan⁵**

Fakultas Ilmu Tarbiyah dan Keguruan, UIN Maulana Malik
Ibrahim Malang, Indonesia¹

Universitas Samudra Aceh, Indonesia²

STKIP-PGRI Pontianak, Indonesia³

Politeknik Negeri Bandung, Indonesia⁴

United International University, Dhaka Bangladesh⁵

¹Email: nazulasilma@gmail.com

Abstract - This review delves into the multifaceted realm of Project-Based Learning (PBL), aiming to provide a comprehensive understanding of its objectives, methodologies, and implications. The study draws on a meticulous examination of existing literature through document analysis and the review of researches centred on PBL. The primary aim of the research is to discern the key objectives pursued by educators and institutions employing PBL as a pedagogical approach. The method of data collection involves an extensive review of scholarly articles, academic papers, and educational reports, spanning various disciplines and educational levels. By synthesizing information from diverse sources, this study aims to construct a nuanced picture of the aims that PBL seeks to achieve, encompassing cognitive, affective, and skill-based learning outcomes. The analysis phase employs a qualitative approach to identify recurring themes, patterns, and variations in the aims of PBL across different educational contexts. Additionally, the study scrutinizes the methodologies adopted in various researches to assess the effectiveness of PBL, examining factors such as project design, assessment strategies, and student engagement. The findings reveal a range of objectives associated with PBL, including fostering critical thinking skills, enhancing collaboration, and promoting real-world applicability of knowledge. Furthermore, the analysis sheds light on the diversity of methodologies employed in PBL research, showcasing the adaptability of this pedagogical approach across disciplines and educational settings. In conclusion, this review consolidates the aims of PBL, highlights the varied methodologies used to assess its impact, and discusses the implications for future educational practices. By synthesizing current knowledge on PBL, this study contributes to the ongoing dialogue surrounding effective pedagogical strategies, providing insights for educators, researchers, and policymakers seeking to optimize learning experiences through project-based approaches.

Keywords: project-based learning (pbl); authentic learning; collaborative learning; problem solving; student-centred

1. Introduction

1.1 Background

In the ever-evolving landscape of education, where the traditional classroom model is continually being reshaped, innovative approaches to learning have become imperative. Amidst these pedagogical advancements, Project-Based Learning (PBL) emerges as a beacon of student-centred enlightenment, steering education towards a more dynamic and practical paradigm (Kelley et al., 2019; Duke et al., 2021).

Imagine a classroom where textbooks come to life, where theories take tangible form, and where students are not mere passive recipients of knowledge but active architects of their own learning. PBL, at its core, embodies this vision. It is a methodology that transcends the confines of conventional teaching, inviting students to immerse themselves in authentic, real-world projects that mirror the complexities they will encounter beyond the classroom (Eldiva & Azizah, 2019).

As we embark on this enlightening exploration of Project-Based Learning, our journey extends beyond the theoretical framework. We delve into the roots of PBL, tracing its evolution from early educational philosophies to its present-day manifestation. We uncover the guiding principles that underpin this methodology, highlighting its emphasis on critical thinking, collaboration, and problem-solving—the very skills essential for success in a rapidly changing global landscape.

This review is not merely an academic exercise; it is a narrative, a story of transformation and empowerment. Through the lens of PBL, we witness the metamorphosis of education from a static repository of facts to a vibrant ecosystem where curiosity is nurtured, and knowledge is actively constructed. Drawing on real-life examples and compelling anecdotes, we illuminate the tangible impact of PBL on students and educators alike.

Join us on this captivating journey as we navigate the landscapes of Project-Based Learning, unravelling its layers and showcasing its potential to not only enhance academic knowledge but also to instil practical skills that transcend the traditional boundaries of education. This is a narrative of innovation, empowerment, and the unfolding revolution in the way we perceive and impart knowledge. Welcome to the transformative power of Project-Based Learning.

In the ever-evolving landscape of education, innovative pedagogical approaches continuously emerge to meet the dynamic needs of learners. Project-Based Learning (PBL) has emerged as a compelling and transformative methodology, offering a departure from traditional instructional models (Condcliffe et al., 2017). This introduction provides an overview of PBL, outlines the background shaping its emergence, identifies pertinent research problems, and articulates the purposes of the study aimed at addressing these challenges (Yaprak, 2022; Beem, 2021; Foss et al., 2007; Ma'rufa & Mustofa, 2021; Arwanto & Ni'mah, 2023; Kİmsesiz, 2017).

Traditional education models have often been critiqued for their limitations in preparing students for the complexities of the real world. In response to this, PBL has gained prominence as an experiential and student-centric approach (Sokalingam, 2010; Almulla, 2020), offering a departure from rote memorization and passive learning. PBL places students at the centre of their educational experience, fostering a dynamic environment where they collaboratively tackle authentic problems, developing not only subject-specific knowledge but also critical thinking, problem-solving, and interpersonal skills.

As PBL gains traction in educational settings worldwide, there is a growing need for a comprehensive understanding of its diverse applications, effectiveness, and potential challenges. The background thus encompasses the evolution of PBL, its theoretical underpinnings, and the global shift toward more student-centred, interactive learning paradigms (Belland et al., 2009; Duke et al., 2021; Hendriani et al., 2020; Rodrigues, 2011).

PBL didn't appear out of thin air. It has a rich history, rooted in the ideas of progressive educators like John Dewey and Paulo Freire, who believed that education should be active, engaging, and relevant to the lives of learners (Creghan & Adair-Creghan, 2015). As the world around us becomes increasingly complex and interconnected, there's a growing recognition that traditional models are no longer enough. Educators and policymakers worldwide are embracing student-centred approaches, like PBL, that empower learners to take ownership of their education and develop the critical thinking, problem-solving, and collaboration skills they need to succeed in the 21st century."

In the ever-evolving landscape of education, innovative approaches to learning have become imperative for cultivating the skills and competencies essential for the 21st century. Among these, Project-Based Learning (PBL) stands out as a dynamic and student-centric methodology that goes beyond traditional teaching paradigms (McKinney, 2023). PBL is more than just an educational technique; it is a philosophy that empowers students to actively engage with real-world problems, fostering critical thinking, collaboration, and problem-solving skills. By immersing learners in authentic, hands-on projects, PBL transcends the confines of rote memorization and encourages a

deeper understanding of content (Bashith & Amin, 2017; Scogin et al., 2017; Ilham, 2022; Halim et al., 2023; Almaida, HG & Jaelani, 2021; Andriyani & Anam, 2022; (Wijaya, 2022); (Setlight et al., 2023); (Mukhlefi Ali & Kanaan Hasan, 2022); (Mahaputra & Yamin, 2023);

As we begin this exploration of Project-Based Learning, we delve into its origins, principles, and the tangible impact it has on both students and educators. This review aims to unravel the layers of PBL, showcasing its effectiveness in cultivating not only academic knowledge but also the practical skills necessary for success in an increasingly complex and interconnected world (Ngadiso et al., 2021; Wijayanti & Budi, 2023; Kuronboyevna, 2020; Susanti et al., 2020).

This journey as we examine the transformative power of Project-Based Learning, unlocking its potential to shape the future of education and prepare students for the challenges and opportunities that lie ahead.

1.2 Research Problems

Despite the increasing adoption of PBL, several research gaps persist. Questions regarding the efficacy of PBL in different educational levels, the impact on diverse learner populations, and the effectiveness of varied project designs remain largely unanswered. Furthermore, the need to explore the adaptability of PBL across disciplines and cultures adds layers of complexity to the existing discourse.

This study aims to address these research problems by undertaking a thorough examination of existing literature, focusing on document analysis and a review of PBL research across diverse contexts. By identifying these research gaps, the study contributes to the ongoing dialogue on educational methodologies, informing educators, policymakers, and researchers about the nuances and potential improvements within the realm of PBL.

1.3 Purposes of the Study

The primary purposes of this study are twofold. Firstly, it seeks to provide a comprehensive synthesis of the existing knowledge on PBL, amalgamating insights from various disciplines and educational levels. Secondly, it aims to bridge identified research gaps by offering nuanced perspectives on the diverse aims, methodologies, and implications associated with PBL.

Through an exploration of these interconnected purposes, the study endeavours to contribute valuable insights to the broader educational community, fostering informed discussions, and guiding future endeavours in the realm of Project-Based Learning.

2. Method

2.1 Document Study

Document study serves as a foundational methodology for this study, offering a meticulous examination of a diverse array of written materials related to Project-Based Learning (PBL). This comprehensive approach includes scholarly articles, academic papers, educational reports, curriculum documents, and institutional guidelines. The primary goal is to distil rich information embedded in written sources, providing a nuanced understanding of the aims, methodologies, and implications of PBL.

2.2 Selection of Documents

The selection process involves a systematic and purposive sampling strategy, ensuring representation from various educational levels, disciplines, and geographical contexts. This inclusivity enables a holistic perspective on PBL, capturing its diverse applications and adaptations.

Documents included in the analysis meet predetermined criteria, such as relevance to PBL, publication in reputable academic journals, and alignment with the research objectives. This ensures the extraction of high-quality and pertinent information.

2.3 Data Extraction

A structured coding framework is employed to systematically extract relevant data from the selected documents. This framework encompasses key themes, objectives, methodologies, challenges, and outcomes associated with PBL. The process involves multiple iterations to ensure the reliability and validity of the extracted data.

In addition to document analysis, this study undertakes a thorough review of previous empirical studies focused on Project-Based Learning. This qualitative synthesis involves scrutinizing research articles, dissertations, and conference papers, with a focus on identifying methodological approaches, research designs, and findings.

A comprehensive search strategy is employed to locate relevant studies, utilizing academic databases, digital libraries, and scholarly repositories. Keywords such as "Project-Based Learning," "PBL effectiveness," and "PBL assessment" guide the search, ensuring the retrieval of studies that align with the research objectives.

Studies selected for review must adhere to predefined inclusion criteria, emphasizing empirical research, relevance to PBL, and alignment with the research questions. This ensures the incorporation of rigorous and applicable evidence in the analysis.

The findings from the reviewed studies are synthesized using a qualitative approach, identifying patterns, commonalities, and variations in PBL practices and outcomes. This process involves coding, thematic analysis, and the creation of a comprehensive narrative that contributes to the overarching goals of the study.

The insights derived from document analysis and the review of previous studies are integrated to provide a holistic understanding of the aims, methodologies, and implications of PBL. This triangulation of data sources enhances the robustness of the study, offering a nuanced and comprehensive exploration of the multifaceted aspects of Project-Based Learning.

3. Results and Discussion

3.1 Results

The present study explores five keywords, they are PBL, Authentic learning, Collaborative learning, Problem solving, and Student-centred learning. (1) Project-Based Learning (PBL): The central term referring to an educational approach where students engage in hands-on projects to gain knowledge and skills. (2) Authentic Learning: Emphasizes the real-world applicability of PBL, ensuring that projects reflect tasks and challenges encountered in professional or everyday settings. (3) Collaborative Learning: Highlights the social aspect of PBL, emphasizing the importance of teamwork and cooperation among students to accomplish project goals. (4) Problem Solving: Central to PBL, this keyword underscores the emphasis on students actively addressing and solving complex problems through critical thinking and inquiry. (5) Student-Centred: Reflects the shift in educational focus from teacher-centred to student-centred, where learners take an active role in their education through exploration, inquiry, and self-directed learning within the PBL framework.

3.2 Discussion

Project-Based Learning (PBL) is a dynamic and student-centric educational approach that fundamentally transforms the traditional paradigm of classroom instruction. At its core, PBL places students at the helm of their learning journey by immersing them in hands-on projects that encapsulate real-world challenges. Unlike conventional teaching methods that rely heavily on lectures and rote memorization, PBL is a pedagogical strategy that prioritizes experiential learning, critical thinking, and practical skill development.

In the realm of PBL, the learning process is catalysed through the conception, planning, and execution of projects that mirror authentic scenarios encountered in professional and everyday life. These projects are not mere academic exercises; instead, they are carefully crafted to simulate complex, real-world problems, compelling students to actively seek solutions through collaboration, inquiry, and creativity.

Key elements of a PBL experience include defining a compelling problem or question that serves as the driving force behind the project. This problem serves as the anchor, steering students' exploration and shaping the learning objectives. Students are not passive recipients of information; instead, they become investigators, problem solvers, and creators, applying interdisciplinary knowledge to develop holistic solutions.

Moreover, PBL emphasizes the cultivation of essential skills beyond the academic domain. Communication, collaboration, critical thinking, and adaptability are nurtured organically as students grapple with the challenges posed by their projects. The collaborative nature of PBL fosters teamwork and communication skills, preparing students for the collaborative environments prevalent in many professional fields.

The journey through a PBL project is inherently reflective, encouraging students to assess their progress, identify areas for improvement, and refine their approaches. The assessment in PBL goes beyond traditional exams; it is embedded in the project itself, often involving a mix of peer

evaluations, presentations, and reflections. This multifaceted evaluation process not only gauges content mastery but also assesses the development of skills crucial for success in the real world.

In essence, Project-Based Learning represents a departure from the conventional teacher-centred approach, propelling education into a realm where students actively construct knowledge, develop critical skills, and cultivate a deep understanding of both content and its real-world applications. PBL is not just a teaching method; it is an educational philosophy that empowers learners to become lifelong, self-directed thinkers and problem solvers. Through the lens of PBL, education is not confined to the classroom; it becomes a journey of exploration, discovery, and meaningful application in the broader context of students' lives.

Authentic Learning, within the context of Project-Based Learning (PBL), represents a pedagogical philosophy that seeks to bridge the gap between the classroom and the real world. It is a guiding principle that underscores the need for educational experiences to mirror and address the complexities, challenges, and problem-solving scenarios encountered in professional and everyday settings.

At its core, Authentic Learning in PBL is about creating a learning environment that transcends the abstract and theoretical. Instead of engaging in exercises with limited real-world relevance, students are immersed in projects that resonate with authentic tasks, problems, and challenges. These projects are carefully designed to simulate the complexities of the actual world, requiring students to apply knowledge and skills in ways that extend beyond the confines of traditional academic exercises.

The authenticity in PBL projects manifests in several key dimensions. Firstly, the problems or questions posed to students are not contrived or artificial; they reflect genuine issues faced in professions or relevant to everyday life. These problems often lack clear-cut solutions and necessitate critical thinking, research, and creative problem-solving—skills that are highly transferable to diverse real-world contexts.

Furthermore, Authentic Learning in PBL incorporates interdisciplinary elements, mirroring the integrated nature of challenges in the real world. Students are encouraged to draw from various disciplines, applying knowledge from mathematics, science, humanities, and other subjects to formulate holistic solutions. This mirrors the collaborative nature of professional work, where problems rarely fall neatly within the boundaries of a single discipline.

The role of the teacher in facilitating Authentic Learning is that of a guide and mentor. Instead of delivering information in a didactic manner, the teacher helps frame the problem, guides the exploration process, and provides support as students navigate the complexities of the project. This shift in the teacher's role fosters a sense of autonomy and responsibility among students, mirroring the expectations and dynamics of real-world projects.

Assessment in Authentic Learning extends beyond traditional testing methods. Evaluation is embedded in the project itself, with criteria reflecting the multifaceted nature of skills development. Peer assessments, self-reflections, and presentations are often integral components of the assessment process, aligning with real-world scenarios where effective communication and collaboration are paramount.

Authentic Learning in the context of PBL represents a commitment to preparing students for the challenges and opportunities they will encounter beyond the classroom. By immersing students in projects with real-world applicability, PBL not only enhances content mastery but also cultivates the critical thinking, problem-solving, and collaboration skills essential for success in professional and everyday life.

Collaborative Learning, as a cornerstone of Project-Based Learning (PBL), stands as a powerful testament to the transformative potential of education when viewed through a social lens. This pedagogical approach goes beyond individual mastery of content and places a premium on the collective intelligence, creativity, and problem-solving capabilities of a group of students working together towards a common goal.

At the heart of Collaborative Learning in PBL is the recognition that many real-world challenges and professional endeavours demand teamwork and cooperation. PBL leverages this understanding by structuring learning experiences in a way that compels students to actively engage with their peers, bringing diverse perspectives, skills, and insights to the collaborative table.

The collaborative journey begins with the formation of groups, it is carefully designed to encourage diversity in terms of skills, backgrounds, and perspectives. These groups become mini-communities of learners, each contributing to and benefiting from the collective knowledge and skills of its members.

Collaborative Learning thrives on interdependence, where the success of the group is intricately tied to the contributions of each member. Shared goals, often embedded in the PBL project, create a sense of purpose that transcends individual achievement. This mirrors the dynamics of real-world professional settings where successful outcomes hinge on effective teamwork.

Effective communication is a linchpin of Collaborative Learning in PBL. Students learn to articulate their ideas, actively listen to their peers, and negotiate differing perspectives. Additionally, Collaborative Learning provides a fertile ground for the development of conflict resolution skills, as students navigate differing opinions and find common ground in pursuit of project objectives.

In the collaborative PBL environment, the teacher assumes the role of a facilitator, guiding and supporting the collaborative process. Rather than being the sole source of knowledge, the teacher becomes a resource, helping students navigate challenges, facilitating discussions, and fostering a culture of mutual respect and cooperation.

Collaborative Learning within PBL is an iterative process that involves regular reflection and feedback. Group members assess their own contributions, provide constructive feedback to peers, and collectively evaluate the overall progress of the team. This reflective aspect cultivates a sense of accountability and a continuous improvement mindset.

Beyond academic content, Collaborative Learning in PBL prepares students for the collaborative nature of the professional world. It mirrors the cross-functional teamwork prevalent in various industries, where diverse skill sets and perspectives converge to solve complex problems.

Collaborative Learning in PBL is a social symphony where individual strengths harmonize into a collective masterpiece. It not only enhances content understanding but also instils invaluable interpersonal skills, preparing students not just for academic success but for a future where collaboration is a cornerstone of innovation and progress.

Problem Solving takes centre stage in Project-Based Learning (PBL), embodying the very essence of this pedagogical approach. At its core, PBL leverages Problem Solving as a guiding principle, propelling students beyond the passive acquisition of knowledge into the realm of active inquiry, critical thinking, and the application of learning to address real-world challenges.

In the landscape of PBL, the journey begins with the identification of a complex and authentic problem or question. This problem serves as the catalyst for student engagement, sparking curiosity, and setting the stage for a deep exploration of content and skills. These problems are deliberately chosen to be multifaceted, lacking clear-cut solutions, and requiring students to delve into the complexities of real-world scenarios.

Problem Solving in PBL hinges on the development of critical thinking skills. Students are not merely tasked with rote memorization or the regurgitation of facts; instead, they are challenged to analyse, synthesize, and evaluate information. Inquiry becomes the vehicle through which students actively seek answers, ask probing questions, and construct knowledge through a process of exploration and discovery.

One distinctive feature of Problem Solving in PBL is its interdisciplinary nature. Students draw upon knowledge and skills from various disciplines to formulate comprehensive solutions. This mirrors the integrative demands of real-world challenges, where problems rarely conform neatly to the boundaries of a single subject.

The identified problem serves as the foundation for the PBL project. Students collaboratively design and execute projects that aim to address the problem at hand. These projects are not mere academic exercises but authentic endeavours that mirror the complexity and uncertainty inherent in professional problem-solving contexts.

In the role of a guide, the teacher facilitates the Problem Solving process, offering support, asking thought-provoking questions, and ensuring that students stay on track. The teacher does not provide ready-made solutions but empowers students to navigate the challenges, fostering independence and self-directed learning.

Problem Solving in PBL is a cyclical process, marked by continuous reflection. Students reflect on their progress, reassess their approaches, and refine their strategies. This reflective aspect

contributes not only to the improvement of the project but also to the development of metacognitive skills, enhancing students' ability to monitor and regulate their own thinking.

Assessment in PBL is intricately tied to the Problem Solving process. Evaluation goes beyond traditional exams and tests; it involves assessing students' ability to analyse information, generate creative solutions, and effectively communicate their findings. Peer assessments and presentations often form integral components of the assessment process.

Problem Solving in PBL is an empowering journey where students become active agents in constructing knowledge, tackling complex challenges, and honing the critical thinking skills essential for success in the real world. PBL positions Problem Solving not merely as an academic exercise but as a life skill, preparing students to navigate the uncertainties and intricacies of their future endeavours.

Student-Centred Learning, epitomized within the framework of Project-Based Learning (PBL), signifies a profound shift in the educational paradigm from a teacher-centric to a learner-centric approach. At its essence, Student-Centred Learning in PBL places students at the helm of their educational experience, fostering autonomy, curiosity, and a deep sense of ownership over the learning process.

Student-Centred Learning empowers learners to take an active and autonomous role in their education. Instead of passively receiving information, students are encouraged to explore, inquire, and construct knowledge independently. PBL provides a structured yet flexible environment that allows students to navigate their learning journey, making choices, and decisions that align with their interests and learning styles.

In the realm of Student-Centred PBL, inquiry becomes a guiding principle. Students are prompted to ask questions, seek answers, and delve into the complexities of real-world problems. This process of inquiry not only deepens their understanding of content but also cultivates critical thinking skills as they actively engage with information and apply it to solve authentic problems.

A hallmark of Student-Centred PBL is the active participation of learners in the design and execution of projects. Students collaborate to define the problem, set project goals, and determine the methods by which they will address the challenge at hand. This participatory approach fosters a sense of agency, responsibility, and collective ownership of the learning process.

In the Student-Centred PBL environment, the teacher assumes the role of a facilitator rather than a dispenser of knowledge. Instead of delivering information in a one-size-fits-all manner, the teacher guides, supports, and tailors instruction to meet the diverse needs of individual learners. This shift encourages a more personalized and responsive learning experience.

Student-Centred Learning acknowledges the diversity in learners' strengths, interests, and learning styles. PBL accommodates this diversity by offering varied learning pathways within a single project. Some students may excel in research, while others thrive in hands-on experimentation or artistic expression. This flexibility ensures that each student can engage with the material in ways that resonate with their unique strengths and preferences.

Assessment in Student-Centred PBL extends beyond traditional grading systems. Students actively engage in self-assessment, reflecting on their learning process, identifying areas of growth, and setting goals for improvement. Peer assessments and presentations further contribute to a comprehensive evaluation that aligns with the principles of self-directed learning.

Student-Centred Learning in PBL is not just about achieving specific academic outcomes; it is a holistic preparation for lifelong learning. By instilling a sense of curiosity, adaptability, and self-motivation, PBL equips students with the skills and mindset needed to navigate a rapidly changing world where continuous learning is paramount.

Student-Centred Learning within the PBL framework represents a pedagogical evolution where education is not a passive reception of information but an active, dynamic, and personally meaningful journey. By placing learners at the centre, Student-Centred PBL not only enhances academic achievement but also nurtures the skills and dispositions essential for a lifetime of learning and exploration.

4. Conclusion

In conclusion, Project-Based Learning (PBL) emerges as a dynamic and transformative educational approach that transcends the boundaries of traditional teaching methodologies. PBL embodies a

paradigm shift where students evolve from passive recipients of information to active architects of their learning journey. Through hands-on projects, authentic problem-solving, and collaborative endeavours, PBL not only imparts subject-specific knowledge but cultivates a spectrum of skills crucial for success in the real world.

The multifaceted nature of PBL is underscored by its emphasis on authentic learning, where projects mirror real-world challenges, and students are empowered to apply their knowledge in meaningful contexts. This authenticity not only deepens understanding but also instils a sense of relevance and purpose in the learning process.

Collaborative Learning within PBL amplifies the social dimension of education, fostering teamwork, communication skills, and an appreciation for diverse perspectives. This collaborative ethos reflects the collaborative nature of professional settings, preparing students for the intricacies of teamwork and shared problem-solving.

At the heart of PBL lies a commitment to fostering critical thinking and problem-solving skills. By placing complex, real-world problems at the centre of the educational experience, PBL challenges students to think critically, inquire actively, and synthesize information across disciplines. This emphasis on problem-solving goes beyond academic achievement; it equips students with the analytical and creative acumen necessary for navigating the complexities of their future endeavours.

Moreover, the student-centred nature of PBL signifies a departure from traditional teacher-centred approaches. Students take on active roles as explorers, inquirers, and self-directed learners, shaping their educational experience and preparing for a lifetime of continuous learning.

Project-Based Learning emerges as a holistic educational philosophy that not only imparts knowledge but also shapes learners into critical thinkers, collaborative problem-solvers, and self-directed individuals. As education continues to evolve, PBL stands as a beacon, guiding the way toward a future where learning is not confined to the classroom but extends into the realms of curiosity, exploration, and real-world application. Through PBL, education becomes a dynamic and transformative journey, preparing students not just for academic success but for a world where adaptability, creativity, and problem-solving are the hallmarks of success.

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