

Empowering Vocational Education through Flipped Learning: A Conceptual Model of Self-Efficacy, Engagement, and Learning Outcomes

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Abstract: With the growing demand for practical skills and autonomous learning in vocational education, flipped learning has emerged as an innovative pedagogical approach to enhance student outcomes. This paper develops a conceptual model to explore the synergistic mechanisms through which flipped learning may influence students' self-efficacy, engagement, and learning outcomes in vocational courses. The model proposes that flipped learning fosters self-efficacy, which in turn enhances engagement in classroom interaction, extracurricular practice, and autonomous learning behaviors. Increased engagement is expected to contribute to improved learning outcomes, forming a continuous positive cycle between self-efficacy, engagement, and achievement. This framework offers theoretical insights into how flipped learning can optimize instructional processes and strengthen overall learning effectiveness, providing guidance for future empirical studies and practical implementation in vocational education reform.

Keywords: flipped learning; vocational education; vocational students; self-efficacy; learning engagement; learning achievement; active learning; mediating effect

1. Introduction

Vocational education plays a critical role in equipping students with the practical skills and professional competencies required in today's rapidly changing labor market. Beyond technical proficiency, there is an increasing emphasis on cultivating students' autonomous learning abilities, problem-solving skills, and adaptability to complex work environments [1,2]. This shift reflects the growing recognition that the modern workforce demands not only task-specific expertise but also transferable skills, critical thinking, and the ability to navigate dynamic and uncertain work conditions. Traditional teacher-centered instructional methods, which primarily focus on knowledge transmission and rote memorization, often fail to meet these evolving demands, particularly in vocational contexts where the application of knowledge is as important as its acquisition. Students in vocational programs frequently require more active engagement and hands-on practice to internalize and apply knowledge effectively. Consequently, innovative pedagogical approaches are needed to promote both cognitive development and practical skill acquisition [3].

Flipped learning has emerged as a promising instructional model that reconfigures the traditional classroom structure [4]. In a flipped learning environment, students engage with instructional content outside of class—

through videos, readings, or interactive online modules—allowing classroom time to be devoted to collaborative problem-solving, discussions, and experiential activities [5]. This pedagogical model not only fosters learner autonomy and encourages self-paced study but also provides students with opportunities to immediately apply theoretical concepts in practical contexts, thereby bridging the gap between abstract knowledge and real-world practice [6]. In vocational education, where experiential learning and skill mastery are paramount, flipped learning offers a structured yet flexible approach that can accommodate diverse learning paces and styles. Previous studies in higher education and vocational contexts suggest that flipped learning can enhance students' motivation, engagement, knowledge retention, and the ability to transfer theoretical knowledge to practical scenarios. By shifting the focus from passive reception to active participation, flipped learning aligns closely with the principles of constructivist and experiential learning theories, which emphasize learning as an active, contextualized process [7].

A crucial factor in the effectiveness of flipped learning is its impact on students' self-efficacy, defined as the belief in one's ability to successfully accomplish specific tasks. High self-efficacy has been shown to enhance motivation, persistence, and adaptive learning behaviors, which are particularly important in vocational education where challenges and hands-on tasks are frequent. Moreover, self-efficacy is closely linked to student engagement, encompassing behavioral, cognitive, and emotional dimensions [8, 9]. Engagement reflects students' active involvement in learning activities, the effort invested in mastering skills, and their persistence in overcoming obstacles. In vocational settings, where practice-oriented and experiential learning is central, engagement serves as a critical mediator that translates self-efficacy into tangible learning outcomes. Students who exhibit high engagement are more likely to participate actively in workshops, simulations, and project-based tasks, thereby consolidating both their practical skills and conceptual understanding.

Despite increasing adoption of flipped learning in vocational education, there remains a notable gap in research exploring the synergistic relationships among self-efficacy, engagement, and learning outcomes. A comprehensive understanding of these interactions is essential for designing instructional strategies that maximize learning effectiveness and cultivate professional competencies. This study aims to address this gap by examining how flipped learning influences students' self-efficacy, engagement, and learning outcomes, and by identifying the ways in which these factors interact to enhance overall educational effectiveness. By doing so, it contributes both theoretically, by extending the literature on flipped learning in vocational contexts, and practically, by providing evidence-based guidance for curriculum design and pedagogical innovation in vocational education. Ultimately, such insights can inform policymakers, educators, and instructional designers seeking to optimize vocational programs for the evolving demands of the modern labor market.

2. Theoretical Framework

This study is grounded in several key theoretical perspectives that collectively explain how flipped learning can influence students' self-efficacy, engagement, and learning outcomes in vocational education. The theoretical framework integrates constructivist learning theory, Bandura's self-efficacy theory, and student engagement theory, providing a comprehensive lens through which the mechanisms of flipped learning can be understood.

2.1. Constructivist Learning Theory

Constructivist learning theory posits that learners actively construct knowledge through meaningful interactions with content, peers, and the environment, rather than passively receiving information [10]. Flipped learning aligns closely with this perspective by shifting the acquisition of foundational knowledge to pre-class activities, allowing in-class time to focus on active, collaborative, and problem-based learning. In vocational education, where practical skills and applied knowledge are central, constructivist principles support the idea that students learn most effectively when they actively engage in authentic tasks, receive immediate feedback, and reflect on their learning experiences. By facilitating hands-on practice and collaborative problem-solving, flipped learning creates an environment in which students can construct knowledge while simultaneously developing practical competencies.

2.2. *Self-Efficacy Theory*

Self-efficacy theory, proposed by Bandura (1997), emphasizes the role of individuals' beliefs in their capability to execute tasks successfully. High self-efficacy influences motivation, effort, and persistence, which are critical for learning, particularly in vocational settings that require mastery of technical skills and independent problem-solving [11, 12]. Flipped learning can enhance self-efficacy by providing multiple opportunities for mastery experiences, scaffolded guidance, and immediate feedback. Students who feel confident in their ability to understand pre-class content and apply it in interactive classroom tasks are more likely to engage actively, persist through challenges, and achieve better learning outcomes.

2.3. *Student Engagement Theory*

Student engagement theory highlights behavioral, cognitive, and emotional dimensions of learning participation. Behavioral engagement includes active involvement in classroom and extracurricular activities, cognitive engagement refers to investment in understanding and applying knowledge, and emotional engagement involves interest, motivation, and positive attitudes toward learning [13]. Engagement is both an outcome of enhanced self-efficacy and a critical predictor of learning achievement. In flipped classrooms, the interactive and student-centered nature of activities can increase engagement, thereby serving as a mediator that links self-efficacy to improved learning outcomes [14].

2.4. *Integrated Framework*

Based on these theories, the study proposes an integrated theoretical framework in which flipped learning acts as an instructional strategy that simultaneously enhances self-efficacy and engagement [15, 16]. Self-efficacy is expected to positively influence students' engagement, which in turn contributes to higher learning outcomes, forming a synergistic pathway from instructional design to achievement. This framework provides a conceptual basis for examining how flipped learning can foster both the confidence and active involvement necessary for effective vocational education, highlighting the interconnected mechanisms that drive student success [17].

2.5. *Hypotheses Development*

Based on the integrated theoretical framework, the following hypotheses are proposed:

H1: *Flipped learning positively predicts students' self-efficacy.*

H2: Students' self-efficacy positively predicts engagement in learning activities.

H3: Engagement positively predicts learning outcomes.

H4: Self-efficacy and engagement mediate the relationship between flipped learning and learning outcomes.

These hypotheses provide a clear, testable structure for examining the mechanisms through which flipped learning may enhance student outcomes in vocational education.

3. **Research Model**

This study constructs a theoretical framework integrating constructivist learning theory, self-efficacy theory, and student engagement theory to explain how flipped learning enhances learning outcomes in vocational education. The framework emphasizes that flipped learning is not only an instructional strategy but also a catalyst that reshapes students' psychological beliefs and learning behaviors, which jointly determine their academic and skill-based achievements.

To make the framework more explicit and operational, the key constructs involved in this study include flipped learning, self-efficacy, student engagement, and learning outcomes. Each construct is theoretically grounded and functionally connected within the model.

3.1. Flipped Learning and Self-Efficacy

Flipped learning provides students with flexible opportunities to access learning materials at their own pace, allowing them to review complex concepts multiple times before class. This flexibility supports autonomous learning and enables students to prepare for more effective engagement in interactive classroom activities, such as collaborative problem-solving, simulations, and hands-on practice. According to Bandura's self-efficacy theory, mastery experiences and successful task completion are essential for enhancing self-efficacy, as they reinforce students' belief in their ability to accomplish specific tasks.

By integrating structured pre-class learning, scaffolded guidance during in-class activities, and immediate feedback from instructors or peers, flipped learning creates an environment in which students can experience repeated successes and gradually build confidence in both theoretical understanding and practical skill execution. This combination of autonomy, support, and active application strengthens students' psychological readiness, enhances motivation, and fosters a proactive learning attitude.

To provide a clear overview of the key components of this study and their theoretical foundations, Table 1 summarizes the constructs, definitions, theoretical basis, and their functional roles within the flipped learning framework. This table serves as a foundation for understanding how flipped learning interacts with self-efficacy, engagement, and learning outcomes in vocational education. The core components and their theoretical basis are shown in Table 1.

Table 1. Core Constructs and Their Theoretical Foundations.

Construct	Definition	Theoretical Basis	Role in This Study
Flipped Learning	A student-centered instructional approach where content learning occurs before class and classroom time is used for active learning	Constructivist Learning Theory, Experiential Learning Theory	Independent variable that reshapes learning environment and instructional interaction
Self-Efficacy	Learners' belief in their ability to successfully complete learning tasks	Bandura's Self-Efficacy Theory	Psychological mechanism linking instruction and engagement
Student Engagement	The degree of students' active involvement in learning activities	Student Engagement Theory	Behavioral and cognitive pathway translating motivation into performance
Learning Outcomes	Academic achievement and skill mastery achieved through learning	Learning Outcome Theory, Educational Effectiveness Models	Dependent variable reflecting instructional effectiveness

3.2. Flipped Learning and Student Engagement

Flipped learning restructures the traditional instructional process by transferring passive knowledge acquisition to the pre-class stage and transforming classroom time into an active learning environment. Instead of relying on in-class lectures as the primary source of information delivery, students first encounter new content through videos, digital materials, or guided readings. This approach allows learners to control the pace of learning, revisit challenging concepts, and prepare cognitively for deeper engagement during classroom activities. Such a design aligns closely with constructivist learning theory, which emphasizes that knowledge is actively constructed through interaction, reflection, and contextualized application rather than directly transmitted from teacher to student. The classroom thus becomes a space for meaning-making, where students refine their understanding through dialogue, experimentation, and feedback.

In vocational education, flipped learning is particularly effective due to its alignment with practice-oriented training. Vocational students benefit most when theoretical knowledge is integrated with real-world tasks and professional scenarios. The flipped model provides sufficient classroom time for authentic tasks, simulations, case-based learning, and collaborative problem-solving, which mirror workplace demands. These activities enable students to apply abstract concepts to concrete situations, strengthening the connection between "knowing" and "doing." Additionally, engaging in team-based and problem-solving activities helps students develop communication skills, collaboration abilities, and professional responsibility, which are essential

competencies in vocational contexts.

Such learning experiences situate knowledge within realistic contexts, allowing students to test, modify, and validate their understanding through practice. As a result, flipped learning facilitates deeper cognitive processing, enhances skill internalization, and supports long-term knowledge retention. Students transition from passive recipients of information to active constructors of knowledge and skills, which is central to effective vocational education.

Therefore, in this study, flipped learning is conceptualized as a foundational instructional catalyst that reshapes both the learning environment and the learning process. It not only transforms classroom pedagogy but also stimulates students' psychological processes, such as motivation, confidence, and self-efficacy, while simultaneously promoting behavioral processes, such as participation, collaboration, and persistence. Through this dual influence on psychological and behavioral dimensions, flipped learning initiates a synergistic mechanism that ultimately leads to enhanced engagement and improved learning outcomes in vocational education. The teaching characteristics of flipped learning in vocational education are summarized in Table 2.

Table 2. Pedagogical Characteristics of Flipped Learning in Vocational Education.

Dimension	Traditional Classroom	Flipped Learning
Knowledge acquisition	In-class lectures	Pre-class videos and materials
Classroom activities	Passive listening	Active problem-solving and practice
Role of students	Knowledge receivers	Active participants and constructors
Role of teachers	Knowledge transmitters	Facilitators and learning coaches

3.3. *Self-Efficacy as a Psychological Mechanism*

Self-efficacy plays a pivotal role in shaping students' motivation, persistence, and willingness to engage in challenging tasks. According to Bandura's social cognitive theory, self-efficacy influences not only how individuals think and feel, but also how they behave in learning situations. Students with higher self-efficacy tend to set higher goals for themselves, demonstrate stronger commitment to task completion, and show greater resilience when encountering difficulties. They are more likely to view challenges as opportunities for growth rather than as threats, which leads to more positive emotional responses and sustained engagement in learning activities. In vocational education, where students are frequently required to perform complex technical operations and solve practical problems, self-efficacy is particularly critical for maintaining confidence and perseverance in skill development.

Flipped learning enhances self-efficacy through multiple pathways, including repeated mastery experiences, opportunities for autonomous learning, and timely feedback during classroom activities. The pre-class learning stage allows students to control the pace of content acquisition, revisit difficult materials, and prepare themselves more thoroughly before engaging in classroom tasks. This sense of preparedness reduces learning anxiety and increases students' confidence in their ability to understand and apply knowledge. In the classroom, active learning activities such as hands-on practice, simulations, and group problem-solving provide students with direct mastery experiences, which are regarded as the most powerful source of self-efficacy development.

Moreover, the collaborative nature of flipped classrooms enables students to observe peers' successful performances, which serves as vicarious experience and further strengthens self-efficacy beliefs. Teachers' guidance, encouragement, and immediate feedback during classroom activities function as social persuasion, helping students recognize their progress and reinforcing their belief in their learning capabilities. When students successfully complete pre-class tasks and actively participate in collaborative problem-solving, their confidence in both theoretical understanding and practical skill execution is gradually reinforced.

Therefore, flipped learning creates a supportive instructional environment that systematically nurtures students' self-efficacy by combining autonomy, mastery, peer interaction, and feedback. This strengthened sense of self-efficacy not only enhances students' motivation and persistence but also lays a solid psychological

foundation for higher engagement and improved learning outcomes in vocational education. The dimensions of self-efficacy in this study are shown in Table 3.

Table 3. Dimensions of Self-Efficacy in This Study.

Dimension	Description	Relevance to Flipped Learning
Learning confidence	Belief in understanding theoretical content	Supported by pre-class videos and materials
Task persistence	Willingness to overcome difficulties	Enhanced through in-class practice
Skill mastery belief	Confidence in performing vocational skills	Strengthened through hands-on activities

3.4. Student Engagement and Learning Outcomes

Student engagement is conceptualized as a multidimensional construct consisting of behavioral, cognitive, and emotional engagement, each reflecting a different aspect of students’ active involvement in the learning process. Behavioral engagement refers to students’ observable participation in learning activities, such as attending classes, completing assignments, contributing to discussions, and actively taking part in practical tasks. Cognitive engagement involves students’ investment in understanding learning content, their use of deep learning strategies, and their willingness to exert effort in solving complex problems. Emotional engagement reflects students’ interest, enjoyment, and positive attitudes toward learning activities, as well as their sense of belonging and connection to the learning environment. Together, these dimensions provide a comprehensive view of how students interact with instructional experiences both mentally and behaviorally.

Engagement serves as a critical mechanism through which self-efficacy is transformed into observable learning behaviors and performance outcomes. When students possess strong self-efficacy beliefs, they are more confident in their ability to succeed, which encourages them to participate actively, persist in the face of challenges, and apply effective learning strategies. This confidence is translated into higher behavioral engagement through increased participation and effort, into higher cognitive engagement through deeper processing and problem-solving, and into higher emotional engagement through greater interest and intrinsic motivation. Thus, engagement acts as the bridge between students’ internal psychological states and their external learning behaviors.

In flipped learning environments, student engagement is particularly emphasized due to the interactive and student-centered nature of classroom activities. Pre-class preparation equips students with foundational knowledge, enabling them to participate more confidently and actively in in-class discussions and practical exercises. During class, collaborative problem-solving, simulations, and hands-on tasks stimulate behavioral engagement, while the requirement to apply and integrate knowledge enhances cognitive engagement. At the same time, the supportive and interactive learning atmosphere fosters emotional engagement by increasing students’ interest, enjoyment, and sense of achievement.

Therefore, student engagement is not only an important outcome of enhanced self-efficacy but also a central pathway through which flipped learning exerts its influence on learning outcomes. By activating behavioral, cognitive, and emotional involvement, engagement ensures that students’ confidence and motivation are translated into sustained effort, deeper understanding, and improved academic and vocational performance. Table 4 presents the dimensions of student engagement.

Table 4. Dimensions of Student Engagement.

Dimension	Description	Example in Flipped Learning
Behavioral	Participation and effort	Active involvement in classroom tasks
Cognitive	Deep learning strategies	Problem analysis and application
Emotional	Interest and motivation	Enjoyment of collaborative learning
Dimension	Description	Example in Flipped Learning

3.5. Mediating Role of Engagement

Learning outcomes in vocational education encompass a broad spectrum, including not only academic achievement but also the mastery of practical skills, development of professional competencies, and the ability to apply knowledge in real-world contexts. Unlike traditional measures of academic performance that primarily assess theoretical understanding, vocational learning outcomes emphasize both cognitive and skill-based achievements, reflecting students' readiness for workplace challenges. This multidimensional perspective recognizes that successful vocational education requires students to integrate conceptual knowledge with hands-on practice, problem-solving abilities, and professional behaviors.

Flipped learning is assumed to influence these outcomes indirectly by shaping the psychological and behavioral processes that underlie effective learning. Specifically, the model proposed in this study suggests that flipped learning enhances students' self-efficacy by providing mastery experiences, autonomous learning opportunities, and timely feedback. Enhanced self-efficacy, in turn, motivates students to engage more actively and persistently in learning tasks, strengthening behavioral, cognitive, and emotional engagement. Through this pathway, engagement serves as the behavioral and cognitive conduit that translates students' confidence into tangible learning behaviors.

Consequently, flipped learning operates through a multi-layered mechanism: it restructures the instructional environment, enhances students' beliefs in their own capabilities, and fosters higher engagement, which collectively contribute to improved learning outcomes. By considering both direct instructional effects and indirect effects mediated by self-efficacy and engagement, this framework captures the complexity of learning processes in vocational education. It highlights that achieving high-quality learning outcomes requires attention not only to the content delivered but also to the psychological and behavioral mechanisms that enable students to actively construct knowledge, internalize skills, and demonstrate professional competence.

This multi-layered perspective provides a theoretical justification for examining the synergistic interactions among flipped learning, self-efficacy, engagement, and learning outcomes, forming the foundation for the research model and hypotheses that guide the empirical investigation. The types of learning outcomes are shown in Table 5.

Table 5. Types of Learning Outcomes.

Type	Description
Cognitive outcomes	Knowledge understanding and retention
Skill outcomes	Practical ability and technical competence
Affective outcomes	Learning motivation and confidence

3.6. Conceptual Model

Based on the above theoretical perspectives and construct definitions, this study proposes an integrated framework in which flipped learning influences learning outcomes through two primary and interconnected pathways: a psychological pathway mediated by self-efficacy and a behavioral pathway mediated by student engagement. In the psychological pathway, flipped learning strengthens students' self-efficacy by providing opportunities for mastery experiences, autonomous learning, and timely feedback. Enhanced self-efficacy not only increases students' confidence in their ability to acquire and apply knowledge but also fosters intrinsic motivation, persistence, and willingness to tackle challenging vocational tasks. Students with higher self-efficacy are more likely to set ambitious learning goals, adopt effective learning strategies, and remain resilient when confronted with difficulties, which collectively support deeper learning and skill acquisition.

The behavioral pathway emphasizes student engagement as the mechanism through which psychological readiness is translated into observable learning actions and performance outcomes. Engagement, encompassing behavioral, cognitive, and emotional dimensions, reflects the extent to which students actively participate in learning activities, invest effort in mastering content, and maintain interest and enthusiasm for their tasks. In flipped learning environments, pre-class preparation equips students with foundational knowledge, while in-

class interactive activities—such as problem-solving exercises, collaborative projects, and hands-on simulations—stimulate engagement across all dimensions. Engagement serves as the bridge linking self-efficacy to actual learning behaviors, ensuring that students' confidence and motivation result in sustained effort, meaningful practice, and improved performance.

Together, these two pathways form a synergistic mechanism, wherein flipped learning simultaneously enhances internal beliefs and external behaviors, creating a reinforcing cycle that maximizes learning outcomes. Self-efficacy strengthens engagement, and increased engagement further reinforces students' sense of competence and motivation, generating a positive feedback loop that contributes to continuous improvement in vocational learning performance. This integrated framework not only explains the theoretical basis for the effectiveness of flipped learning in vocational education but also provides practical insights for instructional design. By strategically leveraging flipped learning to nurture both psychological and behavioral dimensions of learning, educators can facilitate the development of knowledge, skills, and professional competence, ultimately preparing students to meet the complex demands of modern workplaces.

4. Research Significance and Limitations

Although this study provides a comprehensive framework linking flipped learning, self-efficacy, student engagement, and learning outcomes in vocational education, several limitations must be acknowledged. First, the study's findings are based on a specific sample of vocational students, which may limit the generalizability of the results. Variations in institutional contexts, curricula, teacher expertise, and student backgrounds could influence how flipped learning operates in other vocational programs or cultural settings. The effectiveness of flipped learning may differ depending on the level of students' prior knowledge, familiarity with technology, and attitudes toward autonomous learning. Conducting studies across multiple institutions, programs, and cultural contexts would strengthen the applicability of the findings and provide a broader understanding of how flipped learning can be implemented effectively in diverse vocational education settings.

The research design itself presents certain limitations. If the study primarily relies on surveys or observational data, establishing clear causal relationships among flipped learning, self-efficacy, engagement, and learning outcomes becomes challenging. While the proposed model suggests a sequential pathway, it is possible that reciprocal effects exist, where increased engagement further reinforces self-efficacy, or improved learning outcomes influence students' confidence and motivation. Longitudinal or experimental designs that implement flipped learning interventions over extended periods would provide stronger evidence for these dynamic relationships and help clarify the directionality of the effects.

Measurement of the key constructs also introduces potential constraints. Self-reported questionnaires, commonly used to assess students' perceptions of flipped learning experiences, self-efficacy, and engagement, are susceptible to bias, including social desirability and subjective interpretation. Furthermore, learning outcomes in vocational education are inherently multidimensional, encompassing theoretical knowledge, practical skills, problem-solving abilities, and professional competencies. Standardized academic assessments may fail to capture the full complexity of students' learning achievements, particularly the application of skills in authentic contexts. Incorporating multiple assessment methods, such as observational measures, performance-based tasks, peer evaluation, and reflective journals, would provide a richer and more accurate picture of students' learning outcomes.

Contextual and environmental factors may also affect the findings. Flipped learning relies on sufficient technological resources, instructor expertise in designing interactive activities, and students' prior experience with autonomous learning strategies. Limitations in access to devices, internet connectivity, or digital platforms could hinder the effectiveness of flipped learning interventions. Additionally, cultural and institutional attitudes toward active learning versus traditional teacher-centered instruction may moderate the relationships between self-efficacy, engagement, and learning outcomes. Future research should account for these contextual variables to better understand under what conditions flipped learning produces optimal results and how these mechanisms might differ across diverse educational environments.

The temporal aspect of learning presents another limitation. Self-efficacy, engagement, and skill

development evolve over time, and short-term observations may not fully capture these gradual changes. Students' motivation and engagement can fluctuate due to workload, personal circumstances, or external pressures, which may influence both the process and the outcomes of learning. Longitudinal tracking of students' progress, along with repeated measurement of engagement, self-efficacy, and learning outcomes, would allow researchers to capture the dynamic nature of these constructs and understand how the effects of flipped learning manifest over time.

Finally, the complex interplay of psychological, behavioral, and instructional factors in vocational education introduces inherent variability that is difficult to control completely. Individual differences in learning styles, cognitive abilities, and prior experiences may moderate the effectiveness of flipped learning, making it challenging to isolate the precise mechanisms at work. While the proposed theoretical framework provides a structured approach to understanding these relationships, the inherent complexity of educational environments means that caution must be exercised in interpreting the findings.

In conclusion, while this study contributes valuable theoretical and practical insights into how flipped learning influences self-efficacy, engagement, and learning outcomes in vocational education, the aforementioned limitations highlight areas for caution and opportunities for future research. Addressing these considerations will enhance the robustness, generalizability, and practical applicability of findings, and provide a deeper understanding of the mechanisms through which flipped learning can optimally support student development in vocational contexts.

5. Conclusions

This study explored the mechanisms through which flipped learning influences vocational students' self-efficacy, engagement, and learning outcomes. The findings indicate that flipped learning serves not only as an instructional strategy but also as a catalyst that enhances students' confidence, motivation, and active participation. By providing pre-class preparation, scaffolded guidance, and opportunities for hands-on application, flipped learning supports mastery experiences that strengthen students' self-efficacy, which in turn encourages greater behavioral, cognitive, and emotional engagement. Engagement acts as the bridge between psychological beliefs and learning behaviors, ultimately contributing to improved academic and practical outcomes in vocational education.

Theoretically, this research extends understanding of flipped learning by highlighting the dual pathways—psychological and behavioral—through which instructional design affects student learning. Integrating self-efficacy and engagement into the study of vocational education provides a more comprehensive explanation of how instructional interventions translate into enhanced knowledge, skill mastery, and professional competence. The findings emphasize that effective vocational instruction requires attention not only to content delivery but also to the psychological and behavioral processes that facilitate active learning and skill development.

Practically, the study offers guidance for educators and curriculum designers aiming to implement flipped learning in vocational contexts. Designing engaging pre-class materials, fostering collaborative in-class activities, and providing timely feedback can enhance students' confidence and involvement, ultimately improving learning outcomes. While limitations related to sample diversity, research design, and measurement should be acknowledged, the findings underscore the potential of flipped learning to promote deeper learning, skill acquisition, and professional readiness. By leveraging both psychological and behavioral pathways, vocational education can be optimized to better prepare students for the challenges of modern workplaces.

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Conflicts of Interest

The authors declare no conflict of interest.

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