

# THE EFFECT OF THE 5E INSTRUCTIONAL MODEL ON THE LEARNING MOTIVATION OF CHINESE HIGHER VOCATIONAL EDUCATION STUDENTS\*

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## Abstract

This study aims to develop a 5E instructional model and explore its impact on the learning motivation of Chinese higher vocational students. The sample consisted of 80 freshmen majoring in New Energy Vehicle Technology at Yibin Vocational and Technical College, who obtained lower scores of learning motivation. Participants were selected through purposive sampling and randomly assigned divided into an experimental group and a control group, with 40 students in each group. The experimental group received 5E instructional model, while the control group did not. A quasi experimental pretest posttest control group design was adopted for quantitative data analysis.

The research instruments included: (1) A 5E instructional model program for enhancing learning motivation, consisting of 14 thematic activities each following the five stages of Engage, Explore, Explain, Elaborate, and Evaluate, revised by three educational experts. (2) A learning motivation scale adapted from the Motivated Strategies for Learning Questionnaire (MSLQ), which included

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six dimensions: intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, learning self efficacy, and test anxiety, with a total of 36 items. Data were analyzed paired samples t tests, and independent sample t tests. The experimental results showed that the learning motivation of students in the experimental group was significantly higher than both their pre intervention levels and the control group across all six dimensions ( $p < 0.001$ ), while the total learning motivation score of the control group decreased.

**Keywords:** 5E Instructional Model, Learning Motivation, Higher Vocational Education, Chinese Students

## Introduction

Cultivating students' learning motivation has become a global educational priority, particularly in vocational education which aims to cultivate skilled talents. Countries such as the United States and Australia have long prioritized improving learning motivation as a core objective of vocational education reform. The British government has also explicitly proposed adopting interactive teaching to stimulate students' continuous learning motivation in response to technological changes in the industry (Hodgson & Spours, 2019). However, recent research in China shows that the learning motivation of higher vocational students is generally low: nearly 50% of students are driven by external pressure rather than intrinsic interest, and only 30% study out of curiosity about knowledge (Wang, 2025). Insufficient learning motivation not only leads to poor mastery of professional skills but also weakens students' career adaptability, which has become an urgent problem to be solved for the high quality development of vocational education in China.

The 5E instructional model, developed by Bybee et al. (2006) based on constructivist theory, has been proven effective in enhancing students' learning motivation by transforming passive knowledge reception into active inquiry

learning. However, existing research on the 5E model mainly focuses on professional courses such as science and engineering, and rarely involves non professional teaching scenarios such as thematic class meetings in higher vocational education.

From the perspective of student development, most higher vocational students are in emerging adulthood and value independent exploration and autonomous choice (Arnett, 2000). Traditional one way lecture style class meetings cannot meet their psychological needs and often further reduce their learning enthusiasm. According to Erikson's (1998) psychosocial development theory, negative learning attitudes formed by students during adolescence will continue into the higher vocational stage. The OECD's (2022) PISA report also points out that the learning motivation of Chinese students declines significantly after junior high school. Therefore, this study takes thematic class meetings as the carrier and applies the 5E instructional model to explore an effective way to enhance the learning motivation of Chinese higher vocational students.

## Objectives

1. To develop the 5E teaching model to enhance students' learning motivation.

2. To study the teaching effect of 5E teaching model

- 2.1 To compare the learning motivation between the experimental group before and after participating in the 5E teaching program.

- 2.2 To compare the differences in learning motivation between students in the experimental group and the control group after experimental group participating in the 5E teaching program.

## Methodology

This study adopted a quasi experimental pretest posttest control group design. The independent variable was the 5E instructional model, and the dependent variable was learning motivation. The sample was divided into an experimental group and a control group. After the pretest, the experimental group received the 5E instructional model, while the control group did not. The posttest results of the two groups were then compared to explore the impact of the 5E instructional model on the learning motivation of Chinese higher vocational education students. The overall research period was 14 times, including pretest and posttest sessions.

### Participants

The population of this study was 567 freshmen majoring in New Energy Vehicle Technology at Yibin Vocational and Technical College. First, all freshmen were tested with the learning motivation scale to assess their baseline levels. Through purposive sampling, two intact classes with no significant differences in mean scores and standard deviations ( $p > 0.05$ ) were selected as the sample. One class was then randomly assigned to the experimental group and the other to the control group, with 40 students in each group. The experimental group received the 5E instructional model intervention, while the control group received traditional class meetings.

### Research Instruments

This study adapted from the classic definition by Bybee (1997). The 5E Instructional Model refers to a student centered inquiry based teaching system centered around five progressive stages, Engage, Explore, Explain, Elaborate, and Evaluate. It achieves the unity of knowledge acquisition, ability development, and learning motivation stimulation by creating real situations, guiding independent inquiry, and promoting knowledge internalization and transfer. The 5E instructional program developed in this study included 14 thematic class

meeting activities, each strictly following the five stages of the 5E model. The activities were modularly designed around the six core dimensions of learning motivation, with 2 progressive activities configured for each dimension, forming a complete intervention chain of cognitive awakening, experiential exploration, ability construction, and transfer application. The program included a teacher's guidebook and a student manual, revised and approved by three educational experts.

The learning motivation scale was adapted from the Motivated Strategies for Learning Questionnaire (MSLQ) developed by Pintrich et al. (1991), which is widely used in college student motivation research with good reliability and validity. The scale included six dimensions: intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, learning self efficacy, and test anxiety, with a total of 36 items. Optimized by three experts, the content validity was tested using the Item Objective Congruence (IOC) index, and items with an IOC value  $\geq 0.6$  were selected. The learning motivation scale demonstrated excellent internal consistency reliability, with a Cronbach's alpha coefficient of .967.

### **Procedure**

#### **Step 1: Pretest**

Before the experiment, all students completed the learning motivation scale within a specified time to assess their baseline learning motivation levels. The questionnaires were collected and scored immediately after completion. All participants completed the pretest and entered the next stage.

#### **Step 2: 5E Instructional Model Intervention**

In this phase, the experimental group received the 5E instructional model intervention to explore its impact on the learning motivation of New Energy Vehicle Technology students through class meetings. The experimental group participated in 14 thematic class meetings based on the 5E model, each implemented according to the five stages:

Engage Stage: Teachers present real industry problems or career scenarios to stimulate students' curiosity.

Explore Stage: Students independently explore problems through group discussions, data collection, hands on activities, etc.

Explain Stage: Students share their discussion results, and teachers explain core concepts and theories.

Elaborate Stage: Students apply the knowledge they have learned to new scenarios through task practice.

Evaluate Stage: A diversified evaluation method combining self evaluation, peer evaluation, and teacher feedback is adopted.

Meanwhile, the control group received traditional teacher led lecture style class meetings focusing on disciplinary requirements and career planning lectures.

### Step 3: Posttest

After the 14 class meetings based on the 5E instructional model, all students completed the same learning motivation scale again to measure changes in their learning motivation. The posttest used exactly the same learning motivation scale as the pretest.

### Data Analysis

For quantitative data, descriptive statistical analysis was performed, and paired samples t tests and independent samples t tests were used to compare the learning motivation data of the experimental group and the control group. Specifically, paired samples t tests were used to analyze the differences between pretest and posttest scores within groups, and independent samples t tests were used to analyze the differences between pretest and posttest scores between groups. First, an independent samples t test was conducted on the pretest data of the experimental group and the control group to calculate the mean and t value of the two groups. After the experiment, a posttest was conducted on both

groups, and a t test was performed again on the posttest data to compare the mean differences between the control group and the experimental group.

## Results

From research objective 1 To develop the 5E teaching model to enhance students' learning motivation

This study successfully developed a 5E instructional model program to enhance the learning motivation of higher vocational students, which included 14 thematic activities.

The 5E instructional model consists of the following five steps:

1. Engage Stage: Teachers stimulate students' curiosity by asking questions or creating situations with teaching tools, prompting students to re examine existing knowledge, guiding them to understand new concepts, maintaining learning concentration, thus stimulating their interest in knowledge exploration and facilitating the acquisition of new knowledge.

2. Explore Stage: Provide students with unified basic activities to allow them to conduct preliminary exploration of existing knowledge and promote their cognitive transformation. Through this exploration process, students have the opportunity to learn new knowledge and generate new ideas by applying past knowledge and experience, enhancing their creative thinking ability.

3. Explain Stage: Teachers provide students with opportunities to share what they have learned during the exploration stage, then directly introduce relevant concepts and demonstrate operational procedures or technical methods. Students explain their understanding of concepts or demonstrate operational processes, and teachers analyze students' understanding and guide them to conduct more in depth thinking.

4. Elaborate Stage: Achieve learning objectives through practice. Teachers expand students' understanding of concepts and mastery of related skills at this stage.

5. Evaluate Stage: Realize the internalization and sharing of experience. Students are required to give presentations and share their experiences. Through mutual communication and learning experience sharing among students, students' self efficacy is enhanced.

The program comprised 14 activities covering six dimensions of learning motivation: intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self efficacy, and test anxiety, with two activities designed for each dimension, along with opening and closing sessions. All activities were developed based on the 5E instructional model and were reviewed by three educational experts, demonstrating satisfactory content validity.

From research objective 2 To study the teaching effect of the 5E teaching model

**Table 1** shows the results of the independent samples t test on the pretest learning motivation scores of the two groups. The data showed that the p values of all dimensions and the total score of learning motivation between the experimental group and the control group were all  $>0.05$ , indicating that there was no significant difference in the learning motivation levels between the two groups before the implementation of the 5E instructional model, providing a homogeneous basis for the experiment.

| Dimension                                  | Pretest of the control group(N=40) |        | Pre test of the experimental group(N=40) |        | T     | P     |
|--------------------------------------------|------------------------------------|--------|------------------------------------------|--------|-------|-------|
|                                            | X                                  | SD     | X                                        | SD     |       |       |
| Intrinsic Goal Orientation                 | 15.25                              | 5.123  | 15.58                                    | 4.877  | 0.291 | 0.772 |
| Extrinsic Goal Orientation                 | 15.3                               | 4.993  | 15.65                                    | 4.742  | 0.321 | 0.749 |
| Task Value                                 | 15.85                              | 4.6    | 15.98                                    | 4.221  | 0.127 | 0.9   |
| Control of Learning Beliefs                | 15.8                               | 4.648  | 16.05                                    | 4.679  | 0.24  | 0.811 |
| Self efficacy for Learning and Performance | 15.45                              | 4.414  | 15.6                                     | 4.662  | 0.148 | 0.883 |
| Test Anxiety                               | 15.55                              | 4.624  | 15.73                                    | 4.63   | 0.169 | 0.866 |
| Total                                      | 93.2                               | 27.626 | 94.58                                    | 26.962 | 0.225 | 0.822 |

Table 1 Independent Samples t test Results of Pretest Learning Motivation Between the Two Groups

Table 2 shows the results of the paired samples t test for the experimental group. The data showed that after the 5E intervention, the scores of all six dimensions of learning motivation in the experimental group increased significantly, with all differences statistically significant at the 0.001 level. The total score increased from 94.58 to 116.08, with the largest improvement in the task value dimension (from 15.98 to 19.95).

**Table 2** Paired Samples t test Results of Pretest and Posttest for the Experimental Group

| Dimension                                        | Pre test of the<br>experimental group(N=40) |        | Post test of the<br>experimental group(N=40) |         | T     | P      |
|--------------------------------------------------|---------------------------------------------|--------|----------------------------------------------|---------|-------|--------|
|                                                  | X                                           | SD     | X                                            | SD      |       |        |
| Intrinsic Goal<br>Orientation                    | 15.58                                       | 4.877  | 20.05                                        | 1.694   | 7.053 | <0.001 |
| Extrinsic Goal<br>Orientation                    | 15.65                                       | 4.742  | 19.43                                        | 1.662   | 6.532 | <0.001 |
| Task Value                                       | 15.98                                       | 4.221  | 19.95                                        | 1.724   | 7.67  | <0.001 |
| Control of<br>Learning Beliefs                   | 16.05                                       | 4.679  | 19.3                                         | 1.539   | 5.36  | <0.001 |
| Self efficacy for<br>Learning and<br>Performance | 15.6                                        | 4.662  | 18.6                                         | 1.598   | 4.537 | <0.001 |
| Test Anxiety                                     | 15.73                                       | 4.63   | 18.75                                        | 2.121   | 4.898 | <0.001 |
| Total                                            | 94.58                                       | 26.962 | 116.075                                      | 7.47093 | 6.552 | <0.001 |

**Table 3** shows the results of the paired samples t test for the control group. The data indicated that after 14 traditional class meetings, the total learning motivation score of the control group decreased significantly from 93.20 to 92.38 ( $p=0.007$ ).

| Dimension                     | Pretest of the control<br>group(N=40) |       | Post test of the control<br>group(N=40) |       | T     | P     |
|-------------------------------|---------------------------------------|-------|-----------------------------------------|-------|-------|-------|
|                               | X                                     | SD    | X                                       | SD    |       |       |
| Intrinsic Goal<br>Orientation | 15.25                                 | 5.123 | 15.5                                    | 4.982 | 1.136 | 0.263 |
| Extrinsic Goal<br>Orientation | 15.3                                  | 4.993 | 15.2                                    | 4.842 | 0.53  | 0.599 |
| Task Value                    | 15.85                                 | 4.6   | 15.15                                   | 5.066 | 2.254 | 0.03  |

|                                            |       |        |        |          |       |       |
|--------------------------------------------|-------|--------|--------|----------|-------|-------|
| Control of Learning Beliefs                | 15.8  | 4.648  | 15.5   | 4.69     | 0.993 | 0.327 |
| Self efficacy for Learning and Performance | 15.45 | 4.414  | 16.27  | 4.489    | 2.68  | 0.011 |
| Test Anxiety                               | 15.55 | 4.624  | 14.75  | 3.706    | 2.511 | 0.016 |
| Total                                      | 93.2  | 27.626 | 92.375 | 26.58097 | 2.86  | 0.007 |

Table 3 Paired Samples t test Results of Pretest and Posttest for the Control Group

**Table 4** shows the results of the independent samples t test on the posttest scores of the two groups. The data indicated that after the intervention, the experimental group scored significantly higher than the control group in all six dimensions of learning motivation, with all differences statistically significant at the 0.001 level.

| Dimension                                  | Post test of the control group(N=40) |          | Post test of the experimental group(N=40) |         | T     | P      |
|--------------------------------------------|--------------------------------------|----------|-------------------------------------------|---------|-------|--------|
|                                            | X                                    | SD       | X                                         | SD      |       |        |
| Intrinsic Goal Orientation                 | 15.5                                 | 4.982    | 20.05                                     | 1.694   | 5.469 | <0.001 |
| Extrinsic Goal Orientation                 | 15.2                                 | 4.842    | 19.43                                     | 1.662   | 5.219 | <0.001 |
| Task Value                                 | 15.15                                | 5.066    | 19.95                                     | 1.724   | 5.673 | <0.001 |
| Control of Learning Beliefs                | 15.5                                 | 4.69     | 19.3                                      | 1.539   | 4.868 | <0.001 |
| Self efficacy for Learning and Performance | 16.27                                | 4.489    | 18.6                                      | 1.598   | 3.086 | 0.003  |
| Test Anxiety                               | 14.75                                | 3.706    | 18.75                                     | 2.121   | 5.925 | <0.001 |
| Total                                      | 92.375                               | 26.58097 | 116.075                                   | 7.47093 | 5.429 | <0.001 |

Table 4 Independent Samples t test Results of Posttest Learning Motivation Between the Two Groups

## Discussion

For Research Objective 1: Development of the 5E Instructional Model Program The present study developed a 5E Instructional Model tailored to the learning characteristics and professional needs of vocational college students majoring in New Energy Vehicle Technology. The program was designed around the five stages of Engage, Explore, Explain, Elaborate, and Evaluate, with emphasis on authentic vocational situations, collaborative inquiry, classroom interaction, practical application and continuous feedback.

The results reveal that the overall learning motivation of students in the experimental group was significantly enhanced after the implementation of the 5E Instructional Model. This demonstrates that the model can effectively foster learning motivation among vocational college students. Unlike the traditional teacher led lecture based approach, the 5E Instructional Model prioritizes students' active involvement in learning, enabling them to build meaningful learning experiences through real world scenarios, independent inquiry and collaborative interaction.

During the intervention, students in the experimental group took part in a sequence of learning activities, including situational introduction, group inquiry, classroom presentation, knowledge transfer and multi faceted evaluation. These activities transformed their previous passive mode of knowledge reception and strengthened their sense of engagement and commitment to learning.

At the Engage stage, tailored to the characteristics of the new energy vehicle major, researchers introduced industry cases, career development topics and future workplace scenarios to bridge classroom learning and real professional settings. Herrington and Oliver (2000) stated that situated learning can deepen

students' understanding and engagement, as tasks simulating real work environments help them better recognize the significance of learning. For vocational college students, the relevance of coursework to future employment directly influences their learning interest and classroom participation. Accordingly, students are more motivated to engage actively once they realize the connection between classroom learning and career development.

At the Explore stage, students conducted group discussions, collected materials and explored research questions. Rather than merely listening to lectures as in traditional classes, they proactively analyzed problems and completed tasks, evolving from passive knowledge recipients into active learning participants. In his review of active learning research, Prince (2004) confirmed that active and cooperative learning effectively boost students' classroom participation and learning engagement. In this study, collaborative inquiry gradually encouraged students to speak up in class and heightened their sense of involvement.

At the Explain stage, students presented their outcomes and shared opinions, while teachers facilitated in depth understanding through questioning and feedback. Classroom presentation and interaction brought students a steady sense of accomplishment and helped them build stronger learning confidence. Some vocational college students were reluctant to express themselves due to insufficient meaningful learning experiences in the past. Nevertheless, continuous classroom interaction encouraged them to participate more actively and built up their learning confidence.

At the Elaborate stage, activities such as career planning, job task analysis and situational practice were designed to help students apply classroom knowledge to new professional contexts. Vocational education emphasizes practicality and applicability, and knowledge transfer activities enable students to fully perceive the practical value of what they learn in future jobs. Existing

studies have shown that authentic tasks and practical activities strengthen students' awareness of the usefulness of knowledge and further improve their learning engagement (Herrington et al., 2014).

At the Evaluate stage, a combined evaluation system of self assessment, peer assessment and teacher feedback was adopted. Compared with the conventional single examination, process oriented evaluation pays more attention to students' growth and progress throughout the learning process. Consistent supportive feedback helped students gain a sense of achievement and relieved their anxiety about underperforming in class. Continuous recognition during learning further motivated them to participate more actively.

To conclude, the 5E Instructional Model improves vocational college students' learning motivation mainly because it delivers continuous and engaging learning experiences via authentic scenarios, independent inquiry, peer collaboration and ongoing feedback. As students engage in various learning activities, they gradually develop learning interest, a strong sense of engagement and recognition of learning value, which together contributed to the which together contributed to the improvement of their overall learning motivation.

For Research Objective 2: Study the teaching effect of 5E teaching model

The research results fully support the two hypotheses proposed in this study.

Hypothesis 1: After participating in the 5E teaching model, the experimental group has a higher level of learning motivation than before

The research results fully support the two hypotheses proposed in this study. First, the learning motivation of the experimental group improved significantly after participating in the 5E instructional model program.

This is because the student centered design of the 5E model breaks the passive learning state of traditional teaching. Through hands on inquiry and

collaborative communication, students can experience the joy of learning and the sense of achievement brought by hard work, thus transforming from learning driven by external pressure to learning driven by intrinsic interest. The significant improvement in the task value dimension indicates that higher vocational students pay more attention to the practicality of learning content, and the 5E model effectively bridges the gap between classroom learning and real vocational needs by using the five stages of the 5E teaching model.

In this study the 5E teaching model, activities start with Engage Stage, real life scenarios were created based on industry cases and career related dilemmas of the New Energy Vehicle major, which effectively mobilized students' enthusiasm for participation and strengthened their intrinsic goal orientation. According to the Self Determination Theory (Deci & Ryan, 2000), satisfying people's curiosity and needs for autonomous exploration is the key to activating intrinsic motivation. Meanwhile, situational introduction is also a core feature that distinguishes the 5E instructional model from traditional teaching (Bybee et al., 2006). The next stage was Explore Stage, group collaborative inquiry was adopted in this stage. Students gained a direct understanding of the connection between learning and career development, which greatly enhanced their recognition of task value. In the Explain Stage, students present their group inquiry outcomes, with teachers supplementing systematic professional knowledge. This learning process enables students to recognize that academic achievements depend on personal efforts, which effectively strengthens their control of learning beliefs. This result supports the motivational component theory proposed by Pintrich et al. (1991). In the Elaborate Stage, practical tasks related to career planning are arranged to facilitate knowledge transfer. Taking career development as the core driving force, students' extrinsic goal orientation is further improved, which reflects the theory practice integration concept of the 5E instructional model (Bybee, 2009). In the final Evaluate Stage, diversified formative assessments replace the traditional single evaluation method. Continuous positive evaluation

feedback helps students enhance learning self efficacy and reduce test anxiety, which can be reasonably explained by Bandura's Self Efficacy Theory (Bandura, 1997). The findings of the present study are consistent with previous empirical results. According to Çetin Dindar (2012), a quasi experimental study with pre test, post test and control group design was implemented to explore the influence of the 5E learning cycle on students' learning motivation and conceptual understanding. The results indicated that students receiving 5E teaching exhibited significantly higher learning motivation than those taught through conventional lecture based instruction. The study further illustrated that situational design, inquiry practice and active student participation in the 5E model effectively stimulate learning interest and promote classroom engagement.

In addition, according to Tuan et al. (2005), student centered inquiry teaching positively improves students' learning performance. Their empirical findings verified that inquiry based teaching strategies significantly enhance students' learning motivation, self efficacy and classroom participation. Since the core concept of the 5E instructional model originates from inquiry learning, the results of this study are highly consistent with previous studies. Therefore, the five stages of the 5E instructional model cooperate comprehensively to effectively improve the overall learning motivation of vocational college students.

Hypothesis 2: After participating in the 5E teaching model, the experimental group had a higher level of learning motivation than the control group.

The results revealed that the post test total score of learning motivation in the experimental group was significantly higher than that in the control group. It indicates that the 5E Instructional Model can boost their learning motivation across six dimensions.

In terms of intrinsic goal orientation, through situational creation, group discussions and diverse classroom interactions, students in the experimental group gradually enjoyed learning itself and developed increasingly strong learning interest. According to Ryan and Deci (2000) in the Self Determination Theory, students' intrinsic learning motivation can be significantly stimulated when they are granted more opportunities for independent participation and expression. Centered on active exploration and cooperative learning, the 5E Instructional Model precisely meets students' needs for autonomous classroom engagement, which is a key reason why this model effectively arouses learning interest. Bybee (2013) also pointed out that knowledge construction based on inquiry learning can substantially improve students' classroom engagement and learning initiative. The findings of this study are consistent with the above theoretical viewpoints.

In terms of extrinsic goal orientation, career sharing, employment planning and other related content in the curriculum enabled students to clearly recognize the connection between current learning and future career development. For vocational college students, career prospects are usually the core driver of active learning. The Expectancy Value Theory proposed by Eccles and Wigfield (2002) states that students will devote more energy to learning once they realize that learning tasks are closely linked to their long term development. Adopting the 5E Instructional Model, this study constructed authentic career scenarios to help students intuitively understand the practical application of professional knowledge in workplace posts, which in turn greatly strengthened students' extrinsic learning motivation.

The task value dimension saw the most prominent improvement in this study, with its score rising from 15.98 to 19.95. A large number of workplace cases and practical tasks were introduced in class, allowing students to truly perceive how textbook knowledge is applied in real work scenarios. Eccles and Wigfield (2002) argued that students' learning engagement will increase remarkably when

they recognize the practical significance and long term value of learning content. The exploration and application phases of the 5E Instructional Model always integrate theories with real life and connect textbook knowledge with professional practice. Kanter (2010) also stated in his research that inquiry based and project based teaching activities can deepen students' understanding of the value of learning tasks. Overall, the substantial growth in the task value dimension in this study is fully supported by relevant theories.

In terms of learning control beliefs, completing classroom tasks, participating in group collaboration and presenting learning outcomes helped students gradually form a positive perception that efforts lead to progress. Zimmerman (2000) held that abundant positive learning experiences can enhance students' sense of control over the learning process and promote the development of self regulated learning abilities. The 5E Instructional Model advocates student centered knowledge construction. In the process of continuous exploration and problem solving, students developed positive learning styles. Pintrich (2003) further noted that student oriented teaching modes can strengthen learners' sense of learning control and self regulation capabilities. The results of this study indicate that the 5E Instructional Model not only boosts students' classroom participation, but also builds up their confidence in their own learning abilities.

In terms of learning self efficacy, classroom presentations, group inquiry, together with teachers' continuous guidance and support, provided students with plenty of positive learning experiences and constant recognition and encouragement from teachers and peers. Bandura (1997) emphasized in his research that successful learning experiences and positive external feedback are two core factors for improving learning self efficacy. With more frequent classroom participation, students in the experimental group became more calm and confident in speaking, solving problems and cooperating in teams. Schunk

(1991) believed that teachers' encouragement and a sense of achievement gained during learning can continuously consolidate students' learning confidence. In addition, Britner and Pajares (2006) confirmed that inquiry learning and cooperative learning contribute to the enhancement of students' self efficacy. Therefore, the obvious improvement of this dimension in the present study is in line with previous academic conclusions.

In terms of test anxiety, the 5E Instructional Model focuses on students' all round growth rather than taking the scores of a single examination as the sole evaluation criterion. Diversified assessment methods including group mutual evaluation, classroom performance scoring and process assessment effectively relieved students' psychological pressure caused by exam results. Pekrun (2006) proposed that an inclusive and supportive classroom environment can alleviate students' negative academic emotions and optimize learning experience. Meece et al. (2006) also mentioned that student centered classrooms can reduce students' learning anxiety and build a more secure learning atmosphere. The decline in test anxiety among students in the experimental group proves that the 5E Instructional Model plays a positive role in regulating students' learning emotions and helping them adapt to classroom learning.

To conclude, the 5E Instructional Model can effectively improve vocational college students' classroom participation and exert positive effects on the six dimensions: intrinsic goal orientation, extrinsic goal orientation, task value, learning control beliefs, learning self efficacy and test anxiety. This study further verifies the application value of the 5E Instructional Model in vocational education, and also proves that student oriented, inquiry based and situational teaching ideas are of great practical significance for stimulating learning motivation among vocational college students.

## Recommendation

### Practical Recommendations

Based on the findings that the 5E Teaching Model significantly improved students' learning motivation across all six dimensions—intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self-efficacy for learning and performance, and test anxiety—it is recommended that vocational colleges and higher education institutions integrate the 5E Teaching Model into regular classroom instruction. Teachers should emphasize student-centered learning activities that actively engage learners in the construction of knowledge rather than relying solely on traditional lecture-based approaches.

Educational institutions should provide professional development programs and workshops to enhance teachers' competencies in designing and implementing 5E-based instructional activities. Special attention should be given to the Engage and Explore stages, as these phases stimulate curiosity, increase student participation, and encourage active knowledge discovery. Furthermore, teachers should create authentic learning situations that connect classroom content with real-world vocational applications to strengthen students' perceptions of task value and career relevance.

The Elaborate and Evaluate stages should be used systematically to provide students with opportunities to apply their knowledge, reflect on their learning experiences, and demonstrate their competencies through presentations, projects, and collaborative activities. Such practices can strengthen self-efficacy and promote deeper learning. Educational administrators should also support the adoption of innovative instructional approaches by providing adequate learning resources, technology, and institutional support.

Since learning motivation is closely associated with academic success, student retention, and lifelong learning, the 5E Teaching Model should be

considered an effective pedagogical framework for enhancing both cognitive and affective learning outcomes in vocational education settings.

### **Recommendations for Future Research**

Future studies should investigate the long-term effects of the 5E Teaching Model on students' learning motivation, academic achievement, and professional competency development through longitudinal research designs. Researchers are encouraged to conduct follow-up assessments several months after the intervention to examine the sustainability of motivational gains.

Further research should expand the sample size and include students from different educational levels, disciplines, institutions, and geographical regions to enhance the generalizability of the findings. Comparative studies may also be conducted to examine the effectiveness of the 5E Teaching Model across different subject areas and learning environments.

Future researchers may integrate digital learning technologies, artificial intelligence tools, virtual laboratories, or blended learning approaches into the 5E framework to create an Enhanced Digital 5E Teaching Model. Investigating the interaction between technology-enhanced learning and motivational outcomes would provide valuable insights for modern educational practice.

In addition, future studies should explore mediating and moderating variables such as learning engagement, self-regulated learning, critical thinking, creativity, academic resilience, and learning satisfaction to better understand the mechanisms through which the 5E Teaching Model influences student outcomes. Structural Equation Modeling (SEM) may be employed to examine the causal relationships among these variables.

Finally, qualitative or mixed-methods research is recommended to gain deeper insights into students' experiences, perceptions, and reflections regarding participation in 5E-based learning activities. Such studies would contribute to the refinement and further development of the model for diverse educational contexts.

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