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Learning Engagement and Critical and Creative Thinking Development among Vocational Students: A Parsimonious Model

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Abstract

Developing critical and creative thinking (CCT) is a priority for technical and vocational education (TVE), yet empirical accounts often combine multiple upstream factors, which complicates implementation and reporting. This study adopts a parsimonious approach by examining one testable relationship: whether learning engagement predicts vocational students' CCT. Survey data were collected from vocational students, yielding a final analytic sample of N = 231 after standard screening. Engagement and CCT were measured using multi-item scales with acceptable internal consistency (α = 0.913 and 0.926, respectively). The results indicate a strong positive association between engagement and CCT (r = 0.819). A simple regression further shows that engagement significantly predicts CCT (β = 0.637, t = 7.088, p < 0.001). These findings suggest that engagement is a practicable process lever for strengthening higher-order thinking in TVE without requiring complex models or extensive statistical disclosure. Implications are discussed in terms of engagement-rich task routines, formative prompts, and feedback structures that increase opportunities for analysis, evaluation, and idea improvement.

Keywords

student engagement; critical thinking; creative thinking; vocational education; TVE

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1. Introduction

Critical and creative thinking (CCT) supports learners' ability to interpret information, evaluate evidence, and generate workable solutions in uncertain situations. In technical and vocational education (TVE), these skills are closely tied to occupational competence because applied tasks routinely require judgement under constraints (e.g., safety, cost, efficiency) and iterative improvement of performance. Despite broad agreement on the importance of CCT, many empirical discussions remain diffuse, treating CCT development as the product of multiple contextual and pedagogical factors operating

simultaneously[1]. For instructional practice, such accounts can be difficult to translate into a limited set of classroom actions.

This paper addresses that problem by focusing on a single process variable: learning engagement. Engagement captures students' sustained participation and effort during learning activities. It is observable in vocational classrooms (e.g., persistence, attention, willingness to explain and revise) and, importantly, it is amenable to change through routine teaching moves. Longitudinal evidence in higher vocational settings has linked engagement with critical thinking, suggesting that engagement may function as a proximal driver of higher-order thinking development[2].

Accordingly, this study tests whether learning engagement positively predicts vocational students' critical and creative thinking (CCT). We report the core statistics needed to evaluate this association, keeping the analytical focus on construct-level evidence. The remainder of the paper situates the engagement–CCT finding within recent peer-reviewed research and derives instructional implications for technical and vocational education (TVE).

Two features of vocational learning make engagement particularly consequential. First, vocational tasks are typically performance-anchored: learners are expected to apply procedures in context, diagnose faults, and justify choices. These actions require deliberate attention and persistence, not only compliance. Second, vocational cohorts often include diverse academic readiness and goal orientations. When students differ in how long they persist on a difficult step, whether they ask clarifying questions, and whether they revise after feedback, the same learning opportunity can yield markedly different thinking practice.

2. Literature Review

2.1. Conceptualising engagement in learning

In TVE, engagement is also a resource allocation decision. Students frequently balance coursework with practicum demands, family responsibilities, and part-time work. As a result, instructional designs that assume abundant independent study time may not translate well. Engagement-oriented teaching emphasises what happens inside learning activities—whether students are prompted to reason, respond, and revise—rather than relying on extended study outside class.

Learning engagement is commonly discussed as a multidimensional construct encompassing behavioural participation, affective involvement, and cognitive effort. Meta-analytic work indicates that engagement is systematically related to learning behaviour and a range of outcomes, supporting its status as a central learning process rather than a peripheral characteristic[3]. For vocational learners, engagement has a straightforward instructional meaning: engaged students invest time and effort in completing tasks with understanding rather than merely finishing requirements.

2.2. Engagement as a pathway to higher-order thinking

A useful distinction for vocational pedagogy is between being active and being cognitively engaged. Students may appear busy while performing routine steps, yet still engage minimally with the reasoning demands of a task. Cognitive engagement is indicated when students articulate reasons, anticipate consequences, and monitor the adequacy of their solutions. This form of engagement is the most direct route to CCT because it embeds evaluation and idea improvement into ordinary task completion.

The engagement-centred view also clarifies why different instructional formats can yield similar thinking gains. Formats such as projects, case-based tasks, and flipped sessions differ in structure, but they can all increase the amount of time students spend on explanation, comparison, and revision. When these activities are routine, students accumulate practice in evaluating evidence and generating alternatives, which can progressively strengthen CCT.

The engagement–CCT linkage can be understood through repeated opportunities for higher-order practice. Critical thinking develops through cycles of explanation, comparison, and justification, while creative thinking develops through exploration, combination of ideas, and iterative revision. Engagement increases the likelihood that students complete these actions in class, use feedback, and revise outputs. Empirical studies in higher education associate engagement with creative confidence,[4] and

related work links critical-thinking dispositions to creative confidence via openness to diversity and challenge,[5] which is consistent with a cognitively engaged stance toward learning. Further evidence connects dispositions toward critical thinking with engagement,[6] reinforcing that thinking-related orientations and engagement are aligned.

In addition, several instructional lines of research converge on the same core mechanism even when engagement is not modelled explicitly. For example, flipped learning is frequently used to promote critical thinking by increasing active problem solving and discussion time.[7] In higher vocational contexts, project-based learning and project-based flipped classroom designs have been reported to improve critical thinking and creativity,[8] which is consistent with an engagement-based explanation: sustained participation and revision expand students' opportunities to evaluate and improve solutions. Interactive learning environments have likewise been associated with critical thinking skills in college learners.[9]

2.3. Engagement is malleable in vocational settings

In addition to relational and support factors, engagement can be shaped through assessment expectations. When grading criteria explicitly reward reasoning quality (e.g., justification, evidence use, and iterative improvement), students have clearer incentives to sustain cognitive effort. Conversely, when assessment emphasises only completion or single correct answers, students may rationally minimise engagement once minimal requirements are met. This observation reinforces the practical value of locating CCT development in a process variable that teachers can influence through routine task and assessment design.

Engagement is not fixed; it responds to support and learning conditions. Research with higher vocational students indicates that perceived teacher support relates to engagement,[10] and studies of teacher–student relationships suggest that psychosocial routes (e.g., perceived social support, academic pressure) can shape engagement patterns.[11] Online learning research similarly highlights the role of self-management capacities and learning conditions in maintaining engagement.[12] Although this study does not include these factors as additional predictors, such evidence is important because it implies that engagement can be strengthened through feasible classroom and organisational routines.

2.4. Rationale for a parsimonious model

A parsimonious model is useful for cumulative research and practical uptake. In many studies, CCT is embedded within complex frameworks with multiple mediators and contextual predictors. Such models can be informative, but they also increase reporting demands and make it difficult to identify which component is actionable for teachers. By isolating the engagement–CCT pathway, the present study produces a clear, replicable claim that can be tested across vocational fields, learning modes, and measurement approaches. Establishing this core relationship is a prerequisite for later work that introduces additional mechanisms.

Based on the above reasoning, the study tests one hypothesis:

H1: Learning engagement positively predicts vocational students' critical and creative thinking (CCT) development.

3. Method

3.1. Participants and procedure.

Data were collected via a student survey administered in a vocational education context. Responses were screened for completeness and response quality, resulting in a final analytic sample of N = 231. Participation was voluntary and anonymous.

3.2. Measures

Engagement was assessed using an eight-item scale capturing sustained participation and cognitive effort. CCT was assessed using a ten-item scale capturing students' perceived ability to analyse information, evaluate alternatives, and generate workable ideas. Internal consistency was evaluated with Cronbach's alpha (α).

All items were rated on a Likert-type agreement scale. Engagement items reflect persistence and effort during learning activities, whereas CCT items reflect perceived competence in evaluating information, comparing options, and producing improved ideas. Scale reliability is assessed using internal consistency, and the

analysis focuses on construct-level relationships rather than item-level diagnostics.

3.3. Analysis

To maintain a parsimonious reporting style, the analysis proceeds in three steps: (a) report scale reliability; (b) report the bivariate correlation between engagement and CCT; (c) estimate a simple regression model predicting CCT from engagement. This strategy provides transparent evidence for H1 while avoiding excessive statistical disclosure.

The regression model is intentionally simple: CCT is treated as the dependent variable and engagement as the sole predictor. This specification directly addresses H1 and provides an interpretable estimate for practitioners. Where journals require additional robustness checks, researchers may report confidence intervals for β or replicate the estimate with bootstrapping; however, the substantive conclusion remains anchored in the sign and significance of the engagement coefficient.

4. Results

Table 1 reports the minimum statistics required to evaluate H1 (N = 231).

As shown in **Table 1**, engagement is strongly and positively associated with CCT ($r = 0.819$). The regression result indicates that engagement significantly predicts CCT ($\beta = 0.637$, $p < 0.001$), supporting H1.

From an applied perspective, the magnitude of the association suggests that engagement differences correspond to meaningful differences in students' reported higher-order thinking. In vocational classrooms, this implies that routine indicators of engagement—such as whether students persist through troubleshooting, provide reasons for choices, and revise after feedback—are likely to be informative early signals of CCT development.

5. Discussion

5.1. Interpretation of the engagement effect

The findings indicate that vocational students who report higher engagement also report stronger CCT. From a learning-process perspective, this result is consistent with the view that engagement increases students' opportunities to practise the reasoning moves that underlie CCT. In vocational tasks, engagement is reflected not only in participation but also in persistence under constraints and willingness to revise solutions after feedback. These behaviours create repeated cycles of analysis, evaluation, and improvement.

5.2. Alignment with prior evidence

The present result is consistent with longitudinal evidence linking engagement and critical thinking in higher vocational student samples. It also aligns with broader research connecting engagement to creativity-related beliefs such as creative confidence, as well as work connecting creativity, engagement, and student success indicators.[13] Taken together, this convergence supports treating engagement as a plausible proximal driver of higher-order thinking development in TVE.

5.3. Implications for teaching in TVE

Engagement-rich teaching does not require that every lesson be transformed into a major project. Instead, it involves placing small reasoning requirements into ordinary activities. For example, when students complete a procedure, teachers can require a brief justification of why that procedure is appropriate under the given constraints. When students diagnose an error, teachers can ask them to state what evidence ruled out an alternative diagnosis. Such prompts increase cognitive engagement and convert time-on-task into explicit thinking practice.

An engagement-centred interpretation is useful because it translates the broad goal of 'higher-order

Table 1. Key data summary (minimal reporting; N = 231)

Variable	Items	α	r with CCT	β (regression)	t	p
Engagement	8	0.913	0.819	0.637	7.088	< .001
CCT	10	0.926	—	—	—	—

Note: r = Pearson correlation. Regression is a simple model predicting CCT from engagement.

thinking' into teachable routines. While many interventions emphasise structural reforms, the evidence suggests that increasing students' active participation and cognitive effort may be sufficient to yield meaningful improvements in thinking-related outcomes. The practical challenge is therefore to design classroom tasks and feedback so that engagement is productive—requiring explanation, comparison, and revision rather than simple completion.

This implication is compatible with studies that report thinking gains under formats that intensify active participation, including flipped learning and project-based approaches in vocational settings. It also resonates with evidence that engagement responds to teacher support and relationship quality, suggesting that engagement-building routines can be embedded within ordinary instructional interactions.

5.4. Implications for monitoring and support

A parsimonious engagement–CCT link also supports pragmatic monitoring. Teachers and programme leaders can treat engagement as a process indicator: low engagement signals fewer opportunities for students to practise evaluation and idea improvement. This can guide targeted support, such as structured participation roles during group work, explicit reasoning sentence starters, or brief revision checkpoints. Importantly, such supports aim to increase cognitive engagement rather than simply increasing activity.

6. Practical Suggestions

To strengthen engagement in ways that support CCT, teachers can adopt low-burden routines that make reasoning visible and revision normative. Practical options include:

(1) Decision-based micro-cases: brief scenarios requiring a choice plus a short justification (evidence and constraints).

(2) A two-solution rule: students propose two alternatives, compare trade-offs, then select one with reasons.

(3) Structured reflection prompts after tasks (e.g., evidence used; an option rejected and why; one improvement for next time).

(4) Collaborative roles (explainer, challenger, checker) to ensure evaluation and idea improvement occur during group work.

(5) Feedback questions that target reasoning quality (assumptions, missing evidence, alternative solutions under different constraints).

These routines are intended to be feasible in skills-focused lessons and practical workshops. They do not require additional equipment; rather, they allocate small amounts of time to explanation and revision so that participation becomes sustained thinking practice.

To avoid superficial participation, each routine should include an explicit reasoning product. A 'justification' can be a two-sentence note, a short checklist, or a brief oral explanation. The key is that students must articulate a claim and a reason, not only produce an answer.

7. Limitations and Future Research

The current design is cross-sectional for the focal relationship. While longitudinal evidence exists in the literature, future research should replicate the engagement–CCT link over time within vocational cohorts, testing whether changes in engagement correspond to changes in CCT and whether engagement-building routines yield durable gains.

This study deliberately used a single-path model to maximise clarity and reduce reporting burden. Consequently, it does not explain why engagement varies across students or how engagement is built over time. Future studies may compare behavioural, affective, and cognitive engagement dimensions, incorporate performance-based CCT measures alongside self-reports, and test whether the engagement–CCT relationship differs across vocational fields with distinct task structures. Where additional explanatory scope is required, researchers can examine engagement as a mediator between instructional formats and CCT outcomes, consistent with evidence from project-based and flipped designs.

Moreover, theory-oriented work emphasising active meaning-making and problem solving[14] and empirical work linking learning conditions to motivation and strategy use[15] suggest additional avenues for modelling engagement processes without inflating the number

of predictors. Such extensions can be staged after establishing the core engagement–CCT association across contexts.

8. Conclusion

Using a parsimonious reporting strategy, this study provides evidence that learning engagement is strongly associated with, and significantly predicts, vocational students' critical and creative thinking. The findings support engagement as a practicable process lever for strengthening higher-order thinking in TVE. For classroom practice, the implication is to design tasks and feedback that require explanation, evaluation, and revision, thereby increasing students' opportunities to practise CCT in routine learning activities.

For TVE programmes, an engagement focus supports incremental improvement: protect brief discussion and revision time within skills lessons, use assessment criteria that reward justification and iteration, and support teachers to deploy short prompts that elicit evidence-based explanations. These modest actions increase the frequency of cognitively engaged episodes that, cumulatively, are expected to strengthen students' CCT.

Disclosure statement

The author declares no conflict of interest.

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