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An Exploration of FE GCSE Students' Attitudes and Motivation towards Mathematics Lessons: A Vocationally Contextualised Approach

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This action research arose from my teaching practice during my placement at a college in the UK, as part of my PGCE in Further Education at Canterbury Christ Church University, from September 2025 to May 2026. The PGCE, the placement and this research was self-sponsored.

Abstract
Purpose
In this study, I set out to explore the impact of a vocationally contextualised approach to mathematics teaching on Further Education (FE) GCSE students' attitudes, motivation, and engagement, particularly among learners with prior low attainment and negative perceptions of mathematics. I embarked on this study during my PGCE placement in an FE College which started on 06/10/2025 and ended on 22/04/2026.
Design/Methodology/Approach
I employed mixed-methods action research design, combining quantitative and qualitative data. Pre- and post-intervention questionnaires were used to measure behavioural engagement, perceived relevance, and emotional engagement/confidence using Likert scales. Statistical analyses included paired-samples t-tests and the Wilcoxon signed-rank test and the qualitative data from an open-ended question were analysed thematically.
Findings
Results from our analyses revealed statistically significant improvements across all engagement dimensions. Behavioural engagement and perceived relevance showed large effect sizes, while emotional engagement and confidence also improved significantly. The qualitative findings indicated increased motivation, confidence, perceived relevance, and understanding through contextualised learning, and these are supporting Expectancy-Value Theory.
Research Limitations/Implications
The study is limited by a small sample size which may affect generalisability. However, it showcases valuable practitioner-led evidence supporting contextualised approaches in FE mathematics.
Practical Implications
Our findings suggest that embedding vocational contexts into mathematics teaching can enhance student engagement, motivation, and confidence. I therefore encourage FE practitioners to adopt applied, context-based teaching strategies aligned with students' vocational pathways.
Originality/Value
This study contributes to what I feel is probably a gap in FE research by providing mixed-methods, practitioner-led evidence on the effectiveness of vocationally contextualised mathematics teaching, linking quantitative engagement outcomes with qualitative student experiences.
In furtherance of this project, I wish to develop work sheets for students in all vocational courses in the colleges in the UK; embedding GCSE Maths into their vocational courses.
Keywords: GCSE Mathematics resit; vocational contextualisation; Expectancy–Value Theory
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1. INTRODUCTION

Key focus areas of Further Education (FE) Colleges in the UK include job-specific training, industry-standard facilities, and flexible learning. GCSE Mathematics is one of the subjects made compulsory in the college. During my PGCE placement in an FE college, I taught many groups of students belonging to different vocational departments in the college, under the supervision of the rest of the researchers. They were students who did not achieve Grade 4 in Maths in GCSE exam before leaving secondary school. Very many of them had almost given up in Maths. They did not want to be in Maths class again. There was near zero interest in maths. They perceived Maths as irrelevant to their vocational aspirations. Seemingly, this perception contributed to their low motivation

and minimal engagement in maths classrooms, creating a significant barrier to learning. In practice, the students frequently questioned the compulsory nature of mathematics within their programmes, asserting that their primary focus was vocational skill development rather than abstract academic content. National reports on FE practice state that negative attitudes and low self-esteem in mathematics are common among adult and vocational learners, and these affective factors significantly influence motivation and engagement (Education and Training Foundation, 2014; Noyes & Dalby, 2017).

So, the problem I observed and identified in the college with this class of students is that many of them do not see the relevance of mathematics to their chosen careers. In fact, a good number of them told me that they did not need mathematics to excel in their vocational careers. This lack of perceived relevance negatively affects their engagement and participation in FE Mathematics lessons. Engagement in learning is widely recognised as a multidimensional construct encompassing behavioural, cognitive, and emotional elements, and strong engagement is linked to improved persistence, performance, and resilience in learning tasks (Fredricks, Blumenfeld & Paris, 2004). When learners fail to connect with the content (particularly in subjects like mathematics that are experienced as abstract or divorced from learners' lived experiences), engagement often declines and learning outcomes suffer.

Theoretical perspectives on motivation and learning are in support of the notion that relevance enhances engagement. Expectancy-Value Theory emphasise that learners' motivation and engagement are influenced by their confidence in their ability to succeed (expectancy) and the value they assign to a task (task value), including its perceived usefulness (Eccles et al., 1983). When students see mathematics as relevant and useful for their vocational goals, the "utility value" component of task value increases, which in turn enhances engagement and persistence. In FE contexts, linking mathematics content to learners' vocational interests (such as using trade-specific budgeting tasks or measurement problems relevant to construction) increases the perceived utility of mathematics and aligns with learners' personal goals.

Situated Learning Theory is another supportive framework to this study. It emphasises that learning is most effective when it is embedded in meaningful, real-world contexts (Lave & Wenger, 1991). In vocational mathematics, this means designing learning activities that mirror the authentic mathematical demands of students' present chosen vocational subject in the college, as well as their future workplaces.

For instance, situating mathematics concepts in contexts that matter to learners such as:

> *Brick Types (Engineering bricks, Facing bricks, Common bricks, Decorative bricks), Wall Height/Length from brick courses, Bricks in a Course, Cost of Bricks, Mixing mortar, Wall thickness, Cost of bricks, etc for Bricklaying students,*
>
> *Timber Types (Softwood, Hardwood, Treated Wood, and Plywood), Rise of a staircase, Timber for stud walls, dimension of a frame, Cutting timber lengths, Joists for the floor, Stud Spacing, Sections of Framing, Cost of timber, etc for Carpentry students,*
>
> *Video Views hours, Editing Sessions, photos per location, filming setups, Media Production Costs, Recording Time, etc for Media Studies students*
>
> *Number of points in a game, Training Sessions, Laps Run, Balls Used in Training Drills, Cost of Gym Sessions, Fitness Training Time for Sports students*
>
> *Valve testing, Pipe condition, Flow Rate Spinner, Pipe Colours, etc for Plumbing students,*
>
> *Patrol Distance, Fitness Test Points, Training Days, Equipment Issued, Uniform Costs, Drill Training Time, etc for Uniformed and Public Service students.*

helps learners make sense of abstract ideas through practical application. I did all this and more during this action research study. This approach aligns with the principles of Applied Academics**,** which advocate for academic content to be directly tied to learners' experiences and contexts to increase motivation, retention, and transfer of knowledge (Applied Academics, 2016).

The learning-by-doing perspective, rooted in pragmatic educational theory, stresses that active engagement in hands-on, task-oriented activities fosters deeper learning than passive instruction (Dewey, 1916). This

philosophy highlights that learners create understanding through meaningful interaction with problems and contexts, rather than simply absorbing information (Dewey, 1938). (Nickerson, 2026) supported Dewey's argument that students learn through active, hands-on inquiry rather than passive instruction, a principle that remains central to experiential and active learning approaches today. Applied to FE mathematics, tasks that require learners to use mathematics within vocationally relevant scenarios encourage active participation, reflection, and collaboration. All of which contribute to increased engagement.

Empirical research in mathematics education also suggests that learners are more likely to engage with content when they recognise its connection to real-world applications. Studies have shown that contextualised instructional strategies in mathematics (where links are made between classroom content and authentic tasks) are associated with improved learner motivation and positive attitudes (Loes, 2022). This evidence is echoed in vocational mathematics research, which finds that contextualising mathematics instruction to students' vocational pathways increases student engagement and motivation more effectively than traditional abstract instruction (Noyes & Dalby, 2017; MiFEC, 2017).

With these theoretical and empirical foundations, the proposed intervention (exploring enhancement of student engagement through the application of mathematics to students' chosen trades and vocations) is grounded in credible educational research and practice. By embedding mathematics within contexts that matter to learners, it was our expectation that students would experience mathematics as less alien and more meaningful, thereby increasing behavioural engagement (participation and effort), cognitive engagement (investment in understanding), and emotional engagement (positive attitudes and interest). Consequently, this intervention aimed not only to improve engagement but also to contribute to improved learner outcomes, including increased confidence, persistence in mathematics study, and attainment.

2. LITERATURE REVIEW

2.1 Introduction

Motivation and attitudes toward mathematics have long been identified as essential factors influencing learner engagement and achievement, especially in Further Education (FE) settings where GCSE resit learners often face prior low performance and low confidence (MiFEC, 2017; Fredricks, Blumenfeld & Paris, 2004). In FE, having a least a grade 4 in mathematics is made compulsory, but students' vocational aspirations often lead them to question its relevance (ETF, 2014; Loes, 2022). Knowing how to foster positive attitudes and motivation is therefore central to enhancing engagement and outcomes. This literature review looks into three interconnected strands: educational theories of motivation and engagement, vocationally contextualised approaches in FE mathematics, and applied learning frameworks. Finally, to justify the present study, gaps in the literature are identified.

2.2 Theoretical Perspectives on Attitudes and Motivation

The study of attitudes and motivation in learning has been thoroughly theorised. Expectancy-Value Theory (Eccles et al., 1983; Eccles & Wigfield, 2002) notes that learners' motivation is influenced by the value they attach to a task and their expectations of success. Learners who perceive mathematics as irrelevant or unachievable are less likely to engage. This theory gives a strong rationale for aligning mathematics teaching with learners' vocational goals, as perceived relevance increases both motivation and effort.

Constructivist perspectives further suggest that learners construct understanding through meaningful engagement with content (Dewey, 1938; Aubrey & Riley, 2022). When learning is grounded in experiences students can recognise and value, attitudes improve, and persistence get better. Constructivist approaches support expectancy-value insights by underlining the role of context and personal meaning in motivation.

Engagement itself is a multi-dimensional construct incorporating behavioural, cognitive, and emotional domains (Fredricks, Blumenfeld & Paris, 2004; Fredricks, Reschly & Christenson, 2016). Behavioural engagement has to do with participation and effort, emotional engagement encompasses attitudes and affective responses such as enjoyment or anxiety, and cognitive engagement involves investment in learning strategies. These dimensions align closely with the measures used in this study and justify the use of pre- and post-intervention questionnaires assessing behavioural participation, perceived relevance, and confidence.

2.3 Vocationally Contextualised Approaches in FE Mathematics

FE learners often disengage when mathematics is taught abstractly, without clear links to their vocational goals (ETF, 2014; MiFEC, 2017; Loes, 2022). Vocationally contextualised teaching embeds mathematical concepts

within real-world applications related to students' chosen trades or careers, helping learners perceive purpose and relevance (Gregson et al., 2020; Loes, 2022). This approach aligns with Expectancy-Value Theory by increasing perceived utility, and supports behavioural and emotional engagement by providing meaningful contexts in which to apply skills.

Empirical studies emphasise the benefits of contextualisation. Hero and Lindfors (2019) underpin that applied, multidisciplinary learning experiences enhance students' engagement, motivation, and perceived relevance. Though their study does not focus exclusively on mathematics, the principles are transferable to FE mathematics, where connecting concept to vocational practice can transform learners' attitudes from disengagement to investment.

Reflective teaching practices in FE also underscore the importance of adapting pedagogy to learners' needs (Gregson et al., 2020). Teachers who embed contextualised, vocational examples are better able to support learners' motivation, build confidence, and foster positive attitudes, particularly among students who have experienced repeated difficulties in mathematics.

2.4 Applied Learning and Situated Contexts

Applied learning frameworks, such as Applied Academics (2016), emphasise integrating academic content with practical skills, reinforcing the value of knowledge in real-world settings. Similarly, situated learning theory (Lave & Wenger, 1991) posits that learning is most effective when it occurs within authentic, socially meaningful contexts. Both perspectives provide a theoretical foundation for vocationally contextualised mathematics teaching, suggesting that learners are more likely to engage when tasks reflect their future occupational environments.

Dewey's (1938) work on experiential education reinforces this argument, highlighting that experience shapes attitudes and motivation. When learners can see the direct applicability of mathematics to their work or daily life, their engagement increases, and negative attitudes are mitigated. Loes (2022) extends this contemporary perspective, showing that contextually meaningful mathematics lessons enhance engagement, particularly among learners with prior disengagement histories.

2.5 FE Context and Learner Characteristics

FE learners exhibit diverse educational backgrounds, often with prior GCSE low performance in mathematics, low self-efficacy, and limited intrinsic motivation for academic subjects (MiFEC, 2017; ETF, 2023). Gregson et al. (2020) emphasise that FE teaching must recognise learners' vocational identities and prior experiences. Without this alignment, learners may resist engagement, even when instructional strategies are well-designed. Vocational contextualisation thus becomes both a pedagogical and psychological strategy, supporting learners' attitudes and motivation by linking mathematics to tangible outcomes.

2.6 Synthesis and Gaps in Literature

The combined literature suggests that:

1. Motivation and attitudes in mathematics are strongly influenced by perceived relevance and expectancy of success (Eccles et al., 1983; Eccles & Wigfield, 2002; Aubrey & Riley, 2022).

2. Contextualised and applied teaching approaches in FE can enhance engagement and positive attitudes (Gregson et al., 2020; Loes, 2022; Hero & Lindfors, 2019).

3. There is robust theoretical support for integrating vocational contexts through constructivist and experiential learning models (Dewey, 1938; Lave & Wenger, 1991; Applied Academics, 2016).

Gap identified: Despite theoretical and empirical support, there is limited practitioner-led, mixed-methods research investigating how vocationally contextualised approaches specifically influence FE GCSE students' attitudes and motivation in mathematics, capturing both quantitative shifts and qualitative experiences without ignoring the normality test. This study addresses that gap in an action research intervention. The intervention was more or less my PGCE placement which started on 06/10/2025 and ended on 22/04/2026. The documentation as a publishable research work lasted for 5 weeks.

Table: Literature Gap Mapping

Theme	Key Authors/References	Gap Identified	How This Study Addresses It
Attitudes and Motivation in FE Maths	Aubrey & Riley (2022); Eccles et al. (1983); Eccles & Wigfield (2002); Fredricks et al. (2004)	Limited research on how FE GCSE students' motivation and attitudes change specifically in response to vocationally contextualised maths teaching	This study measures changes in behavioural, emotional, and attitudinal engagement pre- and post-intervention using questionnaires and open-ended reflections
Contextualised and Applied Learning	Loes (2022); Hero & Lindfors (2019); Applied Academics (2016); Dewey (1938)	Few studies have examined the effects of real-world and vocationally contextualised maths on student engagement in FE GCSE contexts	This study implements a vocationally contextualised maths intervention and captures its impact on student engagement and perceived relevance
FE Pedagogical Practices & Reflective Teaching	Gregson et al. (2020); MiFEC (2017); ETF (2014, 2023)	Existing literature often describes best practices but provides limited practitioner-led empirical evidence on attitudes and motivation outcomes	The study adopts a practitioner-led action research approach, integrating reflective teaching, pre/post measures, and qualitative feedback
Student Engagement Dimensions	Fredricks et al. (2004, 2016); Loes (2022)	Engagement frameworks exist, but few studies combine quantitative engagement measures with qualitative perceptions in FE GCSE maths	The study uses a mixed-methods approach to measure behavioural, emotional, and cognitive engagement, alongside students' reflections on relevance and motivation
Vocational Relevance & Learner Perceptions	Gregson et al. (2020); Hero & Lindfors (2019); Loes (2022)	Limited empirical evidence linking vocational contextualisation to improved perceptions of relevance, especially for GCSE resit students	The study specifically links maths content to students' vocational courses and measures the effect on perceived relevance, motivation, and engagement

2.7 Literature Review Narrative with Research Questions Alignment

The previous sections have outlined the key theoretical perspectives, FE context, and applied learning frameworks relevant to attitudes and motivation in FE mathematics. This narrative synthesises the literature gap table to show how these themes underpin the current study and link explicitly to the research questions.

2.7.1 Attitudes and Motivation in FE Mathematics

Research shows that students' attitudes and motivation are critical determinants of engagement and achievement in mathematics (Aubrey & Riley, 2022; Eccles et al., 1983; Fredricks, Blumenfeld & Paris, 2004). In the FE GCSE context, many learners enter with prior failures and low confidence, creating barriers to participation and sustained effort (MiFEC, 2017; ETF, 2014). While theoretical models, such as Expectancy-Value Theory, explain how perceived task value and expected success influence motivation, there is limited empirical evidence on how these factors shift in response to vocationally contextualised teaching.

Link to RQ2 and RQ3: This gap directly relates to RQ2, which investigates how embedding real-world and vocational applications influences students' perceptions of relevance, and RQ3, which explores the impact on emotional engagement and confidence. By measuring pre- and post-intervention changes in these attitudes and perceptions, the study addresses this theoretical and practical gap.

2.7.2 Contextualised and Applied Learning

Applied and vocationally contextualised approaches have been shown to increase engagement by linking abstract content to authentic tasks (Hero & Lindfors, 2019; Loes, 2022; Applied Academics, 2016). Situated learning theory emphasises that knowledge is constructed within socially meaningful contexts, and learners are more likely to invest effort when they perceive clear relevance (Lave & Wenger, 1991; Dewey, 1938). Despite this, there is a lack of practitioner-led studies investigating contextualised mathematics in FE GCSE classrooms, particularly with a focus on students' attitudes and motivation.

Link to RQ1 and RQ2: This theme supports RQ1, which focuses on behavioural engagement, as well as RQ2, highlighting perceived relevance. By embedding mathematics within vocational scenarios, the study seeks to determine whether contextualisation can enhance both observable participation and perceptions of utility.

2.7.3 FE Pedagogical Practices and Reflective Teaching

Further Education contexts present unique challenges and opportunities for learner engagement. Reflective teaching practices and FE-specific pedagogy encourage teachers to adapt instruction to learners' vocational identities and prior experiences (Gregson et al., 2020; MiFEC, 2017; ETF, 2023). However, much of the literature describes best practices without providing empirical evidence on outcomes for attitudes and motivation. There is a need for action research approaches that allow teachers to trial interventions while capturing measurable effects.

Link to all RQs (RQ1–RQ4): The reflective, practitioner-led nature of this study directly addresses this gap. By designing, implementing, and evaluating a vocationally contextualised intervention, the study simultaneously examines behavioural engagement (RQ1), relevance (RQ2), confidence (RQ3), and student experiences (RQ4).

2.7.4 Student Engagement Dimensions

Student engagement encompasses behavioural, emotional, and cognitive domains (Fredricks et al., 2004; Fredricks, Reschly & Christenson, 2016; Loes, 2022). Previous research demonstrates that engagement increases when learners perceive relevance and applicability, yet FE GCSE maths learners remain understudied in this respect. Most studies have either focused on secondary schools or vocational students in general, rather than linking engagement to vocationally contextualised mathematics interventions.

Link to RQ1 and RQ3: Measuring engagement pre- and post-intervention allows the study to capture behavioural and emotional shifts, providing empirical evidence to fill this gap. For instance, improved class participation or confidence levels after contextualised lessons would demonstrate the efficacy of applied approaches.

2.7.5 Vocational Relevance and Learner Perceptions

Perceived relevance of mathematics to students' chosen careers is critical in influencing motivation and engagement (Gregson et al., 2020; Hero & Lindfors, 2019; Loes, 2022). FE students frequently question why maths is compulsory, and negative attitudes often stem from a lack of connection between classroom content and vocational goals. While theory and anecdotal guidance support contextualisation, there is little empirical evidence capturing students' perceptions of relevance in FE GCSE mathematics.

Link to RQ2 and RQ4: This theme justifies the qualitative component of the study (Section D of the questionnaire). By allowing students to describe their experiences, the research explores how vocationally contextualised lessons influence perceptions of relevance, motivation, and overall experience, providing rich evidence for RQ4.

2.7.6 Synthesis and Study Justification

The literature converges on several key points:

1. Attitudes, motivation, and engagement are central to successful learning in FE mathematics.
2. Vocationally contextualised and applied teaching approaches have the potential to improve relevance and motivation but are underexplored in FE GCSE contexts.
3. Practitioner-led, mixed-methods interventions are needed to provide empirical evidence on the effects of contextualisation on both quantitative engagement measures and qualitative experiences.

Overall justification: By combining pre/post questionnaires measuring behavioural, emotional, and perceived relevance indicators with qualitative reflections, this study directly addresses the gaps identified in the literature. It aligns closely with all four research questions:

RQ	Connection to Literature
RQ1 – Behavioural Engagement	Links to applied/contextualised learning and engagement dimensions (Hero & Lindfors, 2019; Loes, 2022; Fredricks et al., 2004)
RQ2 – Perceived Relevance	Supported by Expectancy-Value Theory and vocational contextualisation research (Aubrey & Riley, 2022; Gregson et al., 2020)
RQ3 – Emotional Engagement & Confidence	Connects to engagement frameworks and FE pedagogical studies (Fredricks et al., 2004; Gregson et al., 2020; Loes, 2022)
RQ4 – Student Experiences	Justified by applied learning, reflective teaching, and situated learning theory (Dewey, 1938; Lave & Wenger, 1991; Hero & Lindfors, 2019)

This integrated narrative demonstrates that vocationally contextualised mathematics lessons are theoretically grounded, empirically supported, and underexplored in FE GCSE contexts, providing a clear rationale for the current study.

3. METHODOLOGY

3.1 Research Questions (RQ)

Our research questions (RQ) are:

RQ1: To what extent does a vocationally contextualised approach to mathematics teaching influence FE GCSE students' behavioural engagement in mathematics lessons?

RQ2: To what extent does a vocationally contextualised approach influence FE GCSE students' perceptions of the relevance of mathematics to their course and future careers?

RQ3: How does a vocationally contextualised approach to mathematics teaching impact FE GCSE students' emotional engagement and confidence in learning mathematics?

RQ4: How do FE GCSE students describe their attitudes, motivation, and experiences of learning mathematics when vocational contexts are incorporated into lessons?

3.2 Research Design

This study adopts a mixed-methods action research design, combining quantitative and qualitative approaches to explore the impact of vocationally contextualised mathematics teaching on student engagement in Further Education (FE). Mixed-methods designs are particularly appropriate for practitioner-led research, as they allow both the measurement of change and the exploration of learners' experiences underlying that change (Creswell and Plano Clark, 2018; O'Leary, 2021). The action research approach aligns with the reflective and improvement-focused nature of teaching practice in FE contexts (Gregson et al., 2020).

3.3 Quantitative Strand: Measurement and Analysis (RQ1–RQ3)

3.3.1 Questionnaire Design and Constructs Measured

A structured pre- and post-intervention questionnaire is be used to measure changes in student engagement following the implementation of vocationally contextualised mathematics teaching. The questionnaire comprises three Likert-scale sections, each directly aligns to a research question:

- Section A: Behavioural Engagement (RQ1)
  This section will measure observable indicators of engagement, including effort, participation, focus, and persistence in mathematics lessons. Behavioural engagement is widely recognised as a core dimension of student engagement and is closely linked to attendance, task completion, and classroom participation (Fredricks, Blumenfeld and Paris, 2004; Fredricks et al., 2016).

- Section B: Perceived Relevance of Mathematics (RQ2)
  This section will measure students' perceptions of the usefulness and applicability of mathematics to their vocational courses, future careers, and everyday life. This construct is grounded in Expectancy-Value Theory, which suggests that students are more motivated and engaged when they perceive

learning as valuable and relevant to their goals (Eccles and Wigfield, 2002). Research in FE settings highlights perceived relevance as a critical factor influencing engagement in compulsory mathematics provision (Loes, 2022).

- Section C: Emotional Engagement and Confidence (RQ3)
  This section will measure students' affective responses to mathematics, including confidence, enjoyment, anxiety, and emotional comfort in lessons. Emotional engagement plays a significant role in students' persistence and willingness to engage with challenging subjects such as mathematics (Fredricks, Blumenfeld and Paris, 2004).

All items will be measured using a 5-point Likert scale ranging from *1 (Strongly Disagree)* to *5 (Strongly Agree)*. For each section, item scores will be aggregated to produce a mean score per student, allowing for comparison between pre- and post-intervention responses.

3.3.2 Pilot Testing of the Questionnaire

Prior to the main data collection, the questionnaire will be piloted with a small group of FE students similar to the target cohort. The purpose of the pilot is to assess the clarity, accessibility, and suitability of the questionnaire items, particularly given the GCSE resit context and varying levels of learner confidence in mathematics. Students will be asked to complete the questionnaire and provide informal feedback on question wording, scale understanding, and overall length.

3.3.3 Theoretical Rationale for the Intervention and Measures

The questionnaire constructs and intervention design are informed by contextualised and situated learning theories, which emphasise that learning is more meaningful when knowledge is embedded within authentic, real-world contexts (Lave and Wenger, 1991). Embedding mathematics within vocational scenarios aligns with constructivist perspectives, which argue that learners actively construct understanding when new knowledge is connected to existing experiences (Aubrey and Riley, 2022).
In FE contexts, research suggests that contextualised mathematics teaching can enhance motivation, engagement, and perceived relevance, particularly for learners with prior negative experiences of mathematics (Education and Training Foundation, 2023).

3.3.4 Quantitative Data Analysis Procedure

To examine changes in engagement following the intervention, difference scores will be calculated for each student by subtracting pre-intervention scores from post-intervention scores for each engagement dimension.
Before selecting an inferential statistical test, the normality of the difference scores will be assessed using the Shapiro–Wilk test, which is recommended for small sample sizes ($n < 50$) (Field, 2018). The null hypothesis of the Shapiro–Wilk test assumes that the data are normally distributed.

- If $p > 0.05$, the assumption of normality is considered met.
- If $p \leq 0.05$, the assumption of normality is violated.

3.3.5 Choice of Inferential Test

Based on the outcome of the normality testing:

- Paired-samples t-tests will be used if difference scores are approximately normally distributed. This parametric test is appropriate for comparing the means of the same participants measured at two time points and accounts for within-participant variability (Bryman, 2020).
- Wilcoxon signed-rank tests will be used when normality assumptions are not met. This non-parametric alternative compares median ranks rather than means and provides a robust method for analysing paired data that deviate from normality (Field, 2018).

This two-step decision process will ensure that statistical analysis is methodologically rigorous and data-driven, rather than relying on a single test by default.

3.3.6 Effect Size

To complement significance testing, Cohen's d will be calculated for each paired comparison to estimate the magnitude of the intervention's effect. Reporting effect sizes is considered best practice in educational research, as it allows interpretation of practical significance beyond p-values alone (Bryman, 2020).

3.4 Qualitative Strand: Student Experience (RQ4)

3.4.1 Open-Ended Questionnaire Item

To address RQ4, the post-intervention questionnaire will include a single open-ended question:
"How has your experience of learning Maths changed, if at all, after the recent lessons?"
This item will allow students to articulate their experiences of contextualised mathematics teaching in their own words, providing insight into how the intervention influenced their engagement, motivation, confidence, and understanding.

3.4.2 Qualitative Analysis

Responses will be analysed using thematic analysis, following a process of familiarisation, coding, theme development, and interpretation (O'Leary, 2021). Codes will be generated inductively from the data and then collated into broader themes such as perceived relevance, motivation and engagement, confidence and reduced anxiety, and understanding through contextualisation. Theme frequencies will be recorded to indicate how many students contributed to each theme, while recognising that individual responses could reflect multiple themes.

3.5 Integration of Quantitative and Qualitative Data

Quantitative and qualitative findings will be integrated at the interpretation stage. Quantitative results will tell the extent of change in engagement dimensions, while qualitative findings will provide explanatory insight into how and why these changes occurred. I believe this integration will strengthen the credibility of the findings and will align with mixed-methods principles of triangulation and complementarity as proposed by Creswell and Plano Clark, 2018.

3.6 Methodologies Rationale

In this study, I am adopting a mixed-methods action research design to explore the impact of vocationally contextualised mathematics teaching on student interest and motivation in Further Education (FE). The rationale for this approach is grounded in both pragmatic considerations and theoretical alignment. Action research is particularly suitable for practitioner-led studies seeking to improve classroom practice while generating evidence of impact (O'Leary, 2021; Gregson et al., 2020). By integrating quantitative and qualitative methods, the study will be able to measure change and also explain why that change occurred, which aligns with the central goals of educational research (Creswell and Plano Clark, 2018).

3.6.1 Rationale for the Questionnaire

Pre- and post-questionnaire will be designed to measure three key dimensions: behavioural engagement, perceived relevance of mathematics, and emotional engagement and confidence — constructs that are widely recognised in educational research as central to student engagement (Fredricks, Blumenfeld and Paris, 2004).

- Behavioural engagement will be measured because observable interest, effort, attention, participation, and task persistence are indicators of whether students are *actively involved* in learning (Fredricks et al., 2004; Fredricks et al., 2016).
- Perceived relevance will be included because students' beliefs about the utility and purpose of mathematics are strong predictors of motivation and engagement, as posited by Expectancy-Value Theory (Eccles and Wigfield, 2002). Research in FE has shown that learners disengage when they fail to see how mathematics connects to their vocational goals (ETF, 2023; Loes, 2022).
- Emotional engagement and confidence will be included because affective responses such as enjoyment, anxiety, and self-efficacy directly influence students' willingness to persist with challenging tasks (Fredricks et al., 2004).

Using a Likert-scale questionnaire for these constructs is methodologically justified because aggregated scores across multiple items provide reliable and interpretable measures of engagement dimensions, which can be quantitatively analysed for change over time (Bryman, 2020).

3.6.2 Rationale for Statistical Tests

The primary quantitative analysis involves comparing pre- and post-intervention scores for each engagement dimension. A paired-samples t-test will be used as the primary inferential test because the same group of students was measured at two time points, making the data dependent; the paired t-test is specifically designed to assess changes in mean scores for repeated measures (Field, 2018; Bryman, 2020). However, parametric tests rely on the assumption that the difference scores are approximately normally distributed. Therefore, the distribution of difference scores will be tested using the Shapiro–Wilk test, which is optimal for small sample sizes ($n < 50$) (Field, 2018). If normality is not met, the non-parametric Wilcoxon signed-rank test will be used instead, providing a robust alternative that does not assume normal distribution of differences (Field, 2018). This two-stage decision process demonstrates analytic rigour and adherence to statistical assumptions, which strengthens the credibility of the findings.

Complementing significance testing with Cohen's d effect sizes will further allow the study to assess the magnitude of change in engagement, not just whether change is statistically significant. Reporting effect sizes is best practice in educational research and provides practical meaning to the results (Bryman, 2020).

3.6.3 Rationale for Thematic Analysis of Qualitative Data

To address the experiential nature of learners' perceptions (RQ4), qualitative data will be gathered through an open-ended questionnaire item. Thematic analysis will be used to identify patterns of meaning across responses. This method is appropriate for action research because it allows practitioners to systematically organise qualitative data while preserving the richness of learners' voices (O'Leary, 2021). The iterative coding process will identify salient themes such as relevance, motivation, confidence, and understanding through contextualisation, which will explain and illuminate the quantitative findings.

3.6.4 Theoretical Underpinnings

The overall methodological rationale is grounded in well-established learning theories. Expectancy-Value Theory explains why perceived relevance (a quantitative measure) is expected to influence engagement: students who value the task and see its relevance are more likely to invest effort (Eccles and Wigfield, 2002). Situated learning theory suggests that learning is more meaningful when it occurs in authentic contexts related to students' goals and practices (Lave and Wenger, 1991), which is the theoretical premise for the vocationally contextualised intervention. Finally, constructivist approaches emphasise that learners construct understanding when learning is connected to real experiences, justifying both the intervention design and the mixed-methods approach (Aubrey and Riley, 2022).

4. DATA COLLECTION, ANALYSIS & FINDINGS

4.1 Introduction

As I stated in section 3.2, this study adopts a mixed-methods action research design, combining quantitative and qualitative approaches to explore the impact of vocationally contextualised mathematics teaching on student engagement in Further Education (FE).

A structured pre- intervention questionnaire was administered before implementation of vocationally contextualised mathematics teaching and post-intervention questionnaire was administered after. The pre-intervention questionnaire and the post- intervention questionnaire are the same in contents.

Research questions 1, 2 and 3 are the quantitative strand of the measurement and analysis. I explained in section 3.3.1 that the questionnaire comprises three Likert-scale sections, each directly aligns to a research question:

- Section A: Behavioural Engagement (RQ1)
- Section B: Perceived Relevance of Mathematics (RQ2)
- Section C: Emotional Engagement and Confidence (RQ3)

Research Questions → Hypotheses

RQ1 – Behavioural Engagement

- **H_0:** There is no significant difference in behavioural engagement scores before and after the intervention.
- **H_1:** There is a significant difference in behavioural engagement scores before and after the intervention.

RQ2 – Perceived Relevance

- **H_0:** There is no significant difference in perceived relevance scores before and after the intervention.
- **H_1:** There is a significant difference in perceived relevance scores before and after the intervention.

RQ3 – Emotional Engagement and Confidence

- **H_0:** There is no significant difference in emotional engagement and confidence scores before and after the intervention.
- **H_1:** There is a significant difference in emotional engagement and confidence scores before and after the intervention.

To address research question 4, a single open-ended question is used, and this is where the qualitative strand of the analysis comes in.

4.2 Extracting Data From The Questionnaire

All items in the questionnaire are measured using a 5-point Likert scale ranging from *1 (Strongly Disagree)* to *5 (Strongly Agree)*. For each section, item scores are aggregated to produce a mean score per student, allowing for comparison between pre- and post-intervention responses.
Sections & Items

Section	Items
Behavioural Engagement	Q1–Q5
Perceived Relevance	Q6–Q10
Emotional Engagement / Confidence	Q11–Q15

To examine changes in engagement following the intervention, difference scores are calculated for each student by subtracting pre-intervention scores from post-intervention scores for each engagement dimension.

Pre-Intervention Data+ Composite Scores

Student	Q1	Q2	Q3	Q4	Q5	Behaviour Score	Q6	Q7	Q8	Q9	Q10	Relevance Score	Q11	Q12	Q13	Q14	Q15	Emotional Score
1	2	2	3	2	3	2.4	2	3	2	3	2	2.4	3	3	3	3	2	2.8
2	1	2	2	2	2	1.8	1	2	2	2	1	1.6	2	2	2	3	2	2.2
3	3	3	3	3	3	3.0	3	3	4	3	4	3.4	3	3	3	3	3	3.0
4	2	2	2	2	2	2.0	2	2	2	2	2	2.0	2	2	2	2	2	2.0
5	3	3	4	3	3	3.2	3	4	3	4	3	3.4	2	3	3	3	3	2.8
6	2	2	3	2	3	2.4	2	3	2	3	3	2.6	4	4	3	4	3	3.6
7	1	1	2	1	2	1.4	1	2	1	2	1	1.4	1	1	2	1	2	1.4
8	3	2	3	2	3	2.6	3	3	3	3	3	3.0	2	2	3	2	3	2.4
9	4	3	4	4	2	3.4	4	3	4	4	4	3.6	4	4	5	4	4	4.2
10	2	2	1	2	3	2.0	2	2	3	2	3	2.4	3	2	3	3	3	2.8
11	3	3	3	3	3	3.0	2	3	2	3	4	2.8	3	3	3	3	3	3.0

12	1	2	2	1	2	1.6	1	2	2	1	2	1.6	2	1	2	1	2	1.6
13	2	3	3	2	3	2.6	2	3	3	3	3	2.8	3	2	3	2	3	2.6
14	4	4	4	4	5	4.2	4	4	4	5	4	4.2	4	4	4	3	4	3.8
15	3	3	3	3	3	3.0	3	1	3	2	3	2.4	5	4	4	4	4	4.2
16	2	2	3	2	1	2.0	2	2	3	2	3	2.4	3	3	2	2	3	2.6
17	3	3	4	3	4	3.4	3	4	3	4	4	3.6	2	3	3	2	3	2.6

Post-Intervention Raw Scores + Composite Scores

Student	**Q 1**	**Q 2**	**Q 3**	**Q 4**	**Q 5**	**Behaviour Score**	**Q 6**	**Q 7**	**Q 8**	**Q 9**	**Q10**	**Relevance Score**	**Q11**	**Q12**	**Q13**	**Q14**	**Q15**	**Emotional Score**
1	3	4	4	3	4	3.6	4	4	3	4	4	3.8	4	4	4	4	4	4.0
2	2	3	3	3	3	2.8	3	3	3	3	3	3.0	2	2	1	2	2	1.8
3	4	4	4	4	4	4.0	4	4	5	4	5	4.4	4	4	4	4	4	4.0
4	3	3	3	3	3	3.0	3	3	3	3	3	3.0	3	3	3	3	3	3.0
5	4	4	4	4	4	4.0	4	4	4	5	4	4.2	4	3	4	3	4	3.6
6	3	4	3	4	4	3.6	3	4	3	4	4	3.6	3	3	3	2	3	2.8
7	2	2	3	2	3	2.4	2	3	2	3	3	2.6	2	2	3	2	3	2.4
8	4	4	4	4	4	4.0	4	4	4	4	4	4.0	4	4	4	4	4	4.0
9	5	5	5	5	5	5.0	5	5	5	5	5	5.0	4	3	4	3	4	3.6
10	3	3	4	3	4	3.4	3	3	4	3	4	3.4	4	4	4	5	4	4.2
11	4	4	4	4	4	4.0	4	4	5	4	5	4.4	4	4	4	4	4	4.0
12	2	3	3	2	3	2.6	2	3	3	2	3	2.6	3	2	3	2	3	2.6
13	3	4	4	3	4	3.6	3	4	4	4	4	3.8	4	3	4	3	4	3.6
14	5	5	5	5	5	5.0	5	5	5	5	5	5.0	5	5	4	5	4	4.6
15	4	4	4	4	4	4.0	4	4	4	4	4	4.0	4	4	4	4	4	4.0
16	3	3	4	3	4	3.4	3	3	4	3	4	3.4	4	4	4	4	4	4.0
17	4	4	4	4	4	4.0	4	4	4	4	4	4.0	3	3	3	3	4	3.2

Notes

1. Behaviour_Score = average Q1–Q5
2. Relevance_Score = average Q6–Q10
3. Emotional_Score = average Q11–Q15

Behaviour (Pre-)	**Behaviour (Post-)**	**B/diff**		**Relevance (Pre-)**	**Relevance (Post-)**	**R/diff**		**Emotional (Pre-)**	**Emotional (Post-)**	**E/diff**
2.4	3.6	1.2		2.4	3.8	1.4		2.8	4.0	1.2
1.8	2.8	1		1.6	3	1.4		2.2	1.8	-0.3
3	4	1		3.4	4.4	1		3.0	4.0	1
2	3	1		2	3	1		2.0	3.0	1
3.2	4	0.8		3.4	4.2	0.8		2.8	3.6	0.8
2.4	3.6	1.2		2.6	3.6	1		3.6	2.8	-0.5
1.4	2.4	1		1.4	2.6	1.2		1.4	2.4	1
2.6	4	1.4		3	4	1		2.4	4.0	1.6
3.4	5	1.6		3.6	5	1.4		4.2	3.6	-0.6
2	3.4	1.4		2.4	3.4	1		2.8	4.2	1.4
3	4	1		2.8	4.4	1.6		3.0	4.0	1
1.6	2.6	1		1.6	2.6	1		1.6	2.6	1
2.6	3.6	1		2.4	3.8	1.4		2.6	3.6	1
4.2	5	0.8		4.2	5	0.8		3.8	4.6	0.8
3	4	1		2.4	4	1.6		4.2	4.0	-0.2
2	3.4	1.4		2.4	3.4	1		2.6	4.0	1.4
3.4	4	0.6		3.6	4	0.4		2.6	3.2	0.6

B/diff = Behaviour Difference = Behaviour (Post-) − Behaviour (Pre-)
R/diff = Relevance Difference = Relevance (Post-) − Relevance (Pre-)
E/diff = Emotional Difference = Emotional (Post-) − Emotional (Pre-)

4.3 Data Analysis

Before selecting an inferential statistical test, the normality of the difference scores will be assessed using the Shapiro–Wilk test, which is recommended for small sample sizes (n < 50) (Field, 2018).

4.3.1 Shapiro-Wilk Test for normality

This allows us to check whether a sample comes from a population that is normally distributed

around a mean and a population standard deviation. It will suggest to us whether to go parametric or non-parametric. The null hypothesis of the Shapiro–Wilk test assumes that the data are normally distributed.
H_o: Population $= N(\mu, \sigma)$

H_1: Population $\neq N(\mu, \sigma)$ $\alpha = 5\% = 0.05$

- If $p > 0.05$, the assumption of normality is considered met.
- If $p \leq 0.05$, the assumption of normality is violated.

4.3.2 Shapiro-Wilk Test for normality for B/diff

Result:

Number of samples:
17

Mean:
1.082

Standard Deviation:
0.258

Variance:
0.067

Excess Kurtosis:
-0.267

Calculated Shapiro-Wilk statistic W:
0.921431

Calculated Shapiro-Wilk p-value:
0.156136

Critical value of W (5% significance level):
0.892003

Do not reject the Null Hypothesis as calculated W is greater than the critical value of W

Or

Do not reject the Null Hypothesis as p-value > 0.05

From the test result, p-value $= 0.156136 > 0.05$. Therefore, I do not reject the Null Hypothesis. I am going for parametric statistic. I go with t-statistic instead of z-statistic because our sample size is less than 30 and the population standard deviation is unknown.

4.3.3 The Significance Testing for B/diff

Let:

μ_{pre} = population mean pre-intervention score

μ_{post} = population mean post-intervention score

This is a two-tailed test. I do not want to lay claim that vocationally contextualised approach has brought an improvement in the students' attitudes and motivation towards mathematics lessons. Let the tests results and the analyses prove it.

$H_0: \mu_{post} = \mu_{pre}$ This implies that $H_0: \mu_d - 0$

Where: μ_d = population mean difference $= \mu_{post} - \mu_{pre}$

$H_1: \mu_{post} \neq \mu_{pre}$

$t_{cal} = \frac{\bar{X}_d - \mu_d}{S_d/\sqrt{n}}$; and where

t_{cal} = t- calculated

$\bar{X}_d$ = mean of (post-intervention scores − pre-intervention scores)

$\mu_d = \mu_{post} - \mu_{pre}$

S_d = sample standard deviation of (post-intervention scores − pre-intervention scores)

n = sample size

So, $t_{cal} - \frac{\bar{X}_d - \mu_d}{S_d/\sqrt{n}} = \frac{1.082 \quad 0}{\left(\frac{0.258}{\sqrt{17}}\right)} = 17.29$

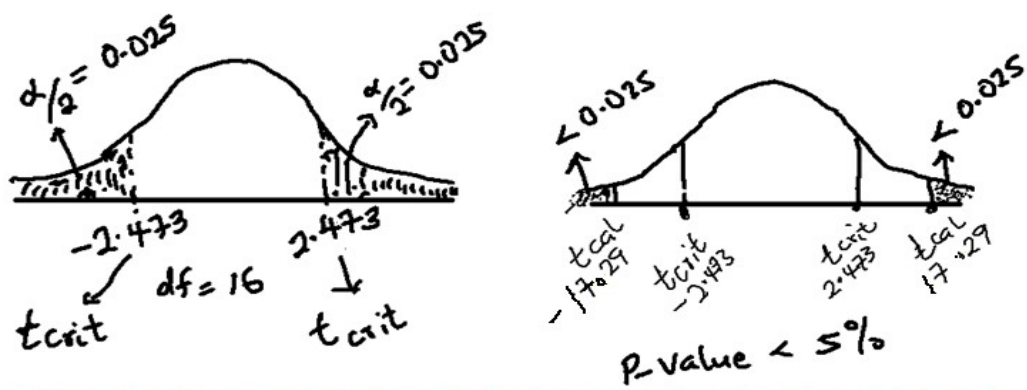
Significance Level (Alpha α) = 5% = 0.05 and Degree of Freedom $(df) = n - 1 = 17 - 1 = 16$

$t_{crit} = \begin{cases} t_{(\alpha/2,\ n-1)} \\ -t_{(\alpha/2,\ n-1)} \end{cases}$ where t_{crit} = t- critical (the table value)

So, $t_{crit} = t_{(0.025,\ 16)} = 2.473$

$t_{cal} > t_{crit}$ and I therefore reject $H_0 : \mu_{post} = \mu_{pre}$. Evidently, $H_1 : \mu_{post} \neq \mu_{pre}$ holds.

4.3.4 Confidence Interval (95%) for B/diff



P-value is less than 5% means that the probability of H_0 being true is less than 5%. Therefore, we reject H_0. This is what happens when t(cal) is greater than t(crit) in magnitude (the area is reduced).

$C.I. = \bar{X}_d \perp t_{crit} \times \left(S_d/\sqrt{n}\right) = 1.082 \pm 2.473 \times \left(\frac{0.258}{\sqrt{17}}\right) = 1.082 \pm 0.154746$

Therefore, $C.I. - [0.9273,\ 1.2367]$. That is, $\bar{X}_d \in [0.9273,\ 1.2367]$.

Interpretation: I am 95% confident that the mean difference is in the range $[0.9273,\ 1.2367]$. This interval is entirely above zero, indicating that the vocationally contextualised teaching approach brought about a significant improvement in the behavioural engagement of the students towards Maths lessons

4.3.5 Effect Size (Cohen's d Test) for B/diff

This quantifies the practical importance of an intervention, complementing statistical significance testing. I note that **Cohen's *d*** is a statistic that shows standardized difference between two means.

Cohen's d	Interpretation
0.2	Small effect

0.5	Medium effect
0.8+	Large effect

$$\text{Cohen's d Test} = \frac{\text{Mean difference}}{\text{Standard deviation of differences}} = \frac{\bar{X}_d}{S_d} = \frac{1.082}{0.258} = 4.19$$

4.19 is a large effect. Although statistical significance of the hypothesis test has indicated that change occurred, this large effect size suggests that embedding vocationally contextualised mathematics had a substantial impact on students' behavioural engagement in mathematics lessons.

4.3.6 Shapiro-Wilk Test for normality for R/diff

Result:

Number of samples: 17

Mean: 1.112

Standard Deviation: 0.310

Variance: 0.096

Excess Kurtosis: -0.167

Calculated Shapiro-Wilk statistic W: 0.922780

Calculated Shapiro-Wilk p-value: 0.164549

Critical value of W (5% significance level): 0.892003

Do not reject the Null Hypothesis as calculated W is greater than the critical value of W

From the test result, p-value $= 0.164549 > 0.05$. Therefore, I do not reject the Null Hypothesis. As I did in section 4.3.2, I am going for parametric statistic. So, in the same vein, I go with t-statistic instead of z- statistic because our sample size is less than 30 and the population standard deviation is unknown.

4.3.7 The Significance Testing for R/diff

Let:

$\mu_{pre} =$ population mean pre-intervention score

$\mu_{post} =$ population mean post-intervention score

$H_0: \mu_{post} = \mu_{pre}$ This implies that $H_0: \mu_d = 0$

where $\mu_d =$ population mean difference $= \mu_{post} - \mu_{pre}$

$H_1: \mu_{post} \neq \mu_{pre}$

This is a two-tailed test. $t_{cal} = \frac{\bar{X}_d - \mu_d}{S_d/\sqrt{n}}$; where

So, $t_{cal} = \frac{\bar{X}_d - \mu_d}{S_d/\sqrt{n}} - \frac{1.112 - 0}{\left(\frac{0.31}{\sqrt{17}}\right)} = 14.79$

Significance Level (Alpha α) $= 5\% = 0.05$

Degree of Freedom $(df) = n \quad 1 = 17 \quad 1 = 16$

$t_{crit} - \begin{cases} t_{(\alpha/2,\ n-1)} \\ -t_{(\alpha/2,\ n-1)} \end{cases}$ where t_{crit} = t- critical (the table value)

So, $t_{crit} = t_{(0.025,\ 16)} = 2.473$

$t_{cal} > t_{crit}$ and it also means that the $p\text{-}value < 5\%$. I therefore reject $H_0: \mu_{post} = \mu_{pre}$.

Evidently, $H_1: \mu_{post} \neq \mu_{pre}$ holds.

4.3.8 Confidence Interval (95%) for R/diff

$C.I. = \bar{X}_d \perp t_{crit} \times \left(S_d/\sqrt{n}\right) = 1.112 \pm 2.473 \times \left(\frac{0.31}{\sqrt{17}}\right) = 1.112 \pm 0.1859$

Therefore, $C.I. = [0.9261,\ 1.2979]$. That is, $\bar{X}_d \in [0.9261,\ 1.2979]$.

Interpretation: I am 95% confident that the mean difference is in the range $[0.9261,\ 1.2979]$.This interval is entirely above zero, indicating that the vocationally contextualised teaching approach brought about a significant improvement in the way students perceive relevance of Mathematics in their vocational studies

4.3.9 Effect Size (Cohen's d Test) for R/diff

This quantifies the practical importance of an intervention, complementing statistical significance testing.

Cohen's d	Interpretation
0.2	Small effect
0.5	Medium effect
0.8+	Large effect

$$\text{Cohen's d Test} = \frac{\text{Mean difference}}{\text{Standard deviation of differences}} = \frac{\bar{X}_d}{S_d} = \frac{1.112}{0.31} = 3.59$$

3.59 is a large effect. Although statistical significance of the hypothesis test has indicated that change occurred, this large effect size suggests that embedding vocationally contextualised mathematics had a significant improvement in the way students perceive relevance of Mathematics in their vocational studies and future employments.

4.3.10 Shapiro-Wilk Test for normality for E/diff

Result:

Number of samples:
17

Mean:
0.706

Standard Deviation:
0.673

Variance:
0.453

Excess Kurtosis:
-0.548

Calculated Shapiro-Wilk statistic W:
0.826021

Calculated Shapiro-Wilk p-value:
0.004720

Critical value of W (5% significance level):
0.892003

Reject Null Hypothesis as calculated W is less than the critical value of W.

From the test result, p-value $= 0.00472 < 0.05$. Therefore, I reject the Null Hypothesis. That is, H_0: Population $= N(\mu, \sigma)$ is hereby rejected. It means that the sample is not from a normally distributed population. I am therefore going for non-parametric statistic. I go with Wilcoxon Signed-Rank Test. Given small sample size and violation of normality assumptions, the Wilcoxon signed-rank test is deemed appropriate (Field, 2018).

4.3.11 Wilcoxon Signed-Rank Test for E/diff (The Significance Testing)

At 5% significance level, I am testing whether if there is a significant difference in emotional engagement and confidence scores before and after the intervention.

- H_0: There is no significant difference in emotional engagement and confidence scores before and after the intervention.
- H_1: There is a significant difference in emotional engagement and confidence scores before and after the intervention.

Emotional (Pre-)	Emotional (Post-)	E/diff	$\lvert E/d \rvert$	Rank R
2.8	4.0	1.2	1.2	14(+)
2.2	1.8	-0.3	0.3	2(-)
3.0	4.0	1	1	10.5(+)
2.0	3.0	1	1	10.5(+)
2.8	3.6	0.8	0.8	6.5(+)
3.6	2.8	-0.5	0.5	3(-)
1.4	2.4	1	1	10.5(+)
2.4	4.0	1.6	1.6	17(+)
4.2	3.6	-0.6	0.6	4.5(-)
2.8	4.2	1.4	1.4	15.5(+)
3.0	4.0	1	1	10.5(+)
1.6	2.6	1	1	10.5(+)
2.6	3.6	1	1	10.5(+)
3.8	4.6	0.8	0.8	6.5(+)
4.2	4.0	-0.2	0.2	1(-)
2.6	4.0	1.4	1.4	15.5(+)
2.6	3.2	0.6	0.6	4.5(+)

$|E/d|$ = The absolute value of E/diff

Total $(\sum R)$

$\sum R(+) =$
$14 + 10.5 + 10.5 + 6.5 + 10.5 + 17 + 15.5 + 10.5 + 10.5 + 10.5 + 6.5 + 15.5 + 4.5 = 142.5$

$\sum R(-) = 2 + 3 + 4.5 + 1 = 10.5$

Notice that the Mean [sum of all the ranks] = Median [1, 2, 3, …, N] (our N = 17)

The Wilcoxon Test Statistic: $T = \min\left[\sum R(+), \sum R(-)\right] = min\,[142.5, 10.5] = 10.5.$

So, $T = 10.5$

The Wilcoxon T statistic will be standardised to a Z value to enable significance testing and effect size calculation.

For large samples, the sampling distribution of the Wilcoxon statistic approximates normality and is therefore converted to a Z statistic for significance testing (Field, 2018)

Since our sample size of 17 is large enough ($N > 10$ is considered large), Z is approximated using:

$$Z = \frac{T - \mu_T}{\sigma_T}$$

Where:

μ_T = expected mean of T

σ_T = standard deviation of T

The expected mean of T: $\mu_T = \frac{N(N+1)}{4} = \frac{17(17+1)}{4} = 76.5$

The standard deviation of T: $\sigma_T = \sqrt{\frac{N(N+1)(2N+1)}{24}} = \sqrt{\frac{17[17+1][2(17)+1]}{24}} = 21.125$

The Z statistic: $Z = \frac{T-\mu_T}{\sigma_T} = \frac{10.5-76.5}{21.125} = -3.12$

The Wilcoxon p-value

For a two-tailed Wilcoxon test, the p-value is:

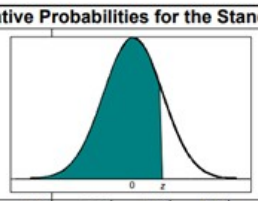
$$p = 2 \times (1 - \Phi(|Z|)) = 2 \times P(Z \geq |Z_{cal}|)$$

Where:

- Φ = cumulative normal distribution
  - Z_{cal} = Calculated Z-score
  - $|Z_{cal}|$ = absolute value of Calculated Z-score
  - Multiply by 2 because it is two-tailed

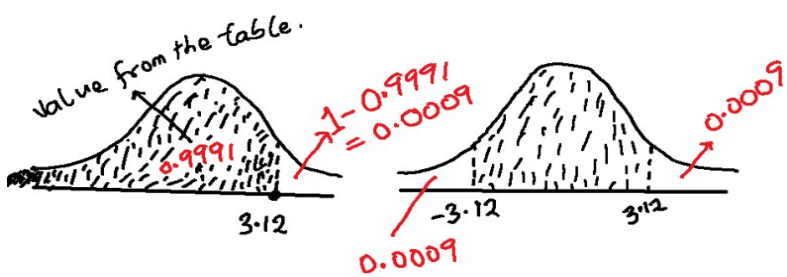
$|Z_{cal}| = 3.12$. Since it is two-tailed, $Z_{cal} = \pm 3.12$

Cumulative Probabilities for the Standard Normal (Z) Distribution



Values in the table correspond to the area under the curve of a standard normal random variable for a value at or below z.

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.9	0.9981	0.9982	0.998							
3.0	0.9987	0.9987	0.998							



From the cumulative probability Z-table above, Z = 3.12 has a cumulative area (probability) of 0.9991.

The one-tailed p-value: $p_{one-tailed} = 1 - 0.9991 = 0.0009$
Therefore, the two-tailed p-value: $p_{two-tailed} = 2 \times 0.0009 = 0.0018$
Decision Rule:

- If $p \leq \alpha$ → reject the null hypothesis (H_0)
- If $p > \alpha$ › fail to reject H_0

So, in our case: $0.0018 < 0.05 \implies$ Reject H_0

Rejecting the null hypothesis means there is statistically significant evidence that post-intervention scores differ from pre-intervention scores. Since the median increased, I can conclude the intervention led to an improvement in the emotional engagement and confidence of the students

4.3.12 The Effect Size

$$r = \frac{Z}{\sqrt{N}} = \frac{-3.12}{\sqrt{17}} = -0.757$$

Using Cohen's (1988) guidelines:

r value	Interpretation
0.10	Small effect
0.30	Medium effect
0.50+	Large effect

Absolute value of r is reported because effect size describes magnitude, not direction.

Our $|r| = 0.757$ = Large effect.

This means the intervention had a strong practical impact, not just statistical significance.

So, I reject the H_0:

H_0: There is no significant difference in emotional engagement and confidence scores before and after the intervention.

Now, what is the direction of the impact?

Notice that in the ranking (see the table above), the positive ranks outweigh the negative ranks. The difference = post-intervention − pre-intervention.

4.4 The Qualitative Analysis (Section D of the Questionnaire)

Theory underpinned:

> *Expectancy-Value Theory (EVT) explains that students' motivation is influenced by two factors: their expectancy of success in a task and the perceived value of that task (Eccles & Wigfield, 2002).*

The section D (question No 16) of the questionnaire forms the qualitative part of this analysis.

The question is:

> *'How do you feel about learning Maths at college?'*

It is an open-ended question. It aimed to explore students' attitudes, emotional engagement, and motivation, before and after the vocationally contextualised lessons.

4.4.1 Pre-Intervention Responses

Before the intervention, many students expressed negative emotions towards mathematics. Responses were short and often reflected anxiety, low confidence, or lack of motivation. For example, students wrote things like: 'Hard', 'Don't like it', 'Stressful', 'Not confident', and 'I struggle'

These responses indicate:

- Low expectancy — students seemed very doubtful of making it in maths
- Low value — they didn't quite see the relevance maths to their course or future careers.

These align with Expectancy-Value Theory, which predicts that low expectancy and low perceived value lead to disengagement."

4.4.2 Post-Intervention Responses

After the intervention, the tone of the responses shifted noticeably. Students wrote things like: 'More confident', 'Useful for my course', 'Practical examples help', 'I can do it', and 'Proud'.

This shows an increase in both expectancy — students felt more capable — and perceived value — they could see how maths relates to their vocational studies. According to Expectancy-Value Theory, this combination drives higher motivation and engagement, which is consistent with the positive change I observed in the quantitative data.

4.4.3 Coding

Pre-Intervention			**Post-Intervention**	
Response	**Code**		**Response**	**Code**
Hard	Perceived difficulty		More confident	Increased confidence
Don't like it	Negative attitude		Makes sense	Improved understanding
Stressful	Anxiety		Useful for my course	Perceived relevance
Not confident	Low confidence		Less nervous	Reduced anxiety
Hate maths, un	Strong negative emotion		Practical examples help	Contextual learning impact
Makes me nervous	Maths anxiety		More motivated	Increased motivation
Boring	Low engagement		Proud	Positive emotional response

4.4.4 Themes

There were other responses not contained in the code table above. But in summary, our themes came out of these emerging patterns:

1. Perceived Relevance and Practical Value
2. Motivation and Engagement
3. Confidence and Reduced Anxiety
4. Understanding through Contextualisation

Pre-Intervention responses were mostly negative, short, or anxious; frequency is low, reflecting limited engagement.

Post-Intervention responses showed positive shift, with higher frequency in each theme.

Theme 1: Perceived Relevance and Practical Value

- Pre-Intervention: 4/17
  - Only 4 students mentioned anything showing maths is relevant to their course or future.
  - Most responses were negative, e.g., "I don't see why I need it", "Boring", "Hard", "Too many numbers".
  - Indicates low perceived value before the lessons.
- Post-Intervention: 15/17
  - After the vocationally contextualised lessons, 15 students wrote responses indicating relevance.
  - Quotes: "Useful for my course", "Practical examples help", "It's okay when linked to real life".
  - Shows a clear increase in perceived value — students now see how maths applies to their learning and careers.

Interpretation: Massive positive shift in perceived value, supporting Expectancy-Value Theory.

Theme 2: Motivation & Engagement

- Pre-Intervention: 3/17
  - Only 3 students mentioned anything that could indicate engagement or motivation,
  - Most responses reflected low interest or negative attitude.
  - Indicates low emotional and behavioural engagement before the lessons.
- Post-Intervention: 14/17
  - After intervention, 14 students described positive feelings or motivation.
  - Quotes: "More motivated", "I enjoy it", "Proud".
  - Indicates a large increase in engagement and willingness to participate.

Interpretation: Vocational examples made maths more interesting, increasing motivation and engagement.

Theme 3: Confidence & Reduced Anxiety

- Pre-Intervention: 5/17
  - Only 5 students wrote anything reflecting confidence or low anxiety.
  - Quotes: "I struggle", "Makes me nervous", "Not confident".
  - Suggests low expectancy and high maths anxiety in most students.
- Post-Intervention: 12/17
  - 12 students now reported higher confidence or reduced anxiety.

- Quotes: "More confident", "I can do it", "Less nervous".
- Indicates improved self-efficacy and emotional engagement.

Interpretation: Contextualised lessons improved students' expectancy, aligning with *Expectancy-Value Theory*.

Theme 4: Understanding through Contextualisation

❖ Pre-Intervention: 6/17

- 6 students wrote something showing partial understanding.
- Quotes: "Confusing", "I don't get it", "Too many numbers".
- Most students struggled to make sense of maths before contextual examples.

❖ Post-Intervention: 13/17

- 13 students wrote responses showing better understanding through real-world examples.
- Quotes: "Makes sense with examples", "I understand more", "Clearer with real-world problems".
- Shows significant improvement in comprehension.

Interpretation: Contextualised, vocationally relevant examples helped students understand concepts, supporting the learning through practical application principle.

4.4.5 Qualitative Findings (Pre vs Post Shift)

Theme	Pre-Intervention (n=17)	Post-Intervention (n=17)	Interpretation / Meaning
Relevance of Maths	4/17 "Don't see why I need it" "Boring"	15/17 "Useful for my course" "Practical examples help" "Good when linked to real life"	Students increasingly recognise the value of maths for their course and career
Motivation & Engagement	3/17 "Boring" "Hard" "I struggle"	14/17 "More motivated" "I enjoy it" "Proud"	Engagement and willingness to participate improved; students show higher emotional and behavioural involvement.
Confidence & Reduced Anxiety	5/17 "Not confident" "Makes me nervous" "Stressful"	12/17 "More confident" "I can do it" "Less nervous"	Students' self-efficacy increased; maths anxiety reduced, reflecting higher expectancy
Understanding through Contextualisation	6/17 "Confusing" "I don't get it" "Too many numbers"	13/17 "Makes sense with examples" "I understand more" "Clearer with real-world problems"	Contextualised examples enhanced comprehension and practical understanding of concepts.

Key Takeaways

1. All themes show a substantial increase in the number of students mentioning them.
2. Relevance of Maths: 4 → 15 (largest improvement, shows value perception increased).

3. Motivation & Engagement: 3 → 14 (large increase, reflects emotional and behavioural engagement).
4. Confidence & Reduced Anxiety: 5 → 12 (shows improved expectancy).
5. Understanding through Contextualisation: 6 → 13 (better comprehension through context).

Some students said verbally: "The applications are making lots of sense."

So, in addition to written responses, informal verbal feedback indicated that students perceived greater clarity when mathematics was linked to vocational applications.

Overall: Pre-intervention numbers reflect low engagement, low confidence, low perceived relevance, and limited understanding. Post-intervention numbers show a clear positive shift across all dimensions, which directly supports your research aim of showing the impact of vocationally contextualised maths lessons.

4.5 Summary of the Findings

I employed a mixed-methods action research design to investigate the impact of vocationally contextualised mathematics teaching on Further Education (FE) students' engagement. Both quantitative and qualitative data were collected through pre- and post-intervention questionnaires, enabling a comprehensive evaluation of changes in students' attitudes, motivation, and engagement.

The quantitative strand addressed Research Questions 1–3 using a structured questionnaire comprising three Likert-scale sections: Behavioural Engagement, Perceived Relevance, and Emotional Engagement/Confidence. Mean scores were calculated for each section, and difference scores (post minus pre) were used to measure change following the intervention.

Statistical analysis showed that:

- Behavioural Engagement and Perceived Relevance data met normality assumptions and were analysed using paired t-tests. Both showed statistically significant improvements, supported by confidence intervals entirely above zero. Effect sizes (Cohen's $d = 4.19$ and 3.59 respectively) indicated very large practical impacts.
- Emotional Engagement and Confidence data violated normality assumptions and were analysed using the Wilcoxon Signed-Rank Test, which also revealed a statistically significant improvement ($p < 0.05$). The effect size ($r = 0.757$) demonstrated a large practical effect, with increased post-intervention scores.

Overall, the quantitative findings consistently indicate that vocationally contextualised teaching led to significant improvements across all three dimensions of engagement.

The qualitative strand (Research Question 4) was explored through an open-ended question grounded in Expectancy-Value Theory (EVT). Pre-intervention responses revealed predominantly negative attitudes, characterised by low confidence, anxiety, and limited perceived relevance of mathematics. In contrast, post-intervention responses showed a clear positive shift, with students expressing increased confidence, motivation, and recognition of mathematics as useful and relevant to their vocational studies.

Thematic analysis identified four key themes:

1. Perceived Relevance and Practical Value
2. Motivation and Engagement
3. Confidence and Reduced Anxiety
4. Understanding through Contextualisation

Across all themes, there was a substantial increase in positive responses post-intervention (e.g., relevance increased from 4 to 15 students, motivation from 3 to 14). These findings demonstrate that students not only became more engaged but also developed a stronger sense of purpose and capability in learning mathematics.

The integration of vocational contexts into mathematics teaching resulted in statistically significant and educationally meaningful improvements in students' engagement, attitudes, and confidence. The alignment

between quantitative and qualitative findings strengthens the conclusion that contextualised learning enhances both motivation and understanding, supporting the study's overall research aim.

5. DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter interprets the findings presented in Chapter 4 in relation to the research questions, theoretical frameworks, and existing literature. The aim is to move beyond describing results to explaining their meaning and significance within the Further Education (FE) context. The chapter also outlines key conclusions, identifies limitations of the study, and provides recommendations for teaching practice and future research.

5.2 Discussion of Findings in Relation to Research Questions

5.2.1 RQ1: Behavioural Engagement

The findings indicate a statistically significant increase in students' behavioural engagement following the vocationally contextualised intervention. The paired-samples t-test results, supported by a large effect size (Cohen's d = 4.19), demonstrate a substantial improvement in participation, effort, and classroom involvement.

This finding aligns with existing literature which suggests that engagement increases when learning is meaningful and relevant (Fredricks et al., 2004; Loes, 2022). By embedding mathematics within vocational contexts, students were more willing to participate actively in lessons. This supports constructivist perspectives (Dewey, 1938), where learners engage more deeply when tasks are connected to real-life experiences.

Furthermore, this result reinforces the principles of applied learning and vocational pedagogy (Gregson et al., 2020), which emphasise the importance of aligning academic content with learners' vocational identities. The increase in behavioural engagement suggests that students no longer viewed mathematics as an abstract requirement but as a useful tool within their chosen fields.

5.2.2 RQ2: Perceived Relevance of Mathematics

The results show a significant improvement in students' perceptions of the relevance of mathematics, with a large effect size (Cohen's d = 3.59). The confidence interval entirely above zero confirms that this change is both statistically and practically meaningful.

This finding strongly supports Expectancy-Value Theory, which posits that motivation increases when learners perceive a task as valuable and useful. Prior to the intervention, students demonstrated low perceived value, often questioning the necessity of mathematics. However, after the intervention, students recognised its applicability to their vocational courses and future careers.

This aligns with research by Loes (2022) and Gregson et al. (2020), which highlights that contextualised teaching enhances perceived utility and relevance. The dramatic shift observed (from 4 to 15 students recognising relevance) suggests that vocational contextualisation directly addresses one of the primary barriers to engagement identified in Chapter 1.

5.2.3 RQ3: Emotional Engagement and Confidence

The Wilcoxon signed-rank test revealed a statistically significant improvement in emotional engagement and confidence, with a large effect size (r = 0.757). This indicates that the intervention had a strong impact on students' affective responses to mathematics, including reduced anxiety and increased confidence.

This finding is particularly important in the FE context, where learners often enter with prior negative experiences and low self-efficacy (MiFEC, 2017). The increase in confidence and reduction in anxiety suggests that contextualised learning can positively reshape students' emotional relationships with mathematics.

From a theoretical perspective, this again supports Expectancy-Value Theory, specifically the "expectancy" component. As students experienced success in meaningful, context-based tasks, their belief in their ability to succeed improved. This is consistent with Fredricks et al. (2004), who emphasise the role of emotional engagement in sustaining learning.

5.2.4 RQ4: Students' Attitudes and Experiences

Qualitative findings provide rich insight into how and why these changes occurred. Pre-intervention responses reflected negative attitudes, low confidence, and limited perceived relevance. In contrast, post-intervention responses demonstrated increased motivation, confidence, and understanding.

Thematic analysis identified four key areas of improvement:

- Perceived relevance and practical value
- Motivation and engagement
- Confidence and reduced anxiety
- Understanding through contextualisation

These findings strongly support situated learning theory (Lave & Wenger, 1991), which emphasises that learning is more effective when embedded in meaningful, real-world contexts. Students' comments such as "practical examples help" and "useful for my course" illustrate how contextualisation enabled them to make sense of mathematical concepts.

Importantly, the qualitative data complements the quantitative findings, providing evidence of triangulation. While statistical results show that change occurred, student voices explain that this change was driven by relevance, clarity, and applicability.

5.3 Overall Synthesis of Findings

Taken together, the findings demonstrate that vocationally contextualised mathematics teaching had a significant and meaningful impact on all dimensions of student engagement:

- Behavioural (participation increased)
- Cognitive (understanding improved)
- Emotional (confidence increased, anxiety reduced)

The consistency between quantitative and qualitative data strengthens the validity of the findings. This supports the study's central argument that contextualisation transforms mathematics from an abstract subject into a meaningful and relevant learning experience.

5.4 Conclusions

This study set out to explore the impact of vocationally contextualised mathematics teaching on FE GCSE students' attitudes, motivation, and engagement.

The key conclusions are:

1. Vocational contextualisation significantly improves engagement
   Students demonstrated increased participation, effort, and willingness to engage in mathematics lessons.
2. Perceived relevance is a critical driver of motivation
   When students understood how mathematics relates to their vocational goals, their motivation increased substantially.
3. Confidence and emotional engagement can be improved through context-based learning
   Students reported reduced anxiety and increased confidence, suggesting that contextualised teaching can reshape negative attitudes.
4. Learning becomes more meaningful when embedded in real-world contexts
   Students' improved understanding highlights the importance of linking abstract concepts to practical applications.

Overall, the study confirms that vocationally contextualised teaching is an effective pedagogical approach for improving engagement and attitudes in FE mathematics.

5.5 Limitations of the Study

While the findings are significant, several limitations should be acknowledged:

- Small sample size (n = 17): Limits generalisability to wider FE populations. Some of the who responded to the pre-intervention questionnaire were absent on the day I administered the post-intervention questionnaire
- Single research setting: Results are context-specific and may vary across different colleges or vocational areas.
- The qualitative analysis was a little difficult because students' responses were too short. Many of them responded in one or two words only. Some of them refused to write. When I asked them, they only gave me their responses verbally.

These limitations suggest that findings should be interpreted cautiously, while still recognising their value within practitioner-led research.

5.6 Recommendations for Practice

Based on the findings, the following recommendations are proposed:

1. Integrate vocational contexts into mathematics teaching
   Teachers should embed real-world, course-specific examples to enhance relevance and engagement.
2. Adopt applied and experiential learning approaches
   Activities should involve practical problem-solving aligned with students' vocational interests.
3. Focus on building confidence and reducing anxiety
   Use supportive, context-based tasks that allow students to experience success.
4. Encourage reflective teaching practices
   Teachers should continuously adapt lessons based on student feedback and engagement levels.
5. Collaborate with vocational departments
   Cross-departmental planning can ensure mathematical content aligns with vocational curricula.

5.7 Recommendations for Future Research

Future studies could build on this research by:

- Conducting studies with larger and more diverse samples
- Exploring long-term impacts on achievement and retention
- Comparing contextualised teaching with traditional approaches
- Investigating differences across vocational subject areas
- Incorporating lesson observations or interviews for deeper qualitative insights

5.8 Final Reflection

This study highlights the importance of making mathematics meaningful for FE learners. When students see value in what they are learning and believe in their ability to succeed, engagement naturally increases. Vocationally contextualised teaching not only improves attitudes and motivation but also supports a more inclusive and effective learning environment.

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Finally, any opinions, interpretations, and conclusions expressed in this article are those of the author and do not necessarily reflect the views of the participating institution or any affiliated organisation.

NOTES

Note 1: Participant Information Sheet & Consent Form

Name of Researcher: Paschal Udoka Offor

Title of Action Research Project:

An Exploration of FE GCSE Students' Attitudes and Motivation towards Mathematics Lessons through a Vocationally Contextualised Approach

Participant Information:

I am conducting an action research project on An Exploration of FE GCSE Students' Attitudes and Motivation towards Mathematics Lessons through a Vocationally Contextualised Approach

If you consent to participate in this study, you will be asked to complete an anonymous questionnaire after one of my lessons.

Please note:

Participation in this study is entirely voluntary, and you may withdraw at any time without

providing a reason. Any data you provide will be anonymised, stored securely during the research, and immediately destroyed once the study is completed

Note

The findings of my study may be published in an academic journal at a later date, under the guidance of my academic tutor(s). Please rest assured that the identities of individuals and the identity of the institution where the research took place will be anonymised during the data collection, data analysis, and writing up stages.

Consent Form

Please initial box:

1. I confirm that I have read and I understand the participant information sheet	
2. I understand that my participation is voluntary	
3. I understand that I may withdraw my participation at any time	

4. I consent to the group interview being audio recorded	
5. I agree to take part in the action research project.	

Name of Participant:

Date:

Signature:

Note 2: QUESTIONNAIRE

Instructions to Students

This questionnaire asks about your views and experiences of learning Maths at college. There are no right or wrong answers. Please answer honestly. Your responses will be kept confidential and will not affect your course results.

Please tick **one box** for each statement.

Scale:
1 = Strongly Disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree

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Section A: Behavioural Engagement in Maths

No.	Statement	1	2	3	4	5
1	I pay attention during Maths lessons.	☐	☐	☐	☐	☐
2	I try my best to complete Maths tasks in class.	☐	☐	☐	☐	☐
3	I participate in Maths activities when asked.	☐	☐	☐	☐	☐
4	I stay focused during Maths lessons.	☐	☐	☐	☐	☐
5	I put effort into understanding Maths work.	☐	☐	☐	☐	☐

Section B: Perceived Relevance of Maths

No.	Statement	1	2	3	4	5
6	I understand how Maths is used in real-life situations.	☐	☐	☐	☐	☐
7	Maths feels relevant to my course or future career.	☐	☐	☐	☐	☐
8	I can see the purpose of learning Maths.	☐	☐	☐	☐	☐
9	Maths feels more meaningful when linked to real-world examples.	☐	☐	☐	☐	☐
10	I believe Maths skills will be useful outside college.	☐	☐	☐	☐	☐

Section C: Emotional Engagement and Confidence

No.	Statement	1	2	3	4	5
11	I feel confident in Maths lessons.	☐	☐	☐	☐	☐
12	I feel motivated to learn Maths.	☐	☐	☐	☐	☐
13	I enjoy Maths lessons.	☐	☐	☐	☐	☐
14	I feel positive about learning Maths at college.	☐	☐	☐	☐	☐
15	Maths does not make me feel anxious.	☐	☐	☐	☐	☐

Section D: Open-Ended Question

16. **How do you feel about learning Maths at college?** (You may write a few sentences.)