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Configurational Influence of Self-Efficacy, Learning Strategies, and Emotions on MOOC Learning Outcomes: An fsQCA Analysis

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Abstract: Measuring learning outcomes in Massive Open Online Courses (MOOCs) is challenging due to the learner diversity and the asynchronous nature of participation. The varying levels of the learner's characteristics, such as self-efficacy, emotions, motivation, learning strategies, and prior knowledge, interact in complex ways to shape the learning outcomes. While ample research exists on the factors influencing outcomes, limited attention has been given to their combined effects. This study employs fuzzy-set Qualitative Comparative Analysis (fsQCA) to investigate the configurations of factors influencing the cognitive, social, and self-growth outcomes in MOOCs. The study uses a dataset of 275 observations to highlight three significant findings: (1) the pathways leading to success differ substantially from those leading to limited outcomes, indicating asymmetry in causal pattern, (2) academic self-efficacy, motivated-learning strategies, and emotions emerge as key interacting conditions that indicate equifinality in achieving successful learning results, and (3) negative emotions, though peripheral, associates with perceived quality and learner satisfaction to support learning achievement. The findings emphasise the value of examining interactive combinations of variables instead of isolated variables and imply practical directions for MOOC design and instructional development.

Keywords: MOOC learning outcomes, self-efficacy, motivated learning strategies, achievement emotions, fuzzy-set Qualitative Comparative Analysis (fsQCA)

1. Introduction

Massive Open Online Courses (MOOCs) have expanded access to higher education by offering scalable and flexible learning options through platforms such as Coursera, edX, NPTEL, and FutureLearn (Guerrero et al., 2021). While democratising education, these online courses also present challenges in achieving consistent learning outcomes due to learner diversity and the self-paced mode of participation (Julia et al., 2021). Prior research highlights the influence of learner characteristics such as motivation, self-regulation, and engagement on academic success in digital environments (Albelbisi et al., 2021).

Despite the vast potential of MOOCs, understanding the factors that drive successful learning outcomes remains complex. Among these factors, **academic self-efficacy (ASE)**, or the belief in one's ability to achieve learning outcomes, is central to persistence and achievement (Allen et al., 2022; Bandura & Adams, 1977). Likewise, **achievement emotions**, conceptualised by the control-value theory (Pekrun, 2006), play a vital role in academic performance. This theory postulates that positive emotions, such as enjoyment and pride, enhance learning engagement, and negative emotions influence learning outcomes in complex ways (King & Areepattamannil, 2014; Pekrun & Linnenbrink-Garcia, 2012).

A third important construct is **motivated learning strategies (MLS)**, which integrate cognitive, emotional, and motivational processes such as goal setting, monitoring, and self-regulation, enabling learners to adapt effectively to online education (Pintrich et al., 1993). Unlike general learning strategies, MLS explicitly connect effort and persistence to

motivational beliefs, making them particularly critical in self-directed online environments. Together, ASE, achievement emotions, and MLS play pivotal roles in impacting **MOOC learning outcomes**, which can be conceptualised across cognitive (knowledge gains), social (collaborative participation), and personal growth (self-regulated learning) dimensions.

Although these factors have been studied individually, less attention has been given to the combined and interactive effects of the antecedents in shaping MOOC learning outcomes. Traditional statistical models often overlook such complex configurations of conditions. This study addresses this gap by employing **fuzzy-set Qualitative Comparative Analysis (fsQCA)** (Ragin, 2006) to explore how ASE, emotions, and MLS influence learning outcomes. These findings provide practical insights for course designers and educators seeking to improve learner satisfaction and achievement in large-scale online education.

2. Conceptual Framework

The conceptual framework (Figure 1) positions **academic self-efficacy, achievement emotions, and motivated learning strategies** as independent variables influencing **MOOC learning outcomes**, with additional moderating effects from perceived quality and satisfaction.

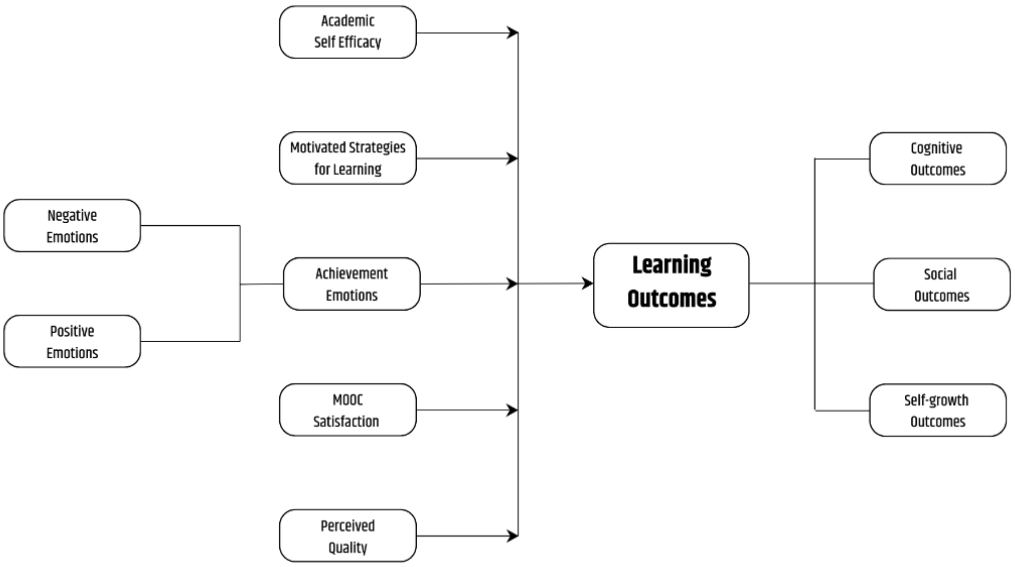

Figure 1. Conceptual framework influencing MOOC learning outcomes.

2.1 Independent Variables and Measures

The following variables were considered for this study based on the literature review of determinants affecting the learning outcomes. These constructs represent psychological and behavioural factors that shape learner engagement and achievements in MOOCs. Each variable was measured using well-established and validated scales to ensure reliability and comparability with prior research.

Academic Self-Efficacy (ASE) refers to learners' confidence in accomplishing academic tasks, influencing engagement and persistence (Honicke & Broadbent, 2016). This study measured ASE using the 8-item Self-Efficacy for Learning and Performance subscale of the Motivated Strategies for Learning Questionnaire (Pintrich et al., 1993). This scale captures the learner's belief in their ability to master course material, perform well on assignments, and achieve high grades, using a 7-point Likert scale format.

Achievement Emotions (AE) are emotional responses to learning activities and their outcomes (Pekrun, 2006). These include both positive emotions (PosEmo), such as enjoyment, hope, and pride, which enhance motivation and satisfaction and negative emotions (NegEmo), such as anxiety, anger, hopelessness, shame, and boredom, which may impede engagement but can also stimulate effort under certain conditions. Negative emotions are further categorised into two types: activating negative emotions (e.g., anxiety, anger, and hopelessness) and deactivating negative emotions (e.g., shame and boredom). A total of 22 items from the shortened standardised Achievement Emotions Questionnaire (AEQ) were employed to assess AE (Bieleke et al., 2021).

Motivated Learning Strategies (MLS) represent the cognitive and metacognitive strategies that help learners to regulate their learning, such as organising content, managing time, rehearsing, and applying problem-solving approaches, all of which contribute to academic success (Credé & Phillips, 2011). The MLS variable was measured using the MSLQ-B subscale, comprising 25 standardised items.

Perceived Quality (PQ) and Satisfaction (SA) were measured using a global, single-item scale to capture learners' overall perception of course design and learning experience. This parsimonious single-item approach was chosen since lengthy instruments may increase dropout rates or survey fatigue (Leung & Xu, 2013).

2.2 Dependent Variable – Learning Outcomes (LO)

Learning outcomes are conceptualised as a multidimensional construct comprising cognitive, social, and self-growth dimensions, providing a comprehensive view of how MOOCs contribute to learner development (Wei et al., 2021).

Each dimension was assessed using a standardised 5-item subscale adapted from (Zhoc et al., 2018), with learners self-evaluating their achievement at the conclusion of the online course.

- **Cognitive outcomes** capture knowledge acquisition, application, and problem-solving skills essential in self-directed online learning (Mayer, 2005).
- **Social outcomes** refer to collaboration, communication, and community-building that support learner engagement and persistence (Greenhow & Lewin, 2016).
- **Self-growth outcomes** emphasise self-regulation, reflection, and personal development, highlighting the transformative role of MOOCs in fostering autonomy and resilience (Dweck, 2007).

3. Methodology

This study employs **fuzzy-set Qualitative Comparative Analysis (fsQCA)**, a case-oriented method suitable for exploring causal complexity (Ragin, 2006). fsQCA identifies multiple pathways called configurations of conditions leading to the same outcome (**equifinality**) and distinguishes between successful and unsuccessful outcomes (**asymmetry**). Configurations are specific sets of causal variables that influence an observed variable of interest. This approach uses set theory and Boolean algebra to assess the complex combination of determinants through comparisons (Fernández-Esquinas et al., 2021).

Data and Sample

Survey data were collected from 275 MOOC participants across three Swayam MOOCs, with the majority having a master's degree and within the 25 to 44 age group. Learning outcomes were assessed through cognitive, social, and self-growth measures. Independent variables included academic self-efficacy (ASE), positive emotions (PosEmo), negative emotions (NegEmo), motivated learning strategies (MLS), perceived quality (PQ), and satisfaction (SA).

Calibration

Variables were calibrated into fuzzy sets using three anchors, namely, 0.95 (full membership), 0.50 (crossover), and 0.05 (full non-membership), based on percentile thresholds. This transformation ensured comparability across constructs.

Analysis Steps

- Necessity analysis tested whether single conditions consistently explained the outcome.
- Truth tables generated all possible condition combinations.
- Logical minimisation identified configurations (recipes) sufficient for high or low learning outcomes.
- The intermediate solutions were identified as the final group of solutions.

4. Results

4.1 Necessary Conditions

Academic Self-Efficacy (ASE) and Satisfaction (SA) emerged as conditions with high necessity consistency (above 0.80), suggesting that strong self-efficacy and a positive course experience often act as fundamental requirements for MOOC success.

4.2 Configurations for High Learning Outcomes

The fsQCA revealed the following multiple sufficient pathways for attaining learning outcomes:

- **Configuration 1:** ASE ● Positive Emotions ● SA → High Learning Outcomes (Learners with strong self-efficacy, enjoyment, and satisfaction achieved consistently significant gains in learning performance.)
- **Configuration 2:** ASE ● MLS ● PQ → High Learning Outcomes (Even in the absence of pronounced emotional states, individuals with strong ASE, effective learning strategies, and perceived course quality attained high outcomes.)
- **Configuration 3:** ASE ● Sub-mean Negative Emotions ● SA → High Learning Outcomes (Manageable levels of negative emotions, e.g., anxiety that motivates persistence, combined with ASE and satisfaction supported achievement.)

4.3 Configurations for Low Learning Outcomes

- **Configuration 4:** Low ASE ● High Negative Emotions ● Low SA → Poor Learning Outcomes
- **Configuration 5:** Low PQ ● Low MLS → Poor Learning Outcomes

The sequence of configurations holds significance, as it reflects the relative magnitude of the outcome variable. Higher-order configurations, such as Configuration 1, correspond to elevated levels of achievement, whereas at the lower end, Configuration 4 exhibits the smallest presence of the study variable, followed by Configuration 5.

5. Discussion

The findings confirm that no single variable ensures MOOC success, but rather, configurations of self-efficacy, emotions, strategies, and course perceptions collectively shape outcomes.

- ASE is a core condition across most pathways, aligning with Bandura's (1977) view that self-efficacy directs effort and persistence.
- Achievement emotions matter, but their role is contextual. Positive emotions (e.g. enjoyment, pride) enhance engagement, while manageable negative emotions (e.g. anxiety) may push learners to invest more effort, which is in line with control-value theory (Pekrun, 2006).
- MLS and PQ act as complementary conditions, even when emotions are mixed, strong strategies and high-quality course design can drive success.
- Satisfaction (SA) appears consistently in high-outcome pathways, reinforcing its role in sustaining engagement and promoting course completion.

These findings demonstrate causal equifinality (different pathways leading to the same outcome) and asymmetry (conditions for outcome success differ from failure), which is central to fsQCA reasoning.

6. Conclusion

This study highlights the importance of configurations of learner and course-related factors in shaping MOOC learning outcomes. Self-efficacy and satisfaction consistently emerge as central drivers, but their impact is amplified when combined with emotional states, motivated strategies, and perceptions of course quality. Importantly, when moderate, negative emotions may not always be detrimental but can contribute to persistence and achievement. By applying fsQCA, this research moves beyond linear models to show how different constellations of factors can yield successful or unsuccessful outcomes.

7. Practical Implications

- For MOOC designers: Enhance learner satisfaction through clear structure, interactive design, and feedback mechanisms.
- For instructors: Foster academic self-efficacy via scaffolding, timely support, and self-regulation prompts.
- For learners: Awareness of emotional regulation and adopting motivated learning strategies can improve success.

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