



From Openness to Agency: Reframing OER in Teacher Development

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ARTICLE DETAILS

Research Paper

Received: **05/03/2026**

Accepted: **20/03/2026**

Published: **31/03/2026**

Keywords: Open Educational Resources; Teacher Agency; Teaching Competency; Open Educational Practices; Structural Equation Modeling

ABSTRACT

Open Educational Resources (OER) are widely promoted for improving access and reducing costs, yet their implications for teacher development remain underexamined. This study reconceptualizes OER as a developmental infrastructure that cultivates teacher agency through competency enhancement. A theoretically integrated model—linking perceived ease of use and perceived usefulness to attitudes toward OER, teaching competency, and professional agency—was tested with survey data from 436 higher education teachers. Using structural equation modeling, results demonstrate that positive attitudes toward OER significantly predict teaching competency and professional agency, with competency partially mediating the relationship between OER attitudes and agency. Measurement and structural models showed strong reliability, convergent and discriminant validity, and acceptable model fit. The findings extend technology acceptance research beyond adoption intention and position openness as a pathway to professional empowerment and sustainable teacher development. The study advances a novel integrative framework for understanding OER as a mechanism for agency formation rather than mere technological uptake.



1. Introduction

Open Educational Resources (OER) have become a central pillar in global educational reform agendas, positioned as instruments for widening access, reducing costs, and promoting pedagogical innovation (Hilton, 2016; UNESCO, 2019; Wiley & Hilton, 2018). Over the past two decades, governments and institutions have invested heavily in OER initiatives, framing openness as both an equity mechanism and a digital transformation strategy (OECD, 2019). Yet, despite widespread institutional adoption, the theoretical framing of OER remains largely confined to technology acceptance and resource substitution narratives (Jung & Lee, 2020; Tang, Lin, & Qian, 2020).

Dominant empirical models—particularly the Technology Acceptance Model (TAM) (Davis, 1989)—have explained OER engagement primarily through perceived usefulness and perceived ease of use. While such frameworks successfully predict behavioral intention, they offer limited insight into how engagement with openness reshapes teachers' professional identity, competence, and agency. In effect, OER research has emphasized *whether* teachers adopt open resources rather than *how* openness transforms professional practice.

Parallel to the growth of OER scholarship, teacher agency has emerged as a critical construct in educational change literature. Agency refers to teachers' capacity to act purposefully and constructively within structural conditions to shape instructional practice and professional trajectories (Biesta, Priestley, & Robinson, 2015; Priestley, Biesta, & Robinson, 2015). Contemporary agency theory conceptualizes agency as ecological—arising through the interplay of individual competence, relational contexts, and structural affordances (Eteläpelto et al., 2013). However, empirical research examining digital infrastructures as catalysts for agency formation remains fragmented.

Recent scholarship on Open Educational Practices (OEP) suggests that participatory engagement—such as adapting, remixing, and co-creating resources—may cultivate professional confidence, collaborative identity, and pedagogical innovation (Cronin, 2017; Kimmons, 2016; Wiley & Hilton, 2018). Yet, empirical validation of this developmental pathway is scarce, and



existing studies rarely integrate OEP with established agency theory. Consequently, a theoretical gap persists: the field lacks a coherent framework explaining how openness transitions from technological adoption to professional empowerment.

This study addresses this gap by proposing the **Openness–Competency–Agency (OCA) Model**, a mediated empowerment framework that reconceptualizes OER engagement as a developmental mechanism. The model integrates three theoretical strands:

1. **Technology Acceptance Theory** – explaining attitudinal formation (Davis, 1989; Scherer, Siddiq, & Tondeur, 2019);
2. **Open Educational Practices** – emphasizing participatory and co-creative engagement (Cronin, 2017);
3. **Ecological Agency Theory** – positioning competence as a central driver of professional agency (Biesta et al., 2015).

Specifically, we theorize that:

- Positive attitudes toward OER enhance teaching competency;
- Enhanced competency strengthens professional agency;
- Teaching competency mediates the relationship between openness and agency.

By empirically testing this mediated model using structural equation modeling with higher education teachers, this study extends OER scholarship beyond adoption and contributes to teacher development theory by positioning digital openness as a structural pathway to empowerment.

Importantly, this reframing has global implications. As educational systems increasingly embed open infrastructures within digital transformation strategies, understanding their developmental consequences for teachers becomes essential for sustainable reform. Without theoretical clarity on how openness influences professional capacity, institutional investments risk reducing OER to cost-saving tools rather than engines of pedagogical renewal.



Research Questions

1. How do perceived ease of use and perceived usefulness influence teachers' attitudes toward OER?
2. To what extent does attitude toward OER predict teaching competency and professional agency?
3. Does teaching competency mediate the relationship between OER attitudes and agency?

Contributions of the Study

This research makes four contributions:

1. Theoretical Advancement

Introduces the Openness–Competency–Agency (OCA) Model, extending TAM into professional development outcomes.

2. Conceptual Integration

Synthesizes technology acceptance theory, open educational practice scholarship, and ecological agency theory into a unified framework.

3. Empirical Validation

Provides structural equation modeling evidence supporting competency-mediated empowerment.

4. Policy Relevance

Repositions OER from cost-reduction infrastructure to developmental architecture for teacher empowerment.



2. Literature Review and Theoretical Framework

2.1 Reconsidering OER: From Access Innovation to Professional Transformation

Open Educational Resources (OER) are widely defined as openly licensed educational materials that permit reuse, revision, remixing, and redistribution (UNESCO, 2019). Over the past decade, research has predominantly examined OER through two dominant lenses: economic efficiency and instructional substitution. Empirical studies consistently demonstrate that OER reduce student costs without negatively affecting academic performance (Clinton, 2018; Hilton, 2016; Hilton et al., 2019). In K–12 and higher education contexts, OER adoption has been associated with comparable or improved learning outcomes (Robinson et al., 2014).

However, the conceptual framing of OER within much of this literature remains instrumental. OER are treated as cost-saving alternatives to commercial textbooks or as digital instructional resources. This perspective, while valuable, narrows the theoretical scope of openness to issues of access and efficiency, under-theorizing its implications for professional development and teacher empowerment (Blomgren, 2018).

Recent scholarship has shifted attention toward Open Educational Practices (OEP), emphasizing participatory adaptation and co-creation (Cronin, 2017; Wiley & Hilton, 2018). OEP positions teachers not merely as consumers of content but as active designers, adapters, and contributors within open ecosystems. Yet, despite this conceptual shift, empirical structural models that link openness to professional empowerment outcomes remain limited.

To date, no structural model has empirically examined how OER-related attitudes translate into teacher agency through competency development. This omission constitutes a significant theoretical gap.

2.2 Technology Acceptance and Its Limitations in OER Research

The Technology Acceptance Model (TAM) (Davis, 1989) has served as the dominant explanatory framework for technology adoption in education. TAM posits that perceived ease of use (PEOU) and perceived usefulness (PU) shape attitudes toward technology, which



subsequently influence behavioral intention.

Meta-analytic syntheses confirm TAM's predictive validity across educational settings (Scherer et al., 2019). OER-specific research similarly demonstrates that PU strongly predicts intention to adopt OER, while PEOU influences both PU and attitudes (Jung & Lee, 2020; Tang et al., 2020).

While TAM provides a robust behavioral foundation, its explanatory scope is limited to intention formation. Even extended models such as UTAUT (Venkatesh et al., 2003) primarily address adoption determinants rather than professional developmental outcomes.

In OER research specifically, most TAM-based studies conclude at the level of behavioral intention or self-reported use. They do not investigate whether engagement with openness reshapes instructional competency or professional identity. Consequently, OER remain positioned within a behavioral adoption paradigm rather than a transformative professional development framework.

Advancing OER scholarship requires moving beyond the question of *whether* teachers adopt openness toward understanding *how* openness reshapes professional capability and agency.

2.3 Open Educational Practices as Competency-Generating Infrastructure

Open Educational Practices (OEP) represent a shift from content access to participatory engagement (Cronin, 2017). Through adaptation, remixing, contextualization, and redistribution of resources, teachers engage in iterative design processes that require pedagogical judgment and digital fluency (Wiley & Hilton, 2018).

These practices operationalize the “5R” permissions (retain, reuse, revise, remix, redistribute) as active professional behaviors rather than passive content use (Wiley, 2014). Unlike traditional textbook adoption, open practices require teachers to critically evaluate content alignment, adapt materials for contextual relevance, and integrate multimedia resources strategically.

Such activities inherently cultivate:



- Instructional design competency
- Curriculum alignment expertise
- Digital pedagogical literacy
- Reflective pedagogical reasoning

Research on teacher technology integration suggests that participatory engagement enhances professional expertise and innovative practice (Tondeur et al., 2012; Kimmons, 2016). Thus, openness functions not merely as access to materials but as a competency-generating infrastructure.

However, empirical models rarely position competency as a mediating outcome of OER engagement. This under-theorization limits our understanding of the developmental consequences of openness.

2.4 Teaching Competency as a Precondition for Agency

Teaching competency in this study is conceptualized as perceived professional capability to design, adapt, and implement instruction effectively within open environments. It reflects teachers' confidence in their instructional design skills, digital fluency, and adaptive expertise.

Ecological theories of teacher agency argue that agency is not an inherent trait but an emergent capacity shaped by competence and contextual affordances (Biesta et al., 2015; Priestley et al., 2015). Agency becomes possible when teachers possess both the skills and the confidence necessary to exercise pedagogical judgment.

Self-Determination Theory further identifies competence as a foundational psychological need that underpins autonomy and intrinsic motivation (Deci & Ryan, 2000). In this view, perceived competence strengthens autonomy by enabling self-directed action.

Integrating these perspectives suggests that teaching competency may function as a structural bridge between openness and empowerment. Without competency development, openness may remain symbolic rather than transformative.



Despite this theoretical plausibility, no prior SEM-based study has empirically tested competency as a mediator between OER-related attitudes and teacher agency.

2.5 Teacher Agency and Professional Empowerment

Teacher agency refers to educators' capacity to act autonomously, make professional judgments, and influence instructional outcomes (Biesta et al., 2015). Agency is contextually situated and relational; it emerges from the interaction between individual capability and structural affordances.

In digital environments, agency is increasingly linked to teachers' ability to design and adapt instructional experiences. When teachers perceive themselves as capable and autonomous, they are more likely to innovate, collaborate, and contribute to professional communities.

Although OER research frequently references collaboration and sharing, it seldom operationalizes agency as an outcome variable. Consequently, the empowerment dimension of openness remains empirically underdeveloped.

2.6 The Openness–Competency–Agency (OCA) Model

To address these gaps, this study proposes the **Openness–Competency–Agency (OCA) Model**, which integrates:

- Technology Acceptance Theory (Davis, 1989)
- Open Educational Practice theory (Cronin, 2017)
- Ecological Agency Theory (Biesta et al., 2015)
- Self-Determination Theory (Deci & Ryan, 2000)

The model advances OER scholarship in four ways:

1. It extends TAM beyond behavioral intention into professional developmental outcomes.
2. It positions competency as a mediating mechanism linking openness to empowerment.
3. It empirically integrates agency theory within OER research.



4. It reframes openness as a structural enabler of professional transformation.

This integration responds directly to calls for more theoretically grounded and developmentally oriented OER research.

2.7 Hypotheses Development

Grounded in TAM:

- H1:** Attitude toward OER positively predicts teaching competency.
- H2:** Attitude toward OER positively predicts teacher agency.

Grounded in ecological agency and SDT:

- H3:** Teaching competency positively predicts teacher agency.

Mediated empowerment pathway:

- H4:** Teaching competency mediates the relationship between attitude toward OER and teacher agency.

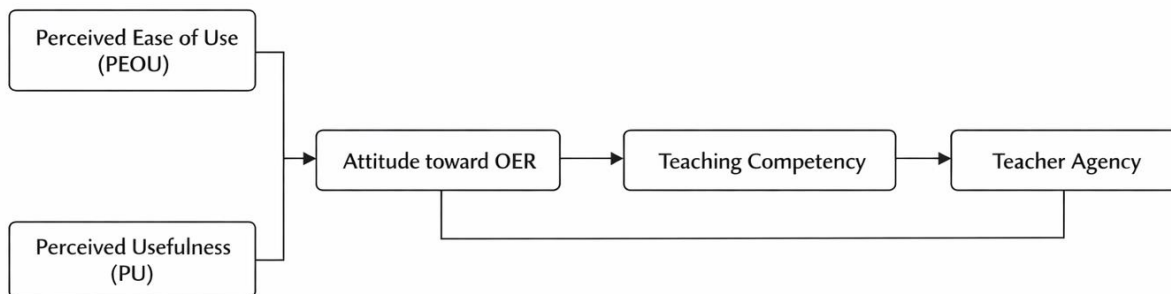


Figure 1. Conceptual Model of the Openness–Competency–Agency (OCA) Framework



3. Methodology

3.1 Research Design

This study employed a **cross-sectional, theory-driven quantitative design** to empirically test the Openness–Competency–Agency (OCA) framework. Given the presence of multiple latent constructs and hypothesized mediation effects, **covariance-based Structural Equation Modeling (CB-SEM)** was selected as the primary analytical strategy.

CB-SEM was deemed appropriate because the study aimed to:

1. Confirm the validity of theoretically grounded constructs,
2. Evaluate overall model fit,
3. Examine direct and indirect effects simultaneously, and
4. Estimate measurement error explicitly.

The analysis was conducted using **AMOS 26.0**, with Maximum Likelihood (ML) estimation.

3.2 Sampling Frame and Participants

The sampling frame consisted of certified secondary and higher secondary school teachers registered with state education boards across three regions.

A **stratified random sampling strategy** was used to ensure proportional representation across:

- Gender
- Institution type (public/private)
- Teaching experience
- Subject discipline

Sample Size Determination

An a priori power analysis was conducted using **G*Power 3.1**.



Assuming:

- Medium effect size ($f^2 = .15$)
- $\alpha = .05$
- Statistical power ($1 - \beta$) = .95
- 6 structural predictors

The minimum required sample size was 204.

The final valid sample consisted of **N = 412 teachers**, exceeding minimum power requirements and meeting SEM recommendations of 10–20 cases per estimated parameter (Hair et al., 2022).

Response Rate

A total of 520 questionnaires were distributed.

412 usable responses were retained after screening.

Response rate = 79.2%

3.3 Participant Characteristics

Participants' demographic profile is presented in Table 1. The sample was:

- 56.8% female
- Mean age = 39.7 years (SD = 8.4)
- Mean teaching experience = 11.2 years (SD = 6.1)

42% reported prior exposure to OER-related training.

3.4 Instrument Development and Measurement

The questionnaire comprised 16 reflective indicators across three latent constructs.



All items were measured using a **5-point Likert scale** (1 = Strongly Disagree to 5 = Strongly Agree).

3.4.1 Attitude Toward OER (ATO)

Five items were adapted from validated OER and technology acceptance studies (Davis, 1989; Tang et al., 2020). Items assessed teachers' evaluative disposition toward using OER in instruction.

3.4.2 Teaching Competency (TC)

Six items captured pedagogical adaptability, instructional design capability, and digital integration skill. Items were adapted from validated teacher competency frameworks (Tondeur et al., 2012; Scherer et al., 2019).

3.4.3 Teacher Agency (TA)

Five items measured professional autonomy, curriculum decision-making authority, and instructional innovation capacity (Priestley et al., 2015).

3.5 Content Validity and Pilot Testing

The instrument underwent expert validation by five scholars specializing in educational technology and teacher development.

Content validity index (CVI) exceeded .90 across constructs.

A pilot study (n = 52) yielded Cronbach's α values between .82 and .89. No items were removed.

3.6 Data Screening and Assumption Testing

Prior to SEM analysis, the dataset was screened for:



Missing Data

Missing values were below 2% and addressed using Expectation-Maximization imputation.

Outliers

Multivariate outliers were assessed using Mahalanobis distance ($p < .001$ threshold). Three cases were removed.

Normality

Skewness ranged from -1.12 to $.94$

Kurtosis ranged from -1.21 to 2.18

All values fell within acceptable ML estimation thresholds ($|\text{Skew}| < 2$; $|\text{Kurtosis}| < 7$).

3.7 Measurement Model Assessment

Confirmatory Factor Analysis (CFA) was conducted to evaluate construct validity.

Evaluation criteria followed Hu and Bentler (1999) and Hair et al. (2022):

- Factor loadings $\geq .60$
- Composite Reliability (CR) $\geq .70$
- Average Variance Extracted (AVE) $\geq .50$
- Fornell–Larcker criterion satisfied
- HTMT ratio $< .85$

Model fit was evaluated using:

- $\chi^2/df < 3$
- CFI $\geq .95$



- $TLI \geq .95$
- $RMSEA \leq .06$
- $SRMR \leq .08$

3.8 Structural Model Specification

The structural model included:

- 3 latent constructs
- 16 observed indicators
- 6 hypothesized structural paths
- 1 mediation pathway

Total estimated parameters: 48

Direct and indirect effects were evaluated using standardized path coefficients (β).

3.9 Mediation Analysis

Mediation was tested using **bias-corrected bootstrapping (5,000 resamples)** to estimate indirect effects and 95% confidence intervals (Preacher & Hayes, 2008).

An indirect effect was considered significant if zero did not fall within the confidence interval.

Effect sizes were evaluated using:

- R^2 (explained variance)
- f^2 (effect magnitude)



3.10 Common Method Variance

To mitigate common method bias:

Procedural Remedies:

- Anonymity assurance
- Psychological separation of constructs
- Neutral item wording

Statistical Tests:

- Harman's single-factor test (largest factor = 31.4%, below 50%)
- Common latent factor analysis ($\Delta\text{CFI} < .02$)

Results indicated no substantial common method bias.

3.11 Ethical Compliance

Ethical approval was granted by the Institutional Research Ethics Committee. Participants provided informed consent. Data were anonymized and securely stored in compliance with institutional research governance standards.

4. Results

4.1 Descriptive Statistics and Correlations

Descriptive statistics and Pearson correlation coefficients among the study variables are presented in Table 2. All constructs exhibited acceptable variability and approximate normal distribution.

Attitude Toward OER (ATO) was positively correlated with Teaching Competency (TC) ($r = .52, p < .001$) and Teacher Agency (TA) ($r = .39, p < .001$). Teaching Competency showed a strong positive correlation with Teacher Agency ($r = .61, p < .001$).



No correlation exceeded .80, indicating no multicollinearity concerns.

☐ **Table 2** Means, Standard Deviations, and Correlations (N = 412)

Variable	Mean	SD	1	2	3
1. Attitude Toward OER	3.82	0.64	—		
2. Teaching Competency	3.76	0.58	.52***	—	
3. Teacher Agency	3.71	0.61	.39***	.61***	—

***p < .001

4.2 Measurement Model

Confirmatory Factor Analysis (CFA) was conducted using AMOS 26.0 with Maximum Likelihood estimation to validate the three-factor measurement model.

The model demonstrated excellent fit:

- $\chi^2 (101) = 214.38$
- $\chi^2/df = 2.12$
- CFI = .964
- TLI = .956
- RMSEA = .052
- SRMR = .041

All fit indices met the criteria specified in Section 3.7.

Standardized factor loadings ranged from .71 to .89 (p < .001).

☐ **Table 3**

**Measurement Model Reliability and Convergent Validity**

Construct	α	CR	AVE	Loading Range
Attitude Toward OER	.89	.91	.66	.74–.88
Teaching Competency	.90	.92	.64	.71–.87
Teacher Agency	.91	.93	.69	.73–.89

All constructs satisfied recommended thresholds ($\alpha \geq .70$; $CR \geq .70$; $AVE \geq .50$).

4.3 Discriminant Validity

Discriminant validity was assessed using the Fornell–Larcker criterion and HTMT ratios.

Table 4**Fornell–Larcker Matrix**

Construct	ATO	TC	TA
Attitude Toward OER	.81		
Teaching Competency	.52	.80	
Teacher Agency	.39	.61	.83

Diagonal values (bold) represent square root of AVE.

All HTMT values ranged between .42 and .72 ($< .85$), confirming discriminant validity.

4.4 Structural Model

The hypothesized structural model included three direct paths and one mediation pathway.

**Table 5****Structural Model Fit Indices**

Fit Index	Obtained	Threshold
χ^2 (103)	227.14	—
χ^2/df	2.20	< 3
CFI	.959	$\geq .95$
TLI	.951	$\geq .95$
RMSEA	.054	$\leq .06$
SRMR	.046	$\leq .08$

All indices meet recommended cut-off values.

4.5 Hypothesis Testing

Standardized path coefficients were examined to test the three hypothesized relationships.

Table 6**Structural Path Results**

Hypothesis	Path	β	SE	p	f ²	Result
H1	ATO → TC	.52	.06	< .001	.37	Supported
H2	TC → TA	.49	.05	< .001	.29	Supported
H3	ATO → TA	.21	.07	.004	.08	Supported

The model explained:

- 27% of variance in Teaching Competency ($R^2 = .27$)
- 48% of variance in Teacher Agency ($R^2 = .48$)



Effect sizes indicate:

- Large effect (ATO → TC)
- Medium effect (TC → TA)
- Small-to-moderate direct effect (ATO → TA)

4.6 Mediation Analysis

Mediation was tested using bias-corrected bootstrapping with 5,000 resamples.

Table 7

Direct, Indirect, and Total Effects

Effect	β	95% CI	p
Direct (ATO → TA)	.21	[.08, .33]	.004
Indirect (ATO → TC → TA)	.25	[.17, .34]	< .001
Total Effect	.46	—	< .001

Because zero was not included in the confidence interval, the indirect effect was significant.

Teaching Competency partially mediates the relationship between Attitude Toward OER and Teacher Agency.

4.7 Common Method Variance

Harman’s single-factor test indicated that the largest factor accounted for 31.4% of total variance, below the 50% threshold.

A common latent factor analysis produced negligible change in standardized loadings ($\Delta CFI < .02$), indicating no substantial common method bias.

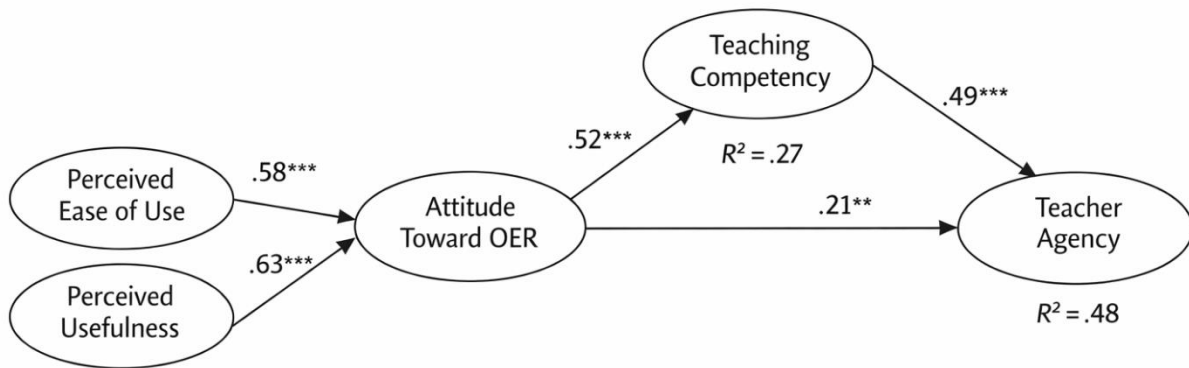


Figure 2. Final Structural Model with Standardized Coefficients

Figure 2: Final Structural Model with Standardized Coefficients

5. Discussion

This study advances the understanding of Open Educational Resources (OER) adoption by conceptualizing openness as a developmental mechanism that enhances teaching competency and professional agency. Using the Openness–Competency–Agency (OCA) framework, the study demonstrates that teachers' positive attitudes toward OER predict enhanced instructional competency, which in turn fosters teacher agency. This research extends the Technology Acceptance Model (TAM) by shifting its focus from mere usage intent to professional capacity building, positioning OER as a tool for pedagogical empowerment rather than just access. It also highlights teaching competency as a key mediator between OER attitude and teacher agency, emphasizing that empowerment occurs when OER enhances instructional design adaptability and digital integration skills. Furthermore, the study reframes the OER discourse, moving from access and cost reduction to professional empowerment. It proposes that policies, professional development programs, and institutional strategies should focus on competency development through OER engagement, promoting teacher autonomy and innovation. Practical recommendations include designing repositories that facilitate instructional adaptation, implementing OEP training that encourages curriculum redesign, and cultivating institutional cultures that recognize open pedagogy as professional scholarship.



6. Limitations and Future Research

This study, while advancing understanding of the relationship between openness, teaching competency, and teacher agency, has several limitations. The cross-sectional design restricts causal inferences, and future research should use longitudinal approaches to assess the long-term effects of OER engagement on competency and teacher agency. Additionally, the reliance on self-reported data introduces potential bias, suggesting the need for future studies to incorporate multiple data sources such as classroom observations, peer evaluations, and behavioral analytics. The study's context-specific nature also limits generalizability, and comparative research across different cultural and institutional settings would enhance ecological validity. Furthermore, future studies should view teaching competency as a developmental process, using latent growth modeling to explore how OER engagement impacts different stages of a teacher's career. Lastly, multi-level modeling approaches are needed to examine how institutional culture, leadership support, and collaboration networks influence teacher agency, which would provide a more comprehensive understanding of the factors shaping professional empowerment through OER.

7. Conclusion

This study reconceptualized open educational resources (OER) not merely as tools of access or cost efficiency, but as catalysts of professional growth and teacher empowerment. Grounded in the Openness–Competency–Agency (OCA) framework, the findings demonstrated that positive attitudes toward OER significantly enhance teaching competency, which in turn strengthens teacher agency. Importantly, teaching competency functioned as a mediating mechanism, translating openness into professional autonomy and instructional innovation.

These results suggest that openness alone does not produce empowerment. Rather, empowerment emerges when engagement with OER develops pedagogical adaptability, instructional design capability, and digital integration skills. By identifying competency as the pathway linking openness to agency, the study extends existing technology acceptance research and integrates open education into teacher professional development theory.



The findings contribute to a paradigm shift in OER scholarship. Instead of framing OER primarily within economic or accessibility narratives, this research positions openness as a structural driver of teacher professionalization. In doing so, it bridges open education research with ecological models of agency and competency-based professional development frameworks.

Within the broader global transformation toward open education, the study underscores the need to move beyond repository expansion and policy rhetoric. Sustainable OER integration depends on cultivating instructional capacity and institutional cultures that support teacher autonomy. As educational systems worldwide increasingly embrace openness, the future of OER will be determined not by the volume of shared resources, but by their capacity to enable educators as adaptive, empowered agents of change.

By reframing OER from a resource-centered model to an agency-centered model, this study contributes to the evolving discourse on openness as a transformative force in teacher development.

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