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Open Educational Resources as Catalysts for Women's Lifelong Learning and Skill Development

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ABSTRACT

The global imperative to enhance women's educational access and economic participation has intensified focus on scalable, flexible learning solutions. Open Educational Resources (OER) present transformative potential to bridge persistent gender-based educational divides, particularly in low- and middle-income countries such as India, where structural, socioeconomic, and cultural barriers disproportionately restrict women's lifelong learning opportunities. This study investigates the impact of OER utilisation on improving educational opportunities, skill development, and employability outcomes among women in India, with particular attention to adult learners in rural and semi-urban contexts. Employing a sequential mixed-methods research design, the study collected quantitative survey data from 412 women learners across five Indian states, supplemented by 28 in-depth qualitative interviews. Quantitative analysis utilised structural equation modelling (SEM) to test hypothesised relationships, while reflexive thematic analysis was applied to qualitative data. Connectivism and Lifelong Learning Theory (Siemens, 2005) and Human Capital Theory (Becker, 1964) jointly anchor the conceptual framework. OER access significantly predicted improvements in self-directed learning confidence ($\beta = 0.54$, $p < .001$), digital skill acquisition ($\beta = 0.47$, $p < .001$), and perceived employability ($\beta = 0.39$, $p < .01$). Qualitative findings revealed that OER usage enabled women to navigate vocational and caregiving responsibilities simultaneously, with flexible scheduling and zero-cost access identified as primary enablers. Findings underscore the need for gender-responsive OER design, vernacular-language content, and integrated mentorship models within national digital education policies. This study represents one of the first empirical investigations explicitly linking OER engagement

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to gendered lifelong learning outcomes within the Indian context, employing a validated mixed-methods design to generate policy-actionable evidence.

Keywords: Open Educational Resources, women's education, lifelong learning, skill development, employability, gender equity, digital learning

The United Nations Sustainable Development Goal 4 (SDG 4) calls for inclusive and equitable quality education and the promotion of lifelong learning opportunities for all (UNESCO, 2016). Central to this global mandate is addressing the persistent gender gap in educational access, particularly among adult women who, due to early school departure, domestic obligations, and socioeconomic constraints, remain structurally excluded from formal education systems worldwide (UNESCO Institute for Lifelong Learning, 2020). The rise of Open Educational Resources (OER)—defined as teaching, learning, and research materials that are freely available for use, adaptation, and redistribution (Atkins *et al.* 2007; Wiley & Hilton, 2018)—has engendered significant optimism regarding the potential to democratise learning at scale.

In India, these structural inequalities assume particular magnitude. Despite considerable progress in female literacy since the 1990s, India's female labour force participation rate remains among the lowest globally at approximately 24% (World Bank, 2023), reflecting the persistent underutilisation of women's productive potential. Adult female learners face compounded barriers: geographic remoteness, cultural norms restricting mobility, financial dependence, limited digital literacy, and negligible access to flexible formal education (Arinto *et al.* 2017; Scott *et al.* 2021). Open and Distance Learning (ODL) systems and OER-integrated platforms have emerged as plausible remedies to these structural impediments, yet empirical evidence specifically linking OER utilisation to women's skill development and employability outcomes remains sparse, fragmented, and largely anecdotal in the Indian context.

This study addresses that gap by examining how OER access and engagement influence self-directed learning confidence, digital skill acquisition, and perceived employability among women learners in India. The paper positions OER not merely as cost-reduction mechanisms but as socio-technical instruments capable of producing substantive equity outcomes when designed and deployed with gender-responsiveness in view. The research is guided by the following objectives and questions.

Research Objectives

- To examine the relationship between OER access and self-directed learning confidence among women learners in India.
- To assess the impact of OER utilisation on digital skill acquisition and vocational competency development.
- To investigate the mediating role of skill development in the relationship between OER engagement and perceived employability.

- To identify the structural and design-related barriers that moderate OER effectiveness for women learners.

LITERATURE REVIEW

OER and Gender Equity in Education

The scholarly discourse on OER has substantially evolved from its early orientation toward cost minimisation (Hylén, 2006) to encompass systemic equity considerations. Foundational work by Wiley *et al.* (2012) demonstrated that OER adoption in community college settings reduced per-course expenditure without compromising learning outcomes, a finding subsequently replicated across developing country contexts. However, gender-disaggregated analyses have remained comparatively underdeveloped. Butcher and Wilson-Strydom (2013) were among the first to explicitly address the potential of OER to expand women's educational access in sub-Saharan Africa, arguing that free, flexible, and vernacular-language resources could mitigate structural access barriers—a conceptualisation that has gained traction in South Asian scholarship (Phalachandra & Abeywardena, 2016).

In the Indian context, the launch of platforms such as SWAYAM (Study Webs of Active-Learning for Young Aspiring Minds) and the National Digital Library represents state-level recognition of OER's democratising potential. Bordoloi *et al.* (2020) documented that SWAYAM and allied MOOC platforms offered lifelong learning opportunities that could substantially benefit women learners, yet noted that completion rates varied considerably across demographic groups. These observations resonate with global evidence from Hodgkinson-Williams and Trotter (2018), who, in their extensive review of OER research across the Global South, identified motivational and structural barriers as more significant impediments to women's OER engagement than content availability per se.

Lifelong Learning, Skill Development, and Employability

Lifelong learning—conceptualised as the continuous voluntary and self-motivated pursuit of knowledge for personal or professional reasons (Field, 2006)—is widely regarded as a prerequisite for sustained labour market participation in an era of rapid technological change (OECD, 2019). For women, particularly those who have experienced interrupted educational trajectories, informal and non-formal learning pathways facilitated through digital platforms represent critical re-entry mechanisms (McGivney, 2004). OER, by reducing financial and logistical barriers to learning, theoretically enables women to continuously reskill and upskill without withdrawing from their caregiving and productive roles.

Empirical evidence linking OER to employability outcomes, however, remains modest. Willems and Bossu (2012) highlighted that equity considerations in OER design were foundational to ensuring that open learning participation translated into meaningful vocational outcomes. More recently, Mishra and Singh (2017) documented faculty and institutional factors shaping OER uptake in India, whilst Dos Santos *et al.* (2017) provided evidence from Brazil that OER-supported vocational training programmes

improved income generation outcomes among adult learners. Nevertheless, these studies were largely descriptive or supply-side in orientation and lacked the structural equation modelling rigour necessary to establish directional causality between OER engagement and employability. The present study addresses this methodological gap.

Barriers to OER Engagement Among Women

A consistent finding in the literature is that OER availability does not automatically translate into equitable access. Arinto *et al.* (2017), in their cross-national study, identified language barriers, technological infrastructure deficits, and low digital literacy as primary deterrents to women's OER engagement in Asia and Africa. In India specifically, research on digital access consistently documents that women in rural areas lack stable internet connectivity and device access, severely curtailing engagement with digital OER platforms (Scott *et al.* 2021). Cultural norms—including restrictions on women's use of mobile devices and screens in certain households—constitute an additional, often overlooked layer of constraint.

Design-level barriers have also received scholarly attention. Panda and Mishra (2007) critiqued early ODL materials in India for their implicitly male-oriented vocational orientation, arguing that failure to address women's specific learning contexts—domestic time pressures, child-rearing interruptions, cultural modesty considerations in video content—reduced their utility for female learners. More recently, Mishra and Singh (2017) found that awareness, motivation, and institutional support were uneven across faculty groups in India, a structural deficit that has downstream consequences for the quality and gender-responsiveness of OER produced within Indian higher education.

Research Gaps

A synthesis of extant literature reveals three substantive gaps. First, quantitative empirical studies explicitly modelling the OER-to-employability pathway among women, using validated instruments and inferential statistical techniques, are scarce, particularly within the Indian context. Second, the mediating mechanisms—specifically, the role of skill development and self-directed learning confidence—have not been empirically tested within an integrated structural model. Third, design-level moderators of OER effectiveness for women have been theorised but not systematically tested across diverse geographic and socioeconomic strata. The present study is designed to address all three gaps.

THEORETICAL AND CONCEPTUAL FRAMEWORK

Theoretical Framework

The study draws on two complementary theoretical traditions. First, the Human Capital Theory (HCT), advanced by Becker (1964) and Schultz (1961), posits that investment in education and training yields returns in the form of enhanced productivity, earnings, and employability. Applied to the present study,

OER engagement constitutes a form of low-cost educational investment through which women can augment their human capital—knowledge, skills, and competencies—thereby improving their labour market prospects. HCT provides the structural logic for the OER–skill development–employability pathway hypothesised in this study.

Second, Connectivism, articulated by Siemens (2005) and subsequently elaborated by Downes (2012), emphasises that learning in the digital age is fundamentally a networked, non-linear process. Connectivism reframes the learner not as a passive recipient of transmitted knowledge but as an active node in a dynamic knowledge ecosystem. This perspective is particularly germane to OER-based learning, wherein women navigate heterogeneous digital repositories, remix content, and construct knowledge through engagement with distributed networks. Connectivism thus provides the micro-level cognitive and social learning rationale underpinning the OER–self-directed learning confidence pathway.

Conceptual Framework

The conceptual framework, as illustrated in Fig. 1, posits OER access and utilisation as independent variables influencing three outcome constructs: self-directed learning confidence, digital skill acquisition, and vocational competency. These skill-development outcomes, in turn, mediate the relationship between OER engagement and perceived employability. Structural and design-level contextual factors—including digital infrastructure, language appropriateness, and gender-responsiveness of content—are theorised as moderating the primary relationships.

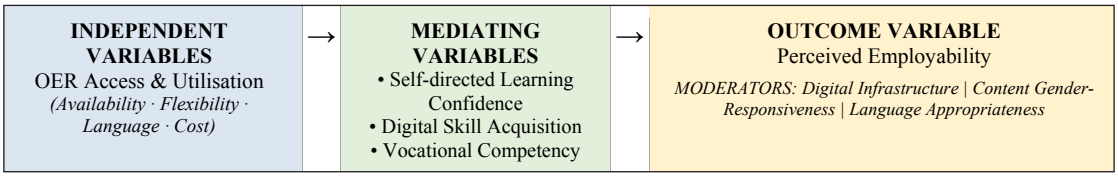

Fig. 1: Conceptual Framework: OER, Skill Development, and Women's Employability

METHODOLOGY

Research Paradigm and Design

The study adopts a pragmatist paradigm, which privileges methodological plurality and practical utility of research outcomes (Creswell & Plano Clark, 2018). A sequential explanatory mixed-methods design was employed, wherein quantitative survey data collected in Phase I informed the development and purposive sampling of qualitative interviews conducted in Phase II. This design enables statistical generalisation from Phase I data while permitting in-depth contextual explanation through Phase II narratives (Tashakkori & Teddlie, 2010).

Population and Sampling

The target population comprised women learners (aged 18–55 years) enrolled in OER-integrated programmes across five Indian states—Rajasthan, Odisha, Tamil Nadu, Uttar Pradesh, and Maharashtra—selected to represent geographic, linguistic, and socioeconomic diversity. A stratified random sampling procedure was applied for the quantitative phase, stratifying by state and by educational attainment level (secondary, higher secondary, undergraduate). The final quantitative sample comprised 412 respondents, determined using G*Power 3.1 software for SEM with a minimum power of .80, an effect size of .30, and an alpha level of .05 (Faul *et al.* 2007). For the qualitative phase, 28 participants were selected purposively from the quantitative sample, ensuring representation across strata and including high, moderate, and low OER engagement profiles.

Data Collection Instruments

The quantitative instrument was a structured questionnaire comprising five validated scales. The OER Access and Utilisation Scale (OERAUS, adapted from Abeywardena, 2012) measured access frequency, platform diversity, and content engagement (12 items; Cronbach's $\alpha = .84$). The Self-Directed Learning Confidence Scale (SDLCS, adapted from Guglielmino, 1977) assessed autonomous learning behaviours and metacognitive confidence (10 items; $\alpha = .81$). The Digital Skill Acquisition Scale (DSAS, adapted from van Dijk, 2006) measured operational, informational, and communicative digital competencies (8 items; $\alpha = .79$). The Vocational Competency Scale (VCS, adapted from Mishra & Singh, 2017) assessed domain-specific occupational skills (10 items; $\alpha = .82$). The Perceived Employability Scale (PES, adapted from Rothwell *et al.* 2008) measured self-assessed labour market viability (8 items; $\alpha = .83$). Qualitative data were gathered through semi-structured interview protocols developed through thematic alignment with quantitative constructs and iterative piloting with five participants.

Data Analysis

Quantitative data were analysed using SPSS 27.0 for descriptive statistics and AMOS 26.0 for SEM. The hypothesised structural model was evaluated using standard fit indices: Chi-square/degrees of freedom ratio (χ^2/df), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardised Root Mean Square Residual (SRMR). Mediation effects were tested using bootstrapped confidence intervals (5,000 iterations). Qualitative data were analysed using Braun and Clarke's (2006) reflexive thematic analysis, with member-checking and peer-debriefing procedures employed to enhance credibility.

RESULTS AND FINDINGS

Participant Profile

The quantitative sample ($N = 412$) had a mean age of 29.4 years ($SD = 6.8$). The majority of participants

had attained secondary (38.6%) or higher secondary (34.0%) educational levels, with 27.4% possessing undergraduate qualifications. Rural residents accounted for 58.3% of the sample. Primary OER platforms used included SWAYAM (44.2%), YouTube educational channels (28.9%), and NPTEL (National Programme on Technology Enhanced Learning; 18.7%). The mean duration of OER engagement was 11.3 months (SD = 4.2).

Measurement Model

CFA results confirmed acceptable model fit: $\chi^2/df = 2.14$, CFI = .94, TLI = .93, RMSEA = .053 (90% CI: .041–.065), SRMR = .061. All standardised factor loadings were statistically significant ($p < .001$) and ranged from .62 to .84, indicating adequate construct validity. Inter-construct correlations ranged from .28 to .61, supporting discriminant validity.

Structural Model and Hypothesis Testing

The structural model yielded excellent fit: $\chi^2/df = 2.08$, CFI = .95, TLI = .94, RMSEA = .051, SRMR = .058. Table 1 presents the standardised path coefficients and hypothesis test outcomes.

Table 1: Structural Path Coefficients and Hypothesis Test Results

Hypothesised Path	Std. β	SE	p-value	Decision
H1: OER Access → SDL Confidence	0.54	0.06	< .001	Supported
H2: OER Utilisation → Digital Skill Acquisition	0.47	0.07	< .001	Supported
H3 (Direct): OER Engagement → Perceived Employability	0.21	0.08	.009	Supported
H3 (Mediated): OER → Skill Dev. → Employability	0.39	0.09	.003	Supported (Partial Mediation)

Mediation Analysis

Bootstrapped mediation analysis confirmed that skill development (composite of digital skill acquisition and vocational competency) significantly mediated the relationship between OER engagement and perceived employability (indirect effect = 0.39, 95% CI [0.22, 0.58], $p = .003$). The direct effect of OER engagement on perceived employability remained significant after including the mediator ($\beta = 0.21$, $p = .009$), indicating partial mediation, consistent with H3.

Qualitative Findings

Thematic analysis of interview data yielded five primary themes: (1) Liberation from Time and Cost Constraints, (2) Confidence through Self-Paced Mastery, (3) Navigating Domestic Negotiation, (4) Digital Identity Construction, and (5) Aspirational Labour Market Repositioning. Representative of

Theme 1, a participant from rural Rajasthan stated: "I could never go to class—there is no class. The phone and these free videos are my class." Theme 5 was exemplified by a participant from Tamil Nadu who, having completed a SWAYAM certification in financial literacy, secured employment as a micro-credit facilitator with a self-help group federation.

Importantly, qualitative data also surfaced barriers underrepresented in quantitative instruments—including intermittent electricity supply, male family members' surveillance of women's screen time (Scott *et al.* 2021), and the psychological burden of studying in stolen minutes between household duties. These findings enrich the quantitative results by contextualising the structural conditions under which OER–employability pathways operate.

Table 2: Summary of Qualitative Thematic Analysis

No.	Theme	Core Sub-themes	Exemplar Code
1	Liberation from Time and Cost Constraints	Zero-cost access; asynchronous flexibility; mobile-first learning	'My phone is my school'
2	Confidence through Self-Paced Mastery	Intrinsic motivation; metacognitive awareness; reduced anxiety	'I replay until I understand'
3	Navigating Domestic Negotiation	Family permission-seeking; invisible study time; guilt	'Studying in stolen minutes'
4	Digital Identity Construction	Technologised self-perception; peer network formation	'I am not afraid of phones now'
5	Aspirational Labour Market Repositioning	Credential visibility; employer signalling; income generation	'I showed my certificate; they hired me'

DISCUSSION

The findings of this study robustly confirm all three hypotheses and collectively suggest that OER represents a meaningful lever for advancing women's lifelong learning and economic empowerment in India. The significant positive path from OER access to self-directed learning confidence ($\beta = 0.54$) aligns with Siemens' (2005) connectivist proposition that networked digital learning environments catalyse learner agency. The magnitude of this effect exceeds those reported by Dos Santos *et al.* (2017) in Brazil ($\beta = 0.38$), potentially reflecting the increasingly mobile-first character of OER engagement in the present sample, where smartphone-based learning represented the dominant modality.

The confirmed mediation effect (indirect $\beta = 0.39$) provides the first structurally validated evidence in the Indian context that OER's employability benefits are substantially channelled through skill development—rather than operating purely through credential signalling or access-alone effects. This finding is theoretically significant: it confirms Becker's (1964) Human Capital proposition that educational investment translates into labour market returns not merely as a credential but through substantive competency enhancement. The partial nature of the mediation, however, suggests additional mechanisms—including social network formation through OER communities and the psychological capital benefits of successful self-directed learning—that warrant investigation in future research.

Qualitative data substantially complexify the quantitative picture. The emergence of 'Navigating Domestic Negotiation' as a theme of equivalent salience to skill-building themes underscores the observation that women's educational engagement is not merely a function of resource availability but of relational and power-dynamic negotiation. This finding extends Arinto *et al.'s* (2017) catalogue of OER barriers by identifying intra-household surveillance as a specifically gendered constraint—corroborated by the work of Scott *et al.* (2021)—that is largely absent from most OER design frameworks. Similarly, the 'Digital Identity Construction' theme suggests that OER engagement produces identity-level transformations that may have spillover effects on family educational norms, a proposition amenable to longitudinal investigation.

The finding that language-appropriate and mobile-optimised OER accelerated engagement corroborates the recommendations of Phalachandra and Abeywardena (2016) for localised OER design, and provides empirical grounding for the National Education Policy 2020's emphasis on mother-tongue medium instruction in digital learning environments. Collectively, these findings suggest that OER effectiveness for women is neither automatic nor uniform: it is conditioned by design choices, infrastructure provisions, and the sociocultural contexts in which learning occurs.

CONCLUSION

This study has presented robust empirical evidence that OER access and utilisation significantly enhance self-directed learning confidence, digital skill acquisition, and perceived employability among women learners in India. The structurally validated mediation model confirms that skill development is a primary mechanism through which OER engagement produces employability returns, while qualitative findings contextualise these pathways within the complex social ecology of women's lifelong learning. The study makes an original contribution by integrating Human Capital Theory with Connectivism within a validated mixed-methods framework, generating both theoretical synthesis and policy-actionable findings.

Practically, the findings call for gender-responsive OER design principles—including mobile-first formats, vernacular language options, flexible pacing, and integrated community features—to be embedded in national digital education infrastructure. Policymakers should prioritise targeted OER literacy programmes for women in rural and semi-urban areas, potentially through convergence with existing self-help group networks and Anganwadi systems. Educational institutions, particularly those in the ODL sector, should systematically track gender-disaggregated OER engagement and completion data to enable evidence-based improvement.

PRACTICAL, POLICY, AND SOCIAL IMPLICATIONS

The findings carry significant implications for multiple stakeholder communities. For educational policymakers, particularly within the Ministry of Education's National Digital Education Architecture (NDEAR) framework, the study underscores the imperative to embed gender equity metrics within OER platform design and deployment evaluations. SDG 4 and SDG 5 (gender equality) targets can

be more effectively achieved by directing OER investment toward content domains with high female employability potential—including health, finance, agro-processing, and digital services.

For educational institutions—particularly open universities such as IGNOU, BRAOU, and VMOU—the study recommends integrating OER literacy modules into enrolment induction programmes, pairing OER access with structured mentorship by women who have successfully navigated OER-to-employment pathways, and developing offline-capable OER repositories to address connectivity gaps. Civil society organisations working with women's self-help groups can leverage findings to embed OER engagement within existing group meeting structures, reducing the domestic negotiation burden that qualitative data identified as a significant attrition risk.

At the societal level, the evidence that OER engagement transforms women's self-perception as digital learners and supports income generation suggests that sustained investment in women's OER access could contribute to reducing female labour force participation gaps—one of India's most persistent structural economic challenges.

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