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Perceptions of the quality of open online courses in OUSL from the perspective of deep learning

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Abstract

Purpose – The purpose of the paper is to investigate teachers' and students' perceptions of the quality of open online courses by identifying critical design elements that foster deep learning and 21st century skill acquisition, bridging the gap between the rapid expansion of Massive Open Online Courses (MOOCs) and their actual educational effectiveness.

Design/methodology/approach – Using a mixed-method approach, we analyzed data from more than 200 learners through structured questionnaires assessing skill mastery and learning experiences. These findings were triangulated with semi-structured interviews of 10 instructors at the Open University of Sri Lanka (OUSL). Quantitative and qualitative data convergence ensured methodological rigor.

Findings – Findings indicate a discrepancy between learner outcomes and instructional design in MOOCs. A notable gap exists between the design intentions of instructors and the learners' perceived achievement of deep learning outcomes. Inadequate professional scaffolding restricts learners' capacity to apply competencies in real-world situations. Institutional challenges continue to impede the development of effective online-offline learning communities in the context of technological and pedagogical reforms.

Originality/value – This research presents a Global South perspective on MOOC design, proposing context-sensitive strategies to enhance learner–instructor interactions. This work presents frameworks for aligning course design with deep-learning objectives and the development of 21st century competencies, thereby improving the quality of open education initiatives.

Keywords MOOCs, Open online courses, Deep learning, 21st-century skills,
Perception of high-quality MOOCs

Paper type Research article

1. Introduction

With the global proliferation of Massive Open Online Courses (MOOCs), the Open University of Sri Lanka (OUSL) has integrated Open Educational Practices (OEP) with Open Educational Resources (OER) to advance Continuing Professional Development through MOOCs (CPDMOOCs). It aims to foster a participatory, meaningful, reflective, collaborative and innovative pedagogical culture (Karunanayaka and Naidu, 2020). This study examines students' and teachers' perceptions of deep learning to evaluate course quality in OUSL and propose quality improvement pathways.

2. Recognizing and rethinking deep learning in MOOCs

2.1 Recognizing deep learning in MOOCs: modifying the 21st century competency framework

Learning and innovation skills, information, media and technology skills, and life and career skills, had been introduced into Chinese education studies at the beginning of the new century,

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by the publication skills for the 21st century: Learning for the Age in Which We Live. The establishment and advancement of these three skills depend on four foundational systems: standards and evaluation, curriculum and instruction, teacher professional development and learning environment. The initial category, "learning and innovation skills", emphasizes critical thinking, problem-solving, communication, collaboration, creativity and innovation, commonly referred to as the "4C" skills (Birnie and Charles, 2011). "7C" skills broaden the notion of 4C skills, including critical thinking, creativity, collaboration, cross-cultural understanding, communication, computation and career (Birnie and Charles, 2011). The 21st entury skills advocated by the United States have gained global recognition and significantly influence education practice. To fulfill the demands of 21st century skills, "deep learning", an innovative learning approach, has progressively gained global popularity. Deep learning is defined as the acquisition of six global competencies: character, citizenship, collaboration, communication, creativity and critical thinking (Michael *et al.*, 2020).

In 2012, the National Research Council of the United States published a report entitled Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st century, which examined the integration of deep learning and 21st century skills (Birnie and Charles, 2011). The report categorizes 21st century skills into three domains: cognitive abilities, self-abilities and interpersonal abilities (National Research Council, 2012), and it characterizes deep learning as the capacity to transfer knowledge acquired in one context to another (National Research Council, 2012). The notion of "transfer" connects 21st century skills with deep learning, utilizing previously acquired knowledge to facilitate the assimilation of new information or the development of problem-solving abilities in relevant cultural contexts. Deep learning emphasizes the process of knowledge internalization and the formation of knowledge transfer abilities. It is a crucial method for fostering students' 21st century skills and serves as a fundamental foundation for the advancement of smart education in the information era. The result of deep learning is transferable knowledge, encompassing both subject matter expertise and an understanding of how, why and when to utilize this information to address inquiries and resolve issues (National Research Council, 2012). Simultaneously, the Hewlett Foundation in the United States provided a comparable definition: deep learning encompasses the information and abilities essential for students to thrive in a swiftly evolving world. Deep learning enables students to comprehend fundamental academic material, engage in critical thinking and complex problem-solving, collaborate effectively, communicate proficiently and prepare for lifelong learning (The Hewlett Foundation, 2012).

In summary, deep learning prioritizes the "depth" of learning, positing that 21st century curriculum focuses more on the profound comprehension of knowledge and abilities than those of the preceding century (Kay and Greenhill, 2001). Secondly, deep learning emphasizes the "transferability" of knowledge and skills, emphasizing critical understanding of learning content and establishing connections with existing knowledge (Beattie *et al.*, 1997). As Bransford *et al.* (2000) notes, it also emphasizes "knowledge transfer, students' comprehension, and their problem-solving application of knowledge". Deep learning exhibits several salient characteristics, including comprehensive knowledge; critical thinking, creativity and innovation; entrepreneurial acumen and ethical decision-making; self-awareness and self-direction, encompassing the capacity to navigate one's own learning and development; as well as personality traits such as curiosity, perseverance and courage, which surpass the demands of 21st century skills (James, 2020). Thirdly, deep learning prioritizes "problem-solving", indicating that the acquisition of new knowledge or mastery of skills necessitates multiple stages in the learning process, along with advanced analysis and processing, enabling students to modify their thinking, self-regulation, or behavior to effectively apply this knowledge and skills (Eric and LeAnn, 2010). Consequently, learners can selectively acquire new content, establish connections with their original cognitive structure, transfer and apply it in specific teaching situations or practical problems, and employ critical thinking to solve practical problems under the premise of deep learning and

understanding. Thus, deep learning has undergone adaptation, integration and transcendence of 21st century competencies. The conceptualizations characterize deep learning as a pedagogical strategy and an aspirational outcome of 21st century education, which signifies a paradigm shift toward competency-based education. Although there is a well-established theoretical alignment between deep learning and these skills, the application of these principles in MOOCs reveals substantial pedagogical tensions that necessitate critical examination. Firstly, MOOCs "frequently prioritize quantity over quality, resulting in superficial discussions that fail to cultivate critical analysis or creative problem-solving" (Gao, 2014). Project-based assessments in MOOCs hardly replicate real-world complexity. These deficiencies underscore a "hollowing out" of skill acquisition. Secondly, the systemic difficulties in maintaining learner engagement are revealed by the notorious attrition rates of MOOCs. Although "high-achieving learners thrive in self-paced environments, others require scaffolding support mechanisms to achieve meaningful skill internalization" (Hu, 2021). Third, theoretical frameworks such as Fullan's "six global competencies" (Michael *et al.*, 2020) and Bellanca's focus on ethical leadership and curiosity (James, 2020) are predominantly aspirational in most MOOC situations. The prioritization of real-world problem-solving is essential for future designs to overcome these constraints.

2.2 Rethinking MOOC quality: perspectives on the integration of deep learning and 21st century skills

The emergence of MOOCs has provided advantages to numerous online learners, with their "quality" consistently attracting international attention (Downes, 2016). Conole developed a MOOC quality assessment scale encompassing 12 dimensions, including openness, large-scale engagement and multimedia utilization (Conole, 2013). Ehlers established quality standards for assessing MOOCs, which encompass course methods, usability and interactivity (Ehlers and Ossiannilsson, 2016). Hew believed that the criteria for a good open online course should meet five requirements: problem-based learning, good teachers, active learners, peer interaction and useful course resources (Hew, 2016). In China, high-order, innovative and challenging are the basic principles for promoting the construction of open online courses in first-class universities (Ministry of Education of the PRC, 2019), and these courses are also called "first-class courses" or "golden courses" (Dong, 2019). The evaluation criteria for university "golden courses" are thought to emphasize students' deep learning (Lü, 2020). The objective of open online courses is to facilitate learners in achieving deep learning as well.

To enable learners to acquire 21st century skills, teachers should purposefully design and teach courses to promote students' deep learning. Nonetheless, as Collins (2020) articulated at the outset of his book What's Worth Teaching? Rethinking Curriculum in the Age of Technology: The curricula implemented in educational institutions globally today can be traced to the early 20th century, comprising knowledge that is often irrelevant to adults, thereby hindering learners' comprehension of the knowledge acquired and its real-world applications. Conversely, Michael *et al.* (2020) posited a "fair assumption" in Deep Learning: Engage in the World, Change the World, asserting that deep learning is universally applicable, particularly for students who disengaged from school. This certainly offers boundless possibilities and chances for instruction and learning in open educational institutions. Integrating 21st century skills and deep learning into curricula and pedagogy is challenging. The "transfer" aspect of deep learning states that "deep learning can be understood as a process in which an individual applies knowledge acquired in one context to another; learning is for the purpose of transfer" (James and Margaret, 2020). Consequently, the concept of "transfer" aptly characterizes deep learning in open online courses, as fostering transferable knowledge and abilities aligns precisely with the demands of 21st century skills.

The international discussion over MOOC quality has primarily concentrated on technical metrics. Hew's five principles (problem-based learning, teacher quality, learner agency, peer interaction and resource utility) correspond with superficial quality measures yet neglect to

confront structural problems (Hew, 2016). While MOOCs advocate for universal access to deep learning, their design frequently mirrors the disengagement they purport to address. It reveals that developed countries have made great contributions towards MOOCs, and "the United States is the top contributor in terms of partner institutes, courses, and number of instructors" (Ayoub *et al.*, 2020). Pellegrino and Hilton's transfer theory highlights the importance of contextual adaptation; nonetheless, the majority of MOOC assessments are still decontextualized. To transcend these restrictions, the evaluation of MOOC quality must progress beyond global standardization to consider cultural relevance. This article seeks to integrate 21st century skills and deep learning within the investigation of teachers and students' perceptions of high-quality MOOCs at OUSL, aiming to identify viable strategies for enhancing the quality of open online courses.

2.3 Theoretical framework

This study performs a conceptual framework analysis based on the literature review results, focusing on two aspects: 21st century skills and deep learning. In practical applications, a comparison and integration of the two are conducted. This study examines the current perceptions of teachers and students regarding the design, operation and utilization of high-quality open online courses, focusing on the dimensions of learners' ability construction and deep-learning experience. Ability construction primarily denotes the process by which learners comprehend that open online courses can improve the learning experience, offer a real-world learning environment, foster collaboration, facilitate engagement in learning and enhance their skills. The deep-learning experience encompasses the ability of learners to selectively acquire new content from open online courses, integrate it with prior knowledge, transfer and apply it in various contexts, and employ critical and innovative thinking to address practical challenges. This study aims to investigate learners' perceptions of high-quality MOOCs in relation to the development of multiple competencies and skills in deep learning. The second objective is to examine and contrast the similarities and differences in perceptions of MOOC quality between students and teachers, specifically regarding its role in enhancing students' ability construction and deep-learning experiences from the viewpoints of learning and teaching.

Drawing on the synergies between 21st century skills and deep learning, this study adopts a dual-dimensional framework (Figure 1):

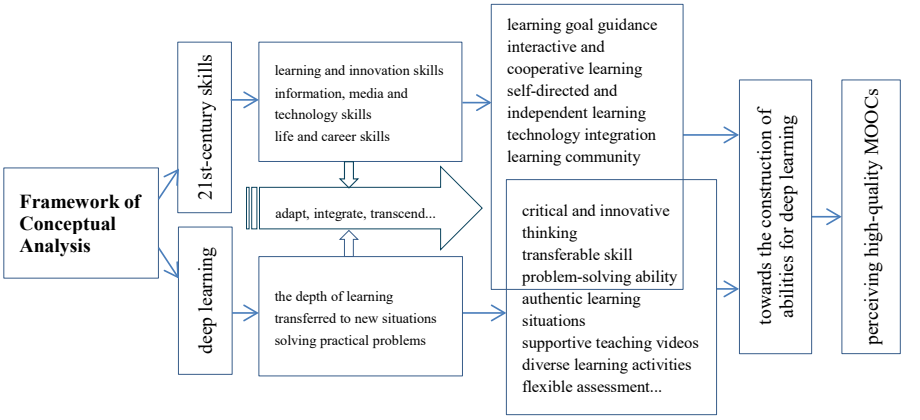

Figure 1. Framework of conceptual analysis. **Source(s):** Created by authors

(1) Learner competency development: Analyzing the impact of open online courses on knowledge construction, critical thinking and collaborative skills enhancement.

(2) Deep learning experience: Assessing learners' capacity for knowledge transfer, problem-solving and practical application.

3. Methodology

This study utilized a mixed-method approach, integrating both quantitative and qualitative components. In the quantitative section, a cross-sectional survey was employed to collect quantitative data, while in the qualitative section, in-depth interviews were conducted with faculty members. The fieldwork had been conducted during November and December, 2023 through institutional exchanges under the Asian Association of Open Universities (AAOU) Visiting Scholar Program.

3.1 Context, sampling and sample selection

This investigation concentrates on the teachers and students at the Open University of Sri Lanka (OUSL), which was founded in 1980 and is located in Colombo, the nation's capital. It is one of the 17 public universities in Sri Lanka. The institution manages eight regional centers and more than thirty learning centers across the nation, presently catering to over 40,000 students in higher education. The Open University of Sri Lanka consists of six faculties: Education, Engineering and Technology, Health Science, Humanities and Social Sciences, Natural Sciences and Management, in addition to one Teacher Development Center, with a total of 337 educators employed. The degree-granting education at OUSL features a comprehensive curriculum that successfully combines academic theory with practical application. The institution offers more than 1,600 courses, in addition to master's and doctoral degrees across various disciplines within each faculty.

A total of 231 student questionnaires were gathered through Google on the OUSL learning platform. The process commenced with a carefully chosen group of survey participants, subsequently employing snowball sampling to incrementally expand the sample size across all faculties. A total of 188 valid questionnaires were obtained, yielding a response rate of 81.39% (refer to Table 1).

Table 1. Basic information of subjects ($n = 188$)

Characteristic	Category	Number	Characteristic	Category	Number
Gender	Male	50	*Faculty*	Humanity and social	63
	Female	138		Natural Science	2
Age	20–29	84		Management	30
	30–39	74	*E-devices*	Mobile	76
	40–49	21		Computers	6
	Above 50	9		Laptops	29
Education	Diploma	57		M + C + L	77
	Bachelor	111	*Learning time*	Less than 10 h	25
	Postgraduate	16		10–19 h	25
	Others	4		20–29 h	30
Faculty	ET	1		30–39 h	32
	Education	15		40–49 h	16
	Health	77		More than 50 h	60

Note(s): Since there are no students below 20 years old among those who filled out the questionnaire, this age group is not included in the table. The number of students from the Faculties of Engineering and Technology and Natural Science who filled out the questionnaire is only 1 and 2, respectively, so these data are not included in the sample comparative analysis during statistics

Source(s): Created by authors

Ten teachers participate in in-depth one-to-one interviews using a semi-structured interview outline. This methodology integrates judgmental and quota sampling, both of which are forms of non-probability sampling, involving interviews with one to two teachers for each unit.

3.2 Instruments and procedures for data collection and analysis

This study utilizes a mixed-methods approach, combining quantitative and qualitative data collection techniques. This study employs questionnaires aimed at students, conducts interviews with educators and analyzes the perceived experiences of learners, designers and implementers of open online courses.

The student questionnaire is a Likert-scale questionnaire designed to evaluate knowledge integration and processing, critical thinking and problem-solving, collaborative learning dynamics and real-world applicability. This study primarily examines two dimensions: the construction of learning ability and the experience of deep learning, to understand perceptions of high-quality open online courses.

The questionnaire consists of a total of 20 items. Items are assessed using a five-point Likert scale, with responses of "strongly disagree", "disagree", "neutral", "agree" and "strongly agree" assigned scores from 1 to 5, respectively. Descriptive analysis, Cronbach's alpha, exploratory factor analysis, *t*-tests and ANOVA were employed to investigate and analyze the factors related to the quantitative data.

The in-depth interview is utilized to investigate teachers' perceptions regarding the quality of open online courses in connection with deep learning at the OUSL. The outlines for the teacher interview primarily focus on five aspects of open online course design: teaching objectives, situation creation, video resources, learning activities and transferable skills. Ten interviews with educators were carried out and recorded. The length of each teacher interview varies between 40 and 60 min, culminating in a total transcription of 22,000 words in English. Consequently, thematic analysis utilizes NVivo software to identify emerging patterns (Figure 2).

4. Findings

4.1 Demographic profiles of the respondents

Table 1 indicates that the majority of survey participants are female students, comprising 73.4% of the sample. Additionally, young individuals, defined as those under 40 years old, represent 84.0%, while students holding a bachelor's degree account for 59.0%. The participants predominantly belong to faculties including Health Sciences, Humanities and Social Sciences, Management and Education.

The questionnaires in this study undergo statistical analysis utilizing SPSS 25.0. An item analysis of the 20 items across two dimensions from 188 student questionnaires at the Open

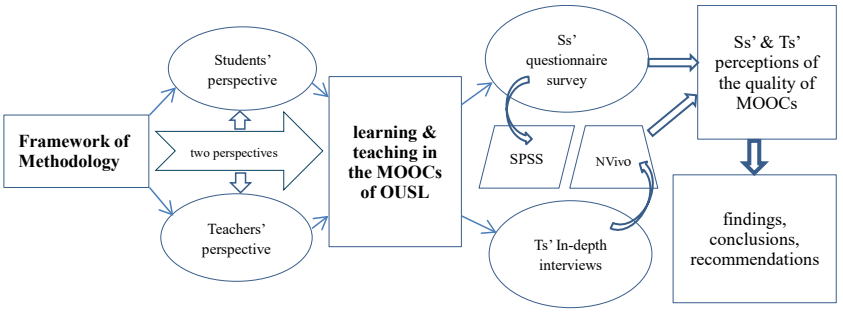

Figure 2. Framework of methodology. **Source(s):** Created by authors

University of Sri Lanka was conducted using a one-sample *t*-test. This analysis aimed to ascertain significant differences among the items based on the test results, thereby evaluating the suitability of all items for subsequent factor analysis. The findings indicate a KMO value of 0.901, with two-tailed test values consistently at 0.000 (refer to Table 2). Significant differences exist among all items, making them highly suitable for factor analysis, and no items require deletion.

4.2 Exploratory factor analysis

The results of the exploratory factor analysis indicate that the rotated component matrix represents the information sources of the extracted common factors. Four factors were renamed as promote knowledge comprehension and processing, promote deep-learning experience, promote social-emotional learning and solve practical life problems. The minimum loading for all items is 0.438, while the maximum loading is 0.789. The four factors account for 57.557% of the total variance (refer to Table 3), suggesting that the cumulative variance explained has achieved a satisfactory level.

4.3 Reliability, validity and difference tests

Subsequent to factor analysis, reliability and validity assessments are conducted on the questionnaire. Initially, the total scores of the items (or variables) within each factor are calculated. The findings regarding the reliability and validity assessments of the formal questionnaire are presented in Table 4 and Table 5.

(1) Reliability test

The Cronbach's alpha (α) coefficient, an internal consistency estimation method, has been employed to assess the reliability of the questionnaire. The reliability is classified as very

Table 2. Results of item analysis of student questionnaire (n = 188)

KMO quantity of sampling suitability		0.901
Bartlett's sphericity test	Approximately chi-squared	1607.011
	Degree of freedom	190
	Significance	0.000

Source(s): Created by authors

Table 3. Results of exploratory factor analysis of student questionnaires (n = 188)

Items	Factor 1	Factor 2	Interpretation rate (%)	Items	Factor 2	Factor 3	Factor 4	Interpretation rate (%)
a5	0.789		17.690	b7	0.573			
a9	0.687			b6	0.542			
a4	0.681			b3		0.726		12.291
a6	0.658			b2		0.698		
a8	0.625			b4		0.688		
a10	0.438			a7		0.472		
b9		0.745	17.092	a1			0.671	10.484
b8		0.690		a3			0.571	
b10		0.656		b1			0.531	
b5		0.594		a2			0.528	

Source(s): Created by authors

Table 4. Reliability test of student questionnaires (n = 188)

Factor	Total alpha coefficient	Promoting self-regulated learning	Promoting deep learning experiences	Promoting social-emotional learning	Promoting the connection between learning and life
Alpha coefficient	0.909	0.851	0.826	0.754	0.704

Source(s): Created by authors

Table 5. Validity test of student questionnaires (Pearson correlation) (n = 188)

Pearson correlation	General questionnaire	Promoting self-regulated learning	Promoting deep learning experiences	Promoting social-emotional learning	Promoting the connection between learning and life
General questionnaire					
Promoting self-regulated learning	0.868**				
Promoting deep learning experiences	0.854**	0.611**			
Promoting social-emotional learning	0.813**	0.567**	0.643**		
Promoting the connection between learning and life	0.794**	0.665**	0.549**	0.520**	

Note(s): $p < 0.01$ indicates a significant correlation

Source(s): Created by authors

satisfactory if the coefficient exceeds 0.8, satisfactory if it exceeds 0.7 and acceptable if it exceeds 0.6. Table 4 illustrates that the α-coefficients for each factor of the questionnaire range from 0.704 to 0.851, with an overall α-coefficient of 0.909, demonstrating strong reliability for the questionnaire (refer to Table 4).

(2) Validity test

The validity of the questionnaire can be established by analyzing the correlations among different factors and the relationships between each factor and the overall score. A higher correlation (above 0.6) between each factor and the total score indicates improved validity, while greater independence among factors, characterized by lower correlation, also enhances validity.

Table 5 illustrates a strong correlation between each factor in the student questionnaire and the total score, with correlation coefficients ranging from 0.794 to 0.868, all exceeding 0.6 and achieving statistical significance ($p < 0.01$). This suggests that each factor effectively represents the content intended to be measured by the questionnaire. The inter-group correlations among the factors range from 0.520 to 0.665, with all correlation degrees achieving significance ($p < 0.01$), indicating a high level of independence among the factors. The questionnaire demonstrates strong discriminant validity.

(3) Difference test

An independent-samples t-test was performed on questionnaires completed by students of varying genders. No significant difference exists in the perception of open online course

quality between male and female students across all factors. Subsequent analysis using variance (ANOVA) and post-hoc multiple comparison (LSD) indicated significant differences between undergraduate and junior-college students regarding factors such as "promote the connection between learning and life", time allocated to "promote deep-learning experience" and "promote social-emotional learning" (refer to Table 6 and Table 7).

Comparative analysis of the average values reveals significant differences between junior-college students ($m = 14.947$) and undergraduates ($m = 15.856$) regarding "Promote the connection between learning and life" (refer to Table 6). Students who study for less than 10 h ($m = 22.480$; 14.433) and those who study for more than 50 h ($m = 24.117$; 15.667) exhibit significant differences in their perceptions of factors such as "Promote deep-learning experience" and "Promote social-emotional learning", respectively (refer to Table 7). Undergraduates demonstrate a greater perception of the promotion of the connection between learning and life through the courses compared to junior-college students. Students dedicating over 50 h annually to their studies report a greater enhancement of deep learning experiences and social-emotional learning compared to those who invest fewer than 10 h. The distinctions between the two aspects indicate that an increase in the number of courses undertaken by students correlates with a higher educational level, while greater investment of time in the learning process is associated with improved perceptions of the quality of open online courses. This will enhance the connection between learning and real life, facilitate deep learning experiences and contribute to the formation of a learning community.

4.4 Quantitative analysis of the students' questionnaire

Descriptive statistics of the questionnaire results facilitate an understanding of students' overall perceptions of open online courses. The total score rate of each item can be determined by comparing the sum of its scores with the maximum value for that item. A higher score rate indicates a more favorable perception of the item's situation among students. The current questionnaire responses indicate a favorable perception of open online courses among students at OUSL, with scores generally between 70 and 80%. Figures 3–6 indicate that, with the exception

Table 6. Multiple comparisons of perceived curriculum quality differences among students with different academic qualifications (LSD) (removing insignificant items and duplicates)

	Educational level (I)	Educational level (J)	Mean-difference (I-J)	Sig
Promoting the connection between learning and life	diploma ($n = 57$)	bachelor ($n = 111$)	0.908*	0.006

Note(s): $p < 0.05$ indicates a significant difference

Source(s): Created by authors

Table 7. Multiple comparisons of students' perceived course quality differences with different learning time (LSD) (removing insignificant items and duplicates)

	Learning time(I)	Learning time (J)	Mean-difference (I-J)	Sig
Promoting deep learning experiences	less than 10 h ($n = 25$)	more than 60 h ($n = 60$)	1.637*	0.020
Promoting social-emotional learning			1.233*	0.026

Note(s): $p < 0.05$ indicates a significant difference

Source(s): Created by authors

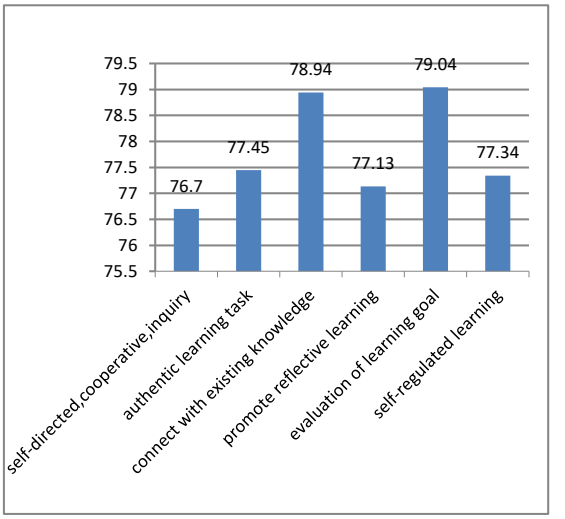

Figure 3. Promote self-regulated learning. **Source(s):** Created by authors

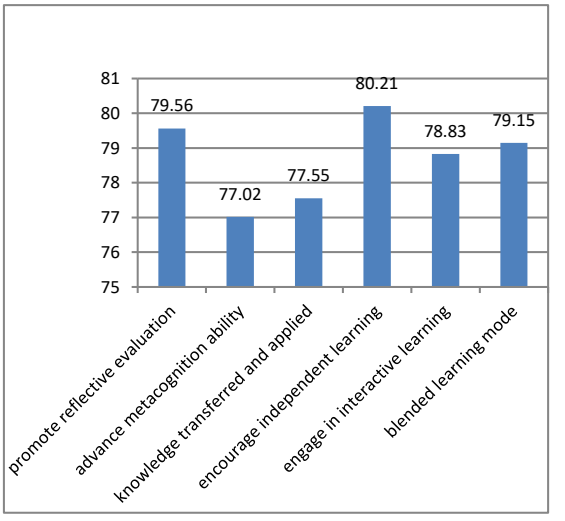

Figure 4. Promote deep learning experience. **Source(s):** Created by authors

of the item "to encourage independent learning" in Factor 2, which has a score rate of 80.2%, the score rates for the other items range from 73.94% to 79.56%. This indicates that significant opportunities remain for enhancing the quality of open online courses to promote deep learning.

(1) Promote self-regulated learning

Students generally concur that open online courses enhance the integration of new knowledge with prior knowledge and support the assessment of learning objectives. Nonetheless, they are less inclined to concur that these courses facilitate independent cooperative exploration and enhance reflective practice (refer to Figure 3) (As shown in Appendix 1).

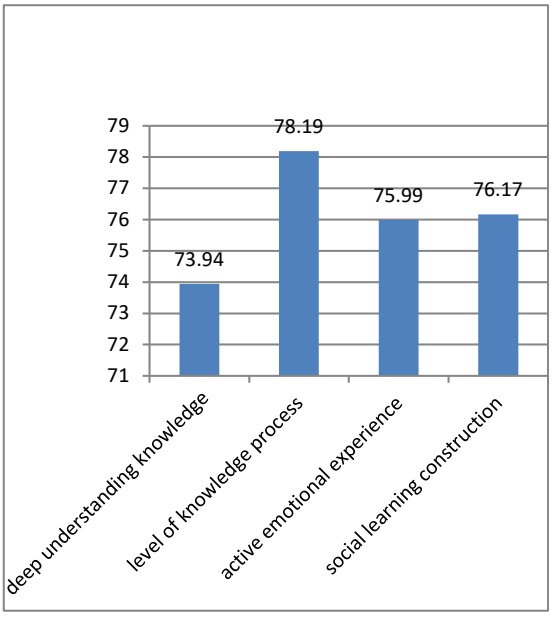

Figure 5. Promote social-emotional learning. **Source(s):** Created by authors

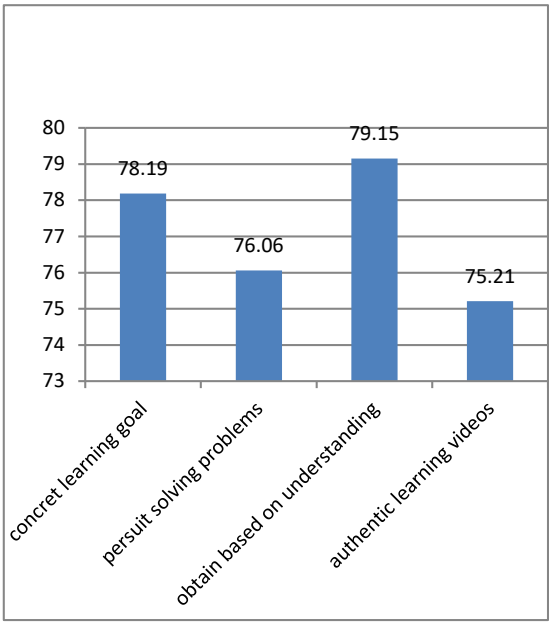

Figure 6. Promote the connection between learning and life. **Source(s):** Created by authors

(2) Promote deep learning experience

Students are more inclined to concur that open online courses foster independent learning, enhance reflective evaluation and facilitate blended learning. However, they are less likely to believe that

these courses can improve metacognitive abilities, knowledge transfer and application skills (refer to Figure 4) (As shown in Appendix 1). The analysis results indicate that students perceive online open courses as primarily emphasizing knowledge connection and acquisition while demonstrating deficiencies in fostering reflective practice and transfer-application abilities. They prioritize students' independent learning and goal evaluation achievement over the development of independent cooperative exploration and metacognitive skills. Research suggests that offering appropriate and targeted cognitive guidance during challenging tasks effectively promotes deep learning and knowledge transfer (Sigmund and Thomas, 2009).

(3) Promote social-emotional learning

Students are more inclined to concur that open online courses facilitate knowledge processing and the construction of social learning. However, they are less inclined to concur that the courses facilitate a comprehensive understanding of knowledge and an active emotional experience (refer to Figure 5) (As shown in Appendix 1).

(4) Promote the relationship between education and real-world application: Students generally concur that open online courses enhance retention through comprehension and elucidate specific learning objectives. However, they are less inclined to concur that the learning videos present realistic scenarios and assist in problem-solving (refer to Figure 6) (As shown in Appendix 1). The analysis of these two factors indicates that students perceive online open courses as primarily aiding in knowledge-processing learning, memory-based understanding and clarification of learning goals. However, they are perceived as somewhat lacking in fostering in-depth understanding, realistic experiences and practical problem-solving skills.

4.5 Qualitative analysis of in-depth interviews with teachers

The interview outlines for the staff members were developed on the literature review of 21st century skills and deep-learning theories, alongside a comprehensive understanding of the open online course practices at OUSL. 10 interviews had been conducted, as they were from various faculties (refer to Table 8).

Table 8. Basic information of subjects ($n = 10$)

Characteristic	Category	Number
Gender	Male	1
	female	9
Age	20–29	1
	30–39	4
	40–49	4
	above 50	1
Education	diploma	0
	bachelor	2
	postgraduate	4
	PhD	4
	others	0
Faculty	ET	1
	Education	1
	Health	2
	Humanity & Social	3
	Natural Science	2
	Management	1

Source(s): Created by authors

(1) Results and analysis of teacher interviews

Interview records of teachers are coded sequentially for citation purposes. FI1-5 denotes the record corresponding to the fifth question posed during the interview with the first teacher (Faculty Interview). Subsequently, open coding, axial coding and selective coding are conducted sequentially on the teacher interview records. The key terms and phrases that encapsulate the themes of the interview content are identified. Five essential terms and corresponding sentences that encapsulate the core themes of the interview are identified in each axial coding (refer to Table 9).

This study employed NVivo software to quantify the index words from teacher interview records. Analysis of interview data and keyword frequency (refer to Table 10) indicates that educators prioritize effective evaluation of specific learning objectives (Q1b) and the development of knowledge and skills (Q1c) when designing open online courses. They focus on creating realistic learning scenarios (Q2a) and presenting real-life contexts (Q2b), utilizing teaching videos to enhance student comprehension (Q3c) and providing meaningful learning experiences (Q3e). Additionally, they emphasize the establishment of an online learning

Table 9. Analysis framework and coding of teacher interviewing records

Selective coding		Setting structured learning objectives	Creating authentic learning situations	Providing supportive instructional videos	Designing interactive and collaborative learning environments	Developing transferable skills
Axial coding	a	Different levels of objectives	Authentic learning situations	Importance of instructional videos	Participatory environment	Transferable skills
	b	Evaluation and encouragement of progress	Real-life scenarios	Supportive videos	Collaborative activities	Problem-solving abilities
	c	Emphasis on knowledge and skills	Encouraging learning participation	Offering learning experiences	Designing group activities	Critical thinking
	d	Cultivation of diverse abilities	Solving problems in real-world	Virtual learning environment	Group discussions	Independent learning
	e	Based on educational theories	Flexible and convenient learning	Promoting better understanding	Providing a learning platform	Reflective learning

Source(s): Created by authors

Table 10. Frequencies of key words in teacher interviewing records

Questions		Q1a-e	Q2a-e	Q3a-e	Q4a-e	Q5a-e
Frequencies of keywords	a	4	*27*	2	*24*	8
	b	*23*	*21*	2	*34*	*11*
	c	*12*	8	*10*	*13*	3
	d	2	5	4	6	5
	e	6	3	*22*	6	*11*

Note(s): The Italicized numbers in Table 10 indicate that they are higher frequencies

Source(s): Created by authors

environment (Q4a), as well as cooperative (Q4b) and group activities (Q4c). Furthermore, there is a strong emphasis on fostering problem-solving skills (Q5b) and reflective learning capabilities (Q5e), among other factors (refer to Table 10).

Simultaneously, while teachers may not prioritize the hierarchical structure of teaching objectives (Q1a), this does not imply a lack of significance attributed to it. Unified standard requirements have been established across various disciplines and majors, becoming common practices in the design of teaching objectives by educators. Teachers universally recognize the significance of teaching videos (Q3a) and their supportive function in the educational process (Q3b). Nevertheless, the frequency of these key terms is low due to the restriction of keywords and variations in individual word usage patterns. Furthermore, variations in the faculties where educators are situated and the courses they reference frequently result in notable discrepancies in their comprehension and articulation of learning objectives, learning activities, learning scenarios and skill acquisition (As shown in Appendix 2).

(2) Word cloud maps of teacher interviews

The subsequent section presents the index word cloud maps corresponding to the five questions analyzed using NVivo, along with examples extracted from the interview records. A word cloud map visualizes textual data through a graphic representation that highlights the frequency of keywords, thereby emphasizing the essential content of the text. High-frequency words are presented in larger, more prominent and red fonts, whereas less frequent words are displayed in smaller fonts (refer to Figure 7 through 11). Figure 7 illustrates the significance of setting specific, tiered goals and their relevance in engineering disciplines. Figure 8 illustrates the necessity of establishing authentic learning contexts and real-world scenarios. Figure 9 highlights the significance of instructional videos in facilitating students' comprehension of learning materials and concepts. Figure 10 illustrates the importance of teachers in creating interactive learning environments and facilitating collaborative activities. Figure 11 demonstrates that the development of transferable skills should prioritize knowledge comprehension and problem-solving capabilities (As shown in Appendix 2).

(3) Combined analysis on teacher interviews

Combining both the coding and word cloud mapping of the teachers' interview transcriptions, the following results can be obtained:

When setting structured teaching objectives, teachers pay attention to the motivating effect of the objectives and the cultivation of professional knowledge and skills (FI1-1, FI7-1, FI2-1, FI3-1, FI7-1).

Teachers attach importance to creating realistic learning scenarios and real-life scenes for learners when designing courses (FI1-2, FI5-2, FI7-2).

Teachers believe that teaching video resources are mainly to support students in better understanding concepts and enhancing the learning experience (FI1-3, FI3-2).

Figure 7. Set structured learning objectives. **Source(s):** Created by authors

Figure 8. Create realistic learning scenarios. **Source(s):** Created by authors

Figure 9. Provide supportive teaching videos. **Source(s):** Created by authors

Figure 10. Design an interactive and cooperative learning environment. **Source(s):** Created by authors

Figure 11. Develop transferable skills. **Source(s):** Created by authors

Teachers strive to design an interactive and cooperative learning environment and carry out group activities and discussions (FI2-4, FI3-4, FI3-4, FI10-4, FI5-5).

Teachers attach importance to developing students' transferable skills, problem-solving abilities and reflective learning (FI10-2, FI1-5, FI6-5).

Interview transcripts highlighted three recurrent themes:

Curriculum design: Faculty emphasized structured objectives (n = 23 mentions) and authentic scenario creation (n = 27 mentions).

Pedagogical approaches: Video resources were prioritized for conceptual scaffolding (n = 10 mentions), while collaborative activities were underutilized.

Assessment strategies: Formative evaluations were deemed critical for fostering self-regulated learning (n = 11 mentions).

The results demonstrate that the faculty of the OUSL have made active efforts in MOOC design and need to continuously improve their teaching capabilities. In fact, capable teachers are an important support for students' online learning. A study in India indicates teachers are facing difficulties conducting online classes due to a lack of proper training and development, although students are getting enough support from teachers (Kulal, 2020).

5. Discussion

5.1 Misalignment continues to exist between instructional design and learner outcomes in the development and implementation of open online courses aimed at fostering deep learning

Teachers at OUSL prioritize the assessment of learning objectives, the development of knowledge and skills, the creation of realistic scenarios, the incorporation of videos to enhance comprehension, and the encouragement of collaboration and problem-solving. Students appreciate these courses but anticipate increased support for independent exploration, reflective practice, metacognitive skills, knowledge transfer and a deeper understanding. A discrepancy exists between the teacher's intentions and students' perceptions, as effectively designed instruction frequently does not correspond with students' experiences and expectations for profound learning. This mismatch indicates that there must be closer alignment between teaching strategies and learners' needs to achieve deeper educational outcomes. This divergence reveals fundamental tensions within open education paradigms: the content-centric approaches of teachers are at odds with the process-oriented, self-regulated learning expectations of learners. This misalignment highlights a critical issue in the expansion of open education.

5.2 Systemic barriers hinder the transfer of knowledge and its practical application, affecting the enhancement of skills for future work and life situations

Quantitative analyses indicate that open online courses achieve an approval rate of less than 80% regarding their effectiveness in promoting deep learning, highlighting substantial shortcomings in existing pedagogical frameworks. Students require enhanced professional guidance to develop essential skills for future employment and life. Learner priorities exhibit three essential demands: (1) Cognitively stimulating knowledge analysis accompanied by emotional reinforcement, (2) Genuine problem-solving structures connecting theoretical and practical realms, and (3) Adaptive feedback mechanisms promoting ongoing academic discourse. In contrast, teachers continue to prioritize the transfer of disciplinary knowledge and the optimization of technical aspects of MOOCs, highlighting a significant disconnect with learners' expectations for pedagogical support and the development of practical competencies.

5.3 Institutional support for collaborative learning ecosystems is insufficient in light of advancements in information technology and educational reform

The survey reveals that students strongly believe that open online courses promote independent learning, which ought to supplement cooperative learning. Teachers are

creating interactive, collaborative settings; however, online learning may result in social isolation. Teachers must innovate to improve the interactivity, cooperation and sense of community in online learning in response to technological and educational reforms. Effective learning communities necessitate more than basic interactivity metrics; they require an epistemological restructuring that harmonizes asynchronous autonomy with synchronous co-construction of knowledge. The ongoing gap between educational objectives and student experiences highlights a fundamental inadequacy in addressing the socio-technical conflicts present in large-scale online education.

6. Implications

6.1 Redesign the curriculum and teaching methods to adopt a learner-centered approach, enhance students' motivation for learning and facilitate self-regulation in their educational processes

Defined instructional objectives and adaptable evaluation methods enhance educational outcomes. Courses ought to emphasize future-oriented skills, promoting self-awareness and adaptability. Educators should integrate technology into learning, develop courses centered on learners, and innovate within online education to enhance motivation and facilitate self-regulated learning.

6.2 Enhance the linkage between learning activities and real-world contexts, implement teaching based on real-life scenarios and develop the capacity to address practical challenges

Open online courses are designed to cultivate innovative talents equipped with problem-solving skills applicable to real-world situations in the 21st century. This necessitates the adoption of contemporary teaching concepts, authentic learning environments and methodologies that emphasize transferable skills, distinguishing them from conventional approaches in terms of objectives, design, monitoring and evaluation. Teachers must implement innovative frameworks to improve students' practical skills. Universitas Terbuka (UT) in Indonesia promotes independent learning among its students, resulting in enhanced self-learning capabilities in the workplace. A study indicates that graduates from UT have sufficiently fulfilled workplace requirements regarding independent learning skills, competence and job performance (Ratnaningsih, 2013).

6.3 Enhance the integration of multiple learning evaluations, attract learners' participation and promote deep learning interaction between teachers and students

Advancements in information technology, the generation of knowledge and the intricacies of education necessitate curriculum reform. The changing learning environments of students necessitate various activities and comprehensive assessments. As technology advances rapidly, the necessity for human interaction between teachers and students increases. The formation of a "learning community" is contingent upon the individuals involved (the learners) rather than solely on the content provided (Cheng, 2013). Teachers in open universities ought to integrate both summative and formative assessments, customizing frameworks to facilitate profound learning. Teacher–student interaction must encompass both cognitive and emotional dimensions, particularly in technology-mediated distance education. Deep learning fosters a collaborative community in which educators and learners engage in mutual learning, resource sharing and problem-solving through digital tools. Teachers monitor student progress, modify instructional strategies and deliver prompt feedback, thereby promoting resilience and motivation for ongoing, in-depth learning.

The restricted sample size and the exclusive focus on a single institution, the Open University of Sri Lanka, provide the findings to accurately represent the perceptions and alignment of teachers and students regarding the quality of open online courses. Thus, the

findings solely reflect the actual state of learning and teaching in open education within Sri Lanka, providing a glimpse into the broader context of the Global South. The researchers will continue this project to include additional open universities in the Global South, aiming to conduct comprehensive analyses of the open education landscape.

Supplementary material

The supplementary material for this article can be found online.

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