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DO REUSABLE LEARNING OBJECTS IMPROVE THE LEARNING EXPERIENCE OF CRITICAL CARE NURSES AND INCREASE THEIR ACCESS TO UPDATE THEIR INFORMATION

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Abstract:

Objective: Online learning platforms offer accessibility and personalization, but traditional courseware models often fail to maximize their advantages. Reusable learning objects (RLOs), self-contained digital learning modules, hold potential for individualized and adaptive learning experiences. However, their effectiveness in critical care nursing education, particularly in culturally diverse contexts like Saudi Arabia, remains underexplored. This study investigates the perceptions and experiences of critical care nurses in Saudi Arabia regarding RLOs as tools for professional development.

Methods: A cross sectional design was employed, integrating quantitative and qualitative approaches. A validated online questionnaire was distributed to 260 critical care nurses in governmental healthcare facilities in Madinah, Saudi Arabia, assessing demographics, RLO perceptions, usage patterns, challenges, and views on future integration. Descriptive statistics, chi-square tests, and correlation analyses were performed using SPSS. Qualitative data from open-ended survey questions underwent thematic analysis..

Results: Nurses hold diverse views on RLOs, with 52.3% having a positive perception and 47.7% a negative one. Higher education levels and extended experience positively correlate with favorable RLO perceptions. Nurses appreciate RLOs' convenience, potential for engagement, and contribution to clinical knowledge and skills. Challenges include lack of awareness, time constraints, and content not tailored to Saudi context. Nurses advocate for RLO integration in future professional development, seeking engaging formats and culturally relevant content.

Conclusion: RLOs hold promise for enhancing critical care education in Saudi Arabia, but successful implementation requires addressing awareness, accessibility, and cultural sensitivity.

Keywords: RLOs, critical care nurses, professional development, Saudi Arabia, perceptions.

BACKGROUND:

The landscape of nursing education is undergoing a transformative journey, spurred by burgeoning advancements in digital technologies and the evolving needs of a complex healthcare landscape. In this paradigm shift, online learning platforms have emerged as promising accessibility, scalability, and the potential to tailor education to individual learning styles [1, 2]. However, within this nascent domain, traditional courseware delivery models often fall short of maximizing the inherent advantages of the digital sphere. Enter reusable learning objects (RLOs): bite-sized, self-contained chunks of digital learning content specifically designed for seamless integration and reuse across diverse pedagogical contexts [3].

Firstly, RLOs liberate curricula from the static shackles of monolithic modules. By deconstructing knowledge into granular, readily-assembled components, they empower educators to become architects of personalized learning pathways, sculpting bespoke educational journeys that resonate with individual needs and ignite the flames of active engagement [4].

RLOs shed the restrictive cloak of linear text and static visuals. Immersive virtual environments, pulsating with simulated clinical scenarios, and interactive gamified modules can be readily packaged as RLOs, transforming passive knowledge acquisition into an electrifying odyssey of active engagement. This multimedia tapestry caters to the kaleidoscope of learning styles that grace the halls of nursing education, ensuring that visual, auditory, and kinesthetic learners each find their path to mastery [5]. Furthermore, RLOs possess the remarkable flexibility to adapt and translate, accommodating culturally diverse student populations. Language barriers dissolve, fostering inclusivity and ensuring equitable access to high-quality nursing education for all [6].

Unlike their monolithic predecessors, RLOs can be readily updated and revised to reflect the quicksilver pace of healthcare knowledge evolution and clinical practice transformation. Collaborative content creation platforms act as vibrant knowledge bazaars, where nurses and educators co-create a tapestry of expertise and lived experiences. This dynamic interplay between content producers and consumers fosters a perpetual cycle of enrichment, ensuring that online nursing education remains a living, breathing entity, ever-responsive to the demands of the dynamic healthcare landscape [7].

The integration of RLOs into online nursing education is not merely a pedagogical tweak, but a seismic shift in the very DNA of knowledge delivery. It promises to cultivate a generation of nurses equipped with the critical thinking, adaptability, and resilience required to navigate the ever-shifting sands of healthcare practice [8]. By embracing the granularization, interactivity, and dynamic nature of RLOs, online nursing education can shed its chrysalis and soar into the sunlit skies of excellence, ultimately impacting the very heart of patient care. This underscores the crucial role of curriculum integration in fostering awareness and equipping future dentists with the necessary skills [9]. However, in a culturally and geographically diverse nation like Saudi Arabia, understanding the nuanced perspectives of critical care nurses towards RLOs is paramount before charting the course for effective implementation [10]. This study delves into the perceptions and experiences of critical care nurses in Saudi Arabia regarding RLOs, shedding light on their potential to enhance and personalize learning within this high-stakes practice domain.

METHODS:

This study employed a mixed-methods approach, integrating quantitative and qualitative methods, and was conducted in governmental healthcare facilities within Madinah, targeting critical care nurses employed in these institutions during December 2022.

In order to assess the effectiveness of reusable learning objects in teaching nursing students in Critical care units in the city of Al Madina, Saudi Arabia, a comprehensive study was conducted. A total sample of 800 registered nurses were identified in the city of Al Madina, ensuring a precise confirmation rate of 5% at a 95% confidence level. The statistical parameters used included an alpha

value of 0.05, a power of 80%, and a design effect of two. The sample size was determined using the provided standards, with the help of Epi Info 7 software [11]. To ensure the reliability and accuracy, a sample size to 260 participants was used for statistical significance (Uttley 2019). Here is the formula for calculating sample size (n):

$n = [z2 * p * (1 - p) / e2] / [1 + (z2 * p * (1 - p) / (e2 * N))]$

Where: $z = 1.96$ for a confidence level (α) of 95%,

p = proportion (expressed as a decimal),

N = population size,

e = margin of error.

$z = 1.96, p = 0.5, N = 800, e = 0.05$

$n = [1.962 * 0.5 * (1 - 0.5) / 0.052] / [1 + (1.962 * 0.5 * (1 - 0.5) / (0.052 * 800))]$

$n = 384.16 / 1.4802 = 259.532$

$n \approx 260$

The sample size (with finite population correction) is equal to 260 (Fig. 1).

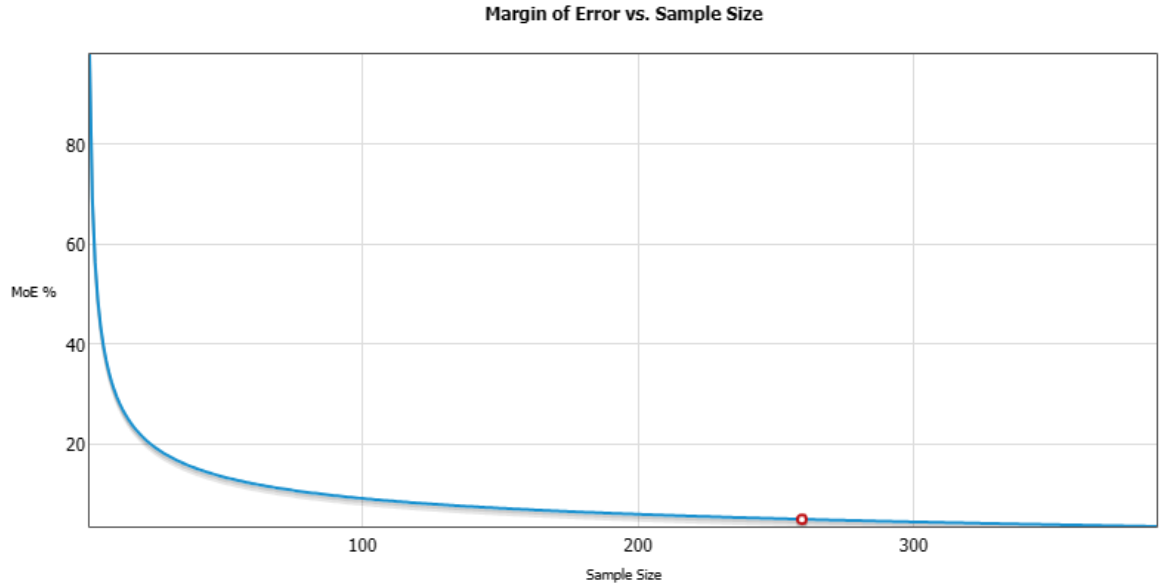

Fig. 1: Margin of error vs. sample size.

After collecting the data, we obtained 385 responses from which 125 questionnaires were excluded due to incomplete data.

Ethical consideration:

Written informed consent was obtained from all participants before data collection. All data were collected and stored anonymously, ensuring confidentiality. Data were securely stored and accessed only by authorized research team members. The study protocol was submitted for approval to the relevant Institutional Review Board (IRB) of General Directorate of Health Affairs in Madinah, Medinah Health Cluster (No. 14/2022).

Instruments and data collection:

An online questionnaire, developed specifically for this study, was used to collect quantitative data on nurses' perceptions of RLOs. The questionnaire includes Likert-scale ratings, multiple-choice options, and closed-ended questions, exploring demographics, perceptions, challenges, and views on the future of RLOs. The questionnaire underwnt expert review and pilot testing with a small sample of critical care nurses to ensure its validity and reliability for the target population. The questionnaire was distributed electronically through email and social media platforms, with reminders for completion.

Data Management and Analysis Plan:
The questionnaire responses were summarized using descriptive statistics, and the findings were presented in the form of percentages and frequencies. The chi-square tests, with a significance level of $P < 0.05$, were used to compare the results. The results were then converted into percentages for each question. The data was analyzed using SPSS version 16.0, developed and maintained by SPSS Inc. of Chicago, IL, USA.

RESULTS:
Table. 1 offers an overview of the demographic characteristics of the 260 critical care nurses who participated in the study. Notably, nearly two-thirds (61.2%) hold bachelor's degrees or higher, highlighting the increasing trend of higher education within the nursing profession. With 50.5% possessing six or more years of experience, the sample represents a seasoned cohort likely familiar with diverse clinical scenarios and learning preferences. A striking 77.3% reported using RLOs for professional development, indicating substantial awareness and potential for further exploration of their value within this cohort. A considerable 75.8% of those who participated in RLO-related courses perceived them as helpful for enhancing professionalism, hinting at potential benefits for continuing education in this area.

Table 1: Demographics data about participants

Questions		Frequency (n)	Percent (%)
Highest level of education in nursing	Diploma Bachelor's degree Master's degree Doctorate	39 63 70 88	15.0 24.2 26.9 33.8
Years of experience I have as a critical care nurse	Less than 1 year 1-3 years 4-6 years 7-10 years More than 10 years	21 42 60 58 79	8.1 16.2 23.1 22.3 30.4
I used RLOs for professional development	Yes	201	77.3
I frequently use RLOs for professional development	• Never • Rarely (once or twice a year) • Occasionally (3-5 times a year) • Frequently (6-10 times a year) • Very frequently (more than 10 times a year)	19 21 80 71 69	7.3 8.1 30.8 27.3 26.5
I have been in a course related to RLOs	Yes	170	65.4
The course helped me to be more professional	Yes	197	75.8
Total		260	100

Critical Care Nurses' Perceptions of RLOs in Saudi Arabia:
Table 2 delves deeper into the critical care nurses' perspectives on RLOs, revealing intriguing insights: While 51.9% have a clear definition, a notable 35.4% require further clarification, highlighting potential gaps in awareness or training. A resounding 68.4% (strongly agree and agree) perceive RLOs as effective learning tools, suggesting their potential to bolster knowledge and skills acquisition. With 64.5% agreeing or strongly agreeing on convenience and pacing, RLOs appear to accommodate individual learning preferences. Over 65% find content relevant and up-to-date, emphasizing RLOs' potential to align with local critical care practices. Interestingly, while 61.3% agree or strongly agree on engaging format, further investigation into preferred interactivity elements is warranted. A remarkable 70.8% feel confident applying RLO-acquired knowledge, demonstrating their real-world

value. Notably, 43.1% perceive RLOs catering to specific Saudi Arabian needs, suggesting their potential to enhance cultural sensitivity and local relevance. Lack of awareness (35%) and time constraints (32.7%) emerge as prominent hurdles, warranting targeted awareness campaigns and flexible learning modules. Simulations and scenarios (40.8%), quizzes and knowledge checks (31.2%), and videos/animations (31.2%) seem most impactful for learning and retention. A robust 73.8% (moderately, very, and extremely effective) acknowledge RLOs' contribution to these vital skills. A striking 66.2% (very and extremely significant) report improved confidence in specific clinical scenarios, highlighting RLOs' potential to empower nurses. Easy integration is noted by 44.2%, suggesting successful knowledge translation into clinical work. A substantial 78.8% appreciate RLOs' opportunities for self-assessment and reflection, fostering deeper learning and personal growth.

Table (2): Nurse's perceptions of RLOs

Questions		**Frequency (n)**	**Percent (%)**
RLO definition	• It is a digital self-contained and reusable entity • Can be used to fulfil specific learning objectives for a course or in a classroom scenario • Short, self-contained, digital learning activities that can be valuable tools for sharing information	135 33 92	51.9 12.7 35.4
RLOs are an effective way for critical care nurses in Saudi Arabia to learn new skills and knowledge	Strongly disagree Disagree Neutral Agree Strongly agree	17 0 65 83 95	6.5 0 25.0 31.9 36.5
RLOs are convenient and accessible for learning at my own pace and schedule	Strongly disagree Disagree Neutral Agree Strongly agree	26 12 55 97 70	10.0 4.6 21.2 37.3 26.9
The content of RLOs is relevant and up-to-date with current critical care practices in Saudi Arabia	Strongly disagree Disagree Neutral Agree Strongly agree	27 11 74 85 63	10.4 4.2 28.5 32.7 24.2
The format and design of RLOs are engaging and interactive, making learning enjoyable	Strongly disagree Disagree Neutral Agree Strongly agree	27 5 79 80 69	10.4 1.9 30.4 30.8 26.5
I feel confident applying the knowledge and skills learned from RLOs in my clinical practice	Strongly disagree Disagree Neutral Agree Strongly agree	39 2 91 35 93	15.0 .8 35.0 13.5 35.8
I find RLOs cater to the specific needs and challenges faced by critical care nurses in Saudi Arabia compared to generic RLOs	Not at all Slightly Moderately A lot Perfectly	25 0 87 112 36	9.6 0 33.5 43.1 13.8
Challenges I face in using RLOs for professional development	• Lack of awareness about available RLOs • Time constraints for completing RLOs • Content not culturally appropriate for Saudi context • Lack of practical application in clinical setting	32 91 52 85	12.3 35.0 20.0 32.7
Interactive elements I find most helpful for learning and retaining information in RLOs	• Simulations and scenarios • Quizzes and knowledge checks • Videos and animations • Interactive tutorials and practice exercises	31 106 81 42	11.9 40.8 31.2 16.2

RLOs challenge critical thinking and clinical decision-making skills	Not at all effective Slightly effective Moderately effective Very effective Extremely effective	7 0 101 61 91	2.7 0 38.8 23.5 35.0
RLOs helped me to improve confidence in addressing specific clinical scenarios or procedures in critical care	Not at all Slightly significant Moderately significant Very significant Extremely significant	0 17 100 72 71	0 6.5 38.5 27.7 27.3
It is easy to integrate the knowledge and skills learned from RLOs into my daily clinical practice	Very difficult Slightly difficult Neutral Easy Very easy	0 3 84 58 115	0 1.2 32.3 22.3 44.2
RLOs provide adequate opportunities for self-assessment and reflection on learning progress	Yes	205	78.8
Total		260	100

Table 3 succinctly showcases the critical care nurses' resounding endorsement of RLOs as integral to future professional development. A remarkable 85.4% (moderately and very important) view RLOs as crucial for future learning, highlighting their perceived potential to transform the educational landscape. Notably, there's a complete absence of "not at all" or "slightly important" selections, emphasizing a strong unified vision for RLO integration.

Table. 3: Future of RLOs in Saudi Arabia

Questions		**Frequency (n)**	**Percent (%)**
RLOs will be for the future of professional development in critical care nursing in Saudi Arabia	• Not at all important • Slightly important • Neutral • Moderately important • Very important	0 4 86 54 116	0 1.5 33.1 20.8 44.6
Total		260	100

Table 4 reveals a split opinion among the nurses, with 52.3% (n = 136) reporting a positive perception of RLOs and 47.7% (n = 124) having a negative perception. Further investigation into the specific reasons behind these contrasting views is crucial to understand the strengths and weaknesses of RLOs as a learning tool for this demographic.

Table 4. Perception of nurses towards RLOs.

Variables	**Frequency**	**Percentage**
Good perception	136	52.3
Poor perception	124	47.7

Correlation studies:

Table 5 offers insights into how level of education and years of experience correlate with critical care nurses' perceptions of RLOs in Saudi Arabia. Nurses with doctorates show a statistically significant association with a clearer understanding of RLO definition ($X2 = 0.361$, $p = 0.01$). Notably, doctoral nurses also exhibit a stronger positive association with RLOs as effective learning tools ($X2 = 0.612$, $p = 0.001$). Interestingly, a significant correlation emerges between doctorates and perceiving RLO format and design as engaging and enjoyable ($X2 = 5.14$, $p < 0.001$).

Also, nurses with over 10 years of experience exhibit a marked positive association with finding RLOs

convenient and accessible for their busy schedules (X2 = 4.22, p < 0.001). A significant correlation is observed between experience and feeling confident applying RLO-acquired knowledge in clinical practice (X2 = 3.76, p = 0.03). Nurses with extensive experience show a stronger association with finding RLOs tailored to their specific needs compared to generic ones (X2 = 6.75, p < 0.001).

The same criteria were shown in Table. 6 as a significant positive correlation emerges between higher levels of education (Master's and Doctorate) and favorable perceptions of RLOs (r = 0.362, p < 0.001 and r = 0.537, p = 0.01). While early-career nurses (less than 3 years of experience) exhibit a negative correlation with good perceptions, those with 4-10 years of experience display a marked positive association (r = 0.269 to 0.665, p < 0.001). Having used RLOs before correlates positively with favorable perceptions (r = 0.319, p = 0.01), highlighting the importance of firsthand experience in shaping attitudes. Frequent RLO use (6-10 times or more than 10 times a year) demonstrates a significantly stronger positive correlation with good perceptions compared to less frequent usage (r = 0.503, p = 0.01).

Table (5): Correlations between the level of education, years of experience and perceptions of RLOs (n= 260).

Questions	Doctorate	More than 10 years
RLO definition	X^2=0.361 p= 0.01	X^2=2.36 p=0.001
RLOs are an effective way for critical care nurses in Saudi Arabia to learn new skills and knowledge	X^2=0.612 p=0.001	X^2=2.50 p=0.05
I used RLOs for professional development	X^2=2.12 p=0.04	X^2=3.21 p=0.001
RLOs are convenient and accessible for learning at my own pace and schedule	X^2=4.91 p=0.001	X^2=4.22 p=<0.001
The content of RLOs is relevant and up-to-date with current critical care practices in Saudi Arabia	X^2=3.25 p=0.03	X^2=1.49 p=0.01
The format and design of RLOs are engaging and interactive, making learning enjoyable	X^2=5.14 p=<0.001	X^2=7.09 p=0.001
I feel confident applying the knowledge and skills learned from RLOs in my clinical practice	X^2=2.79 p=0.04	X^2=3.76 p=0.03
I find RLOs cater to the specific needs and challenges faced by critical care nurses in Saudi Arabia compared to generic RLOs	X^2=3.28 p=0.024	X^2=6.75 p=<0.001
Challenges I face in using RLOs for professional development	X^2=2.15 p=0.032	X^2=0.674 p=0.041
Interactive elements I find most helpful for learning and retaining information in RLOs	X^2=6.11 p=0.05	X^2=1.72 p=0.021
RLOs challenge critical thinking and clinical decision-making skills	X^2=0.581 p=0.041	X^2=0.721 p=0.02
RLOs helped me to improve confidence in addressing specific clinical scenarios or procedures in critical care	X^2=1.772 p=0.01	X^2=0.890 p=0.001
It is easy to integrate the knowledge and skills learned from RLOs into my daily clinical practice	X^2=0.06 p=0.032	X^2=0.361 p=0.011
RLOs provide adequate opportunities for self-assessment and reflection on learning progress	X^2=0.813 p=0.05	X^2=2.79 p=0.035
RLOs are convenient and accessible for learning at my own pace and schedule	X^2=0.874 p=0.012	X^2=0.707 p=0.043

Table (5): Correlations between the perceptions rate and demographics data.

Variables		Correlation coefficient (r)	p value
Perceptions rate (good perception rate)	Diploma	-0.124	0.05
	Bachelor's degree	-0.213	0.3
	Master's degree	0.362	<0.001
	Doctorate	0.537	0.01

	Experience Less than 1 year	-0.157	0.1
	Experience 1-3 years	-0.245	0.12
	Experience 4-6 years	0.269	<0.001*
	Experience 7-10 years	0.665	<0.001*
	Experience more than 10 years	0.488	0.002*
	Used RLOs for professional development	0.319	0.01*
	Frequently use RLOs for professional development; • Never • Rarely (once or twice a year) • Occasionally (3-5 times a year) • Frequently (6-10 times a year) • Very frequently (more than 10 times a year)	 -0.378 -0.413 -0.363 0.151 0.503	 0.3 0.1 0.3 0.001* 0.01*
	I have been in a course related to RLOs	0.691	<0.001*
	The course helped me to be more professional	0.138	0.01*

*Spearman's correlation analysis.

DISCUSSION:

This study ventured into the nascent terrain of reusable learning objects (RLOs) within the critical care nursing landscape of Saudi Arabia. While diverse viewpoints emerged among nurses, the overall tide leans towards recognizing the transformative potential of RLOs for professional development. Their inherent flexibility, engaging nature, and potential for cultural sensitivity offer a promising response to the demand for accessible, personalized, and impactful learning experiences. While challenges remain, RLOs stand poised to rewrite the narrative of critical care education in Saudi Arabia.

Our study resonates with broader research highlighting the effectiveness of RLOs in nursing education. The findings align other studies suggesting that RLOs can effectively facilitate knowledge acquisition and skill development among critical care nurses [3]. This strengthens the growing body of evidence affirming the value of RLOs as valuable tools for professional development in nursing. Additionally, our findings resonate with the emphasis on flexibility and personalization in nursing education. Like previous research, we highlight the inherent adaptability of RLOs, which aligns with recommendations for catering to individual learning styles and preferences [3, 6]. This flexibility holds particular promise for critical care nurses juggling demanding schedules and diverse learning needs.

Our emphasis on cultural sensitivity resonates with calls for contextually-appropriate e-learning resources. Addressing language barriers, religious sensitivities, and local healthcare practices is paramount for RLO effectiveness in Saudi Arabia. This work highlighting the need for culturally relevant and accessible learning resources for nurses in the region [12].

Recognizing the busy schedules and limited technological access of many critical care nurses, user-friendly RLO design and access strategies become crucial. This fosters inclusivity and caters to the specific needs of this workforce [13].

Also, current nursing students frequently utilise the web for learning, possess digital fluency, and gravitate towards non-traditional teaching methods. They represent a generation that demonstrates proficiency, expertise, and enthusiasm in utilising virtual resources [14]. RLOs have been shown to be a successful and well-received educational intervention in a challenging area of the curriculum. They have proven to be more effective in terms of students' attainment compared to the conventional lecture structure. The prevalence and efficiency of online courses can be attributed to their adaptability and accessibility for study [15]. As highlighted by other researchers, the RLO developed and validated in this study has the potential to motivate nursing students to independently explore the assessment of cardiovascular and pulmonary responses [14].

Strengths and limitations:

Strengths: This research benefits from employing both quantitative and qualitative methods, offering a rich and nuanced understanding of nurses' perceptions and experiences with RLOs. Focusing on critical care nurses in Saudi Arabia addresses a gap in current research exploring the effectiveness of RLOs in diverse cultural and healthcare settings. The study provides specific recommendations for improving RLO design, implementation, and integration into existing curricula, paving the way for practical application. The findings address various aspects of RLOs, including accessibility, engagement, cultural sensitivity, and potential challenges, offering a multifaceted picture of their role in professional development.

Limitations: While statistically significant, the sample size (n=260) may limit the generalizability of findings to the broader population of critical care nurses in Saudi Arabia. Convenience sampling methods used for participant recruitment might not represent the entire critical care nursing workforce. The study focused primarily on perceptions and experiences, excluding a direct assessment of RLOs' impact on actual learning outcomes or skill development. Generalizability to other countries with different healthcare systems and cultural contexts might require further investigation.

Implications and Future Studies

RLOs hold promise for personalized, accessible, and engaging learning experiences, addressing the needs of critical care nurses in Saudi Arabia for continuous professional development. RLOs must be tailored to the specific context and challenges of critical care in Saudi Arabia to ensure their effectiveness and applicability. Strategies to address awareness gaps and ensure accessibility for nurses with limited time or technological resources are crucial for successful RLO implementation. Potential for improved healthcare outcomes: By upskilling the critical care nursing workforce through RLOs, healthcare systems can potentially improve patient care and preparedness for emerging challenges.

Future studies should focus on: Investigating the direct impact of RLOs on learning outcomes, clinical skills, and patient care metrics through randomized controlled trials or longitudinal studies. Also, exploring in-depth experiences and challenges of nurses using RLOs in daily practice through interviews and focus groups. Testing the effectiveness of RLOs specifically designed for the Saudi Arabian context and its healthcare system.

Investigation of RLOs' effectiveness in other settings: Replicating the study in different countries and healthcare systems to assess the generalizability of findings and potential adaptations.

Conclusion:

This study navigated the uncharted waters of reusable learning objects (RLOs) in Saudi Arabia's critical care nursing landscape. While nurses hold diverse views, the overall tide tilts toward recognizing RLOs' potential to transform professional development. Their flexible, engaging, and culturally-sensitive nature offers a promising answer to the demand for accessible, personalized, and effective learning experiences. While challenges remain, RLOs stand poised to rewrite the narrative of critical care education in Saudi Arabia. By embracing their adaptability, engaging nature, and potential for cultural sensitivity, we can embark on a voyage of continuous learning, individual empowerment, and ultimately, a healthcare system better equipped to serve its patients.

Declarations

Ethics approval: The study protocol was submitted for approval to the relevant Institutional Review Board (IRB) of General Directorate of Health Affairs in Madinah, Medinah Health Cluster (No. 14/2022).

Consent to participate: Written informed consent was obtained from all participants before data collection. All data were collected and stored anonymously, ensuring confidentiality. Data were securely stored and accessed only by authorized research team members.

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