

ORIGINAL RESEARCH

E-learning in nursing education in Rwanda: A middle-range theory

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ABSTRACT

Background: The rapid development of technology has compelled tertiary institutions to devise innovative teaching strategies to meet the students' needs and market's demands. Recently, the Covid-19 pandemic has forced educational institutions to shift from in-person to online learning. E-learning is one of the areas advancing rapidly and which provide promises in nursing education. The aim of this study was to develop a middle-range theory to guide the utilisation of an e-learning platform in nursing education in the context of Rwanda.

Methods: A grounded theory approach, following Strauss and Corbin, was used. The study population included nurse educators, nursing students, Information and Communication Technologies (ICT) managers, and experts in e-learning and nursing education. The sample size consisted of 40 participants. Data were collected using in-depth interviews, focus group discussion and document analysis. Data analysis was guided by Strauss and Corbin's grounded theory framework, which facilitated the middle-range theory development.

Results: Implementation of e-learning in nursing education emerged as the central concept in this model. E-learning was viewed as a mechanism to advance the country's political agenda to integrate technology in higher education, a tool to widen access to nursing education, a student-centred approach, and blended learning. The implementation of e-learning was facilitated by catalyst agents such as institutional support, e-readiness, partnerships and collaboration, policies and regulations, effective working learning management system, and bridging the digital divide. Integration of e-learning in nursing education was expected to improve nursing education quality and increase competent nurses and midwives graduates.

Conclusions: This study highlights the importance of e-learning in nursing education. The adoption of the innovative, technology-enabled nursing education models would augment capacity to scale up nursing and midwifery education, enhance the quality and relevance of training, and adopt equity-focused policies. This model is a tool to facilitate the establishment of a supported network learning space in nursing education in a fluid and dynamically changing nursing practice context.

Key Words: E-learning, Distance learning, Nursing education, ICT in education

1. BACKGROUND

The rapid development of technology has compelled tertiary institutions to devise innovative teaching strategies to meet the students' needs and the market's demands.^[1-3] Covid-19

has forced educational institutions to shift from in-person to online learning.^[4-7] Developing e-learning contents and providing e-learning opportunities is one of the areas advancing rapidly.^[4,8] E-learning, known as electronic learning, unites

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two areas, learning and technology.^[9] According to Aparicio, Bacao,^[9] learning “is a cognitive process for achieving knowledge” while “technology is “an enabler of the learning process”. The literature indicates that there are varieties of e-learning approaches used to deliver instructions, including computer-assisted instructions, web-based instructions, and virtual teaching spaces.^[10–16] E-learning allows the students to participate in academic activities regardless of geographic and time constraints.^[17–20] Furthermore, e-learning is viewed as a response to global pandemic diseases such as Covid-19, requiring physical distancing and lockdowns.^[6,21–23]

In nursing education, the flexibility provided by e-learning allows nurse educators and the students to manage competing interests such as professional development, practice and the family while they continue to teach and learn.^[18,24] E-learning enhances learning experiences as it promotes collaborations and communication between instructors and the students.^[18,24–26] The success of e-learning depends on teachers’ and students’ knowledge and skills to use Information and Communication Technologies (ICT) tools and applications.^[17,27–29] There is a need to train nursing faculty in innovative teaching strategies to get the most out of technology in education.^[30] The literature indicates that challenges hinder the proper implementation of e-learning, including low ICT literacy of students and teachers, resource constraints, lack of access to online contents, language barriers, lack of support and follow-up.^[24,31–33] Furthermore, there is a lack of relevant ICT standards and a firm framework to facilitate technology use in teaching and learning.^[34–36]

In Rwanda, evidence shows that e-learning was introduced in nursing schools in 2012 to improve nursing education quality and upgrade nurses and midwives’ academic levels from diploma (A2-level) to advanced diploma (A1-level).^[24,33,37] In Rwanda’s context, nurses with A2-level (A2-nurses) make up 90% of all nurses.^[38] Since 1962, A2-nurses were trained through a three-year secondary school education leading to a diploma equivalent to secondary school qualifications. Nurses with A1-level represent less than 10% of the nurses’ total pool.^[38–40] A1-nurses were trained from 1996, and this training became mandatory in all nursing schools after the disruptions of the A2-level in 2007.^[33,38,39] The A1-level is a three-year nursing school training after secondary school, leading to an advanced diploma in nursing. The A2-level was phased out due to insufficient quality of care and services provided by A2-nurses. Nurses with A2-levels are encouraged to upgrade to A1-level, which is currently the lowest acceptable level of nursing education training in Rwanda.^[33,38,39] In Rwanda, other nursing education levels include the bachelor of nursing and midwifery and master’s degrees in nursing in various clinical specialities areas.^[41]

In Rwanda, e-learning in nursing education was conceptualised as “a mechanism to advance political agenda to integrate technology in higher education, a tool to open access to education for working nurses and midwives, a student-centred approach and a blended learning.”^[18] Although the implementation of e-learning in nursing education in Rwanda is positively perceived by nurses educators and students,^[18,24,33,37,42–44] several challenges have been reported, and they included language barrier, low ICT literacy of nursing students and nurse educators, resource constraints, resistance to change, issues related to the Moodle® interface design, lack of policies and framework to guide the implementation of e-learning.^[24,33,37]

This study aimed to develop a middle-range theory to guide the utilisation of an e-learning platform in nursing education in the context of Rwanda.

2. METHODS

2.1 Research approach

A grounded theory approach, following Strauss and Corbin,^[45] was used. Grounded theory facilitated data analysis and development of the middle-range theory. The goal of grounded theory was to take qualitative data beyond mere description to create explanatory theoretical frameworks as suggested by Charmaz,^[46] using a rigorous inductive approach to generate theory from the real-world context. In this study, the combination of action research and grounded theory enabled the study to capitalise on the strengths of the action iterative orientation of action research and the rigorous theory-building techniques of grounded theory.

2.2 Participants and sampling methods

Participants were nursing students, nurse educators, ICT managers and campus managers of selected nursing campuses. Purposive sampling was used to select the participants based on the participants’ involvement in e-learning. Theoretical sampling and data saturation guided the final number of participants. The sample size was comprised of 40 participants: 18 nurse educators, 17 nursing students, two ICT managers, and three experts in the fields whom the selected nursing school recommended.

2.3 Data collection and analysis

Data were collected using in-depth interviews, focus group discussion and document analysis. The interviews were conducted in a quiet environment at their respective campuses and other settings of their choices. The interview guide included questions on the teachers’ use of educational technologies; conceptualisation of e-learning, implementation of e-learning; facilitative and inhibitive conditions of e-learning

implementation, and solutions to the challenges related to e-learning. The interviews were audio-recorded, and the duration ranged between 20 and 40 minutes.

Data analysis was done simultaneously with data collection through a coding process. Open coding allowed identifying common themes of everyday life in relation to the context, meaning, and e-learning platforms. During the coding pro-

cess, underlying patterns were identified, and conceptual saturation was reached when no new categories emerged. Furthermore, theoretical memos served for writing the middle-range theory. Corbin and Strauss^[45] framework guided the data analysis (see Figure 1) and provided categories further analysed through axial coding and constant comparative analysis to generate concepts for the model.

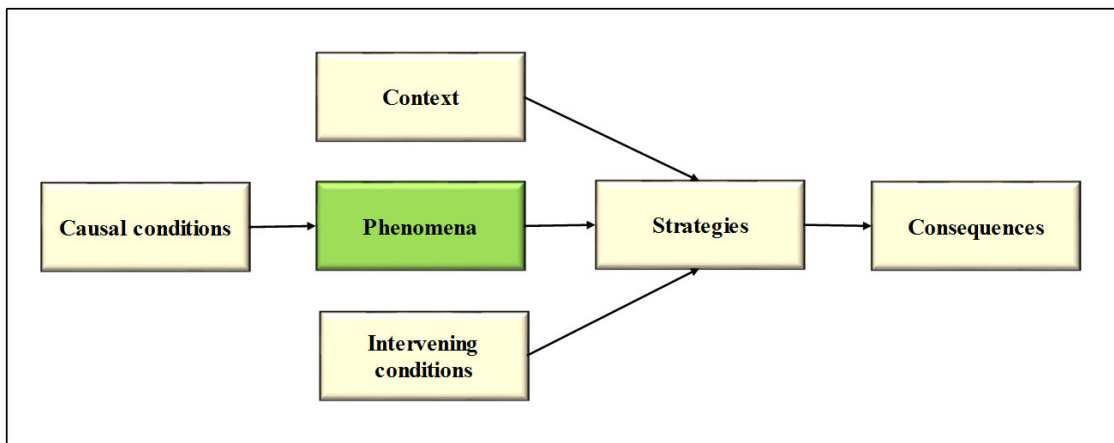


Figure 1. Axial coding adopted from Strauss and Corbin’s framework of grounded theory^[45]

2.4 Middle-range theory development process

The findings from this study guided the development of the middle-range theory, and selective literature was consulted to get familiar with theoretical and empirical work done in relation to the use of e-learning platforms in nursing education.

During developing the middle-range theory, the focus was on selective coding, as suggested by Strauss and Corbin^[47] Selective coding is the final step of the analysis,^[45] which involves integrating concepts around a core category and filling in categories for further explanation and description. This type of coding is likely to occur in the later phases of a study. This stage involves identifying a core category from which a model is developed.^[47] De Vos et al.^[48] state that selective coding entails selecting the core categories, systematically relating them to other categories, validating those relationships, and filling in categories that require further fine-tuning and modifications.

E-learning in nursing education was the core category that represented the central phenomenon of the study. The concepts supporting or linked to the core concept were identified and linked according to how they were related to the core concept and other concepts. According to Jabareen,^[49] the concepts that constitute the middle-range theory support one another, articulate their respective phenomena and establish a middle-range theory-specific philosophy.

2.5 Academic rigour

The credibility was ensured through a detailed description of data collection and analysis process. Data were triangulated by using different methods of data collection. Data and emerging categories were presented to selected participants, and the research supervisor for validation and constant feedback was provided to the researcher. Dependability was respected by using a research protocol to guide data collection and keep the researcher focused. An audit trail was kept throughout, together with a detailed description of the procedures. Confirmability was ensured by having two independent co-coders and having the research design and the findings peer-reviewed. Furthermore, transferability was ensured through a dense description of the research design and the findings.

2.6 Ethical considerations

This study adhered to ethical principles and began after obtaining ethical clearance (No: HSS/1294/014D), research approval from Rwanda’s Ministry of Education, and the gatekeeper’s permission. Furthermore, research participants gave informed consent before their involvement in this study.

3. RESULTS

The middle-range theory presented in this study was developed based on the results obtained from the open and axial coding process, and the implementation of e-learning in nurs-

ing education emerged as a core value. This study’s results are expansive and have been published elsewhere;^[18,24,33] they have been summarised for this article.

3.1 Demographics

Out of 40 participants, 18 were nurse educators, 17 were nursing students, 2 were ICT managers, and 3 were experts in distance learning and nursing education. Furthermore, 21 participants were females, and 19 were males.

3.2 Main categories emerged from the axial coding phase

Guided by the components of Strauss and Corbin Paradigm model, the following categories emerged: Antecedents included: Reforms in nursing education; inadequately prepared graduates; insufficient number of graduates; need to upgrade larger numbers of graduates from A2 to A1 academic levels;

the graduate’s nature produced after engaging in the new curriculum. The context of e-learning in nursing education included the country’s vision to promote the use of technology across all sectors, the transformation of higher education, the transformation of nursing education, collaborative partnership with U.S universities and Rwandan schools, and national ICT strategic plan (see Table 1).

The process of developing and implementing e-learning emerged as an action interaction strategy in this study. This process involved establishing a shared vision of e-learning as a framework to use in nursing education, using campuses as providers of raw data and as settings for testing the middle-range theory developed. Furthermore, the process included planning the effective use of Moodle® as a Learning Management System (LMS) and facilitating a training event on the use of Moodle®.

Table 1. Antecedent and context

Strauss and Corbin paradigm model	Categories	Quotations
Antecedent	Reforms in nursing education	<i>“For nurse and midwifery training, nursing schools are responsible for A1 nursing and midwifery education, which is now the minimally acceptable standard for nurses and midwives. This means that most A2-nurses and midwives will need to upgrade to A1.”</i>
	Inadequately prepared graduates	<i>“The Ministry of Health (MoH) decided in 2006 that training and deploying A2-level nurses and midwives should stop as their skills were deemed insufficient to provide quality patient care...”</i>
	Insufficient number of graduates	<i>“...The schools are relatively small and have insufficient teaching capacity to meet the national desired annual enrolment of 250 students...”</i>
	Need to upgrade larger numbers of graduates from A2 to A1 academic levels	<i>“The e-learning program in schools of nursing and midwifery is a special program which was developed to upgrade nurse with A2-level [diploma] to A1-level [advanced diploma]. The main objective is to upgrade the academic level of those nurses while they are still working in their respective places of work...”</i>
	Nature of the graduate produced after engaging in the new curriculum.	<i>“I think it is a good program in the context of Rwanda...e-learning allows students to study and work...and facilitate the integration of theory into practice.”</i> <i>“...students improve their ICT skills, and they use ICT tools to improve nursing practice and research skills...”</i>
Context	Rwanda Vision 2020	<i>“To promote efficiency and continuous upgrading of skills [...] on-job-training, in-service training and distance learning.”</i>
	Transformation of higher education in Rwanda	<i>“Integrating ICT in teaching and learning... utilising a blended mode of delivery to offer the training....”</i>
	Transformation of nursing and midwifery education	<i>“The e-learning program is designed to adapt to the learning needs of nurses and midwives who are already working, but who need further training.”</i>
	Partnership with other higher teaching and learning institutions to upgrade nursing and midwifery education	<i>“Currently, thirty-six U.S nursing and midwifery educators are twins to seventy-two Rwandan college faculty. The twinning model was developed to enhance the effective transfer of knowledge and skills.”</i>
	National Strategic Plan ICT	<i>“Transform the educational system using ICTs with the aim of improving accessibility, quality and relevance to the developmental needs of Rwanda.”</i>

Table 3 presents the intervening conditions which influenced the successful implementation of e-learning in nursing education. In this study, facilitative conditions included institutional support, partnership and collaboration, policies and guidelines, functionally effective working LMS, e-readiness

and bridging the digital divide.

The expected consequences or outcomes to the implementation of e-learning were responsive and relevant to nursing and midwifery education; healthcare system, nursing practice (see Table 4).

Table 2. Action/interaction

Strauss and Corbin paradigm model	Categories	Quotations
Action interaction	Establishing a shared vision (e-learning as a framework to use in nursing education)	<i>“We have found the topic very interesting, and we are confident that your contribution to nursing and midwifery education in Rwanda will be of great value...”</i>
	Nature of the teaching and learning environment	<i>“The participants identified authentic learning problems and their experiences on using e-learning platforms, which guided the development of the middle-range theory.”</i> <i>“After identifying what should be done to address the problems related to poor utilisation of the e-learning platform, the school became an environment for carrying out actions.”</i>
	Planning effective use of a learning management system (Moodle®)	<i>“Moodle® has been down most of the time in the previous years... Moodle® was not working for one year in 2014.”</i> <i>“There are no guidelines in terms of using e-learning and Moodle®, and there is also a lack of training among nurse educators and students on the use of Moodle®.”</i>
	Facilitating the use of Moodle® as LMS	<i>“Considering the difficulties experienced by nurse educators in using Moodle®, a training event was organised, which took place at the main campus of the selected school.”</i> <i>“Thanks a lot for the training...I am using Moodle® without any problem...I have put the course content on Moodle®, and students are enrolling themselves to access the course.”</i>

Table 3. Intervening conditions and consequences

Strauss and Corbin paradigm model	Categories	Quotations
Facilitative conditions of e-learning	Institutional support	<i>“...IT specialist trained us on how to use Moodle®...when we are having difficulties to enrol the students, we approach the IT specialist.”</i>
	Partnership and collaboration	<i>“All of these faculty members provide expert guidance and teaching in their designated areas. Their efforts are geared towards capacity building of Rwandan faculty and practitioners by mentoring, teaching, training, and providing various learning experiences for Rwandan nurses and midwives.”</i>
	Policies and guidelines	<i>“The ICT in education policy is designed to guide the process of harnessing, deployment and exploitation of ICTs within the education sector to support its organisational activities and operations within the framework of the national ICT-led development vision.”</i>
	Functionally effective of learning management system (Moodle®)	<i>“...I use Moodle® to give the assignments to students, post the course outlines, and videos to improve the online teaching and learning...”</i> <i>“we access the course content easily from Moodle®; when we are at our workplace... we also access the quizzes, assignments, and we can chat with other students and lecturers.”</i>
	E-readiness	<i>“The institutions should be ready and prepared enough...Institutions should have ICT equipment such as computers and internet..., enough staff and trained to teach online.”</i>
	Bridging the digital divide	<i>“Over 3,000km of fibre optic cables were laid across the country connecting all the 30 districts and 11 border posts...Many sites across the nation are connected, including secondary schools, universities, hospitals, district offices, judicial courts and most of the central government institutions.”</i>

Table 4. Consequences Middle-range theory generation

Strauss and Corbin paradigm model	Categories	Quotations
Consequences/Outcomes	Nursing and midwifery education	<i>“It is expected that the quality of education will increase. This is based on the fact that e-learning promotes student-centred approaches where students are self-directed, learn collaboratively and do research, and which in return promotes inquiry-based learning.”</i>
	Health system	<i>“e-learning will allow educating competent nurses and midwives at large scale who are capable of responding to health-related issues of the community, and e-learning is an important tool to develop the skills in complex clinical situations.”</i>
	Nursing practice	<i>“Nurses and midwives are expected to use technology in the clinical settings for record-keeping and communication, and e-learning could be used for mandatory updating and to ensure that practices are kept up to date. It is expected that e-learning will help to correct bad nursing practice routines by integrating newly acquired knowledge into nursing practice”.</i>
	Collaboration and partnership	<i>“The partnership between different stakeholders such as schools of nursing and midwifery, experts in e-learning and nursing education, Ministry of Education and the National Council for Nurses and Midwives are important to the implementation of e-learning and its future sustainability.”</i>
	Lifelong learning	<i>“It expected that students and teachers acquire transferable skills in terms of using science technology and critically showing responsibility towards nursing and midwifery education and health environment.”</i>

The middle-range theory generated is presented diagrammatically as a conceptual model (see Figure 2). This model should be treated as the results, and the model presentation is followed by the discussion of model content against literature. The results from the axial coding phase were interrogated during the selective coding phase, leading to the generation of an e-learning model in nursing education in the context of Rwanda.

Chinn and Jacob’s framework of the model presentation was adopted. Chinn and Jacobs^[50] stated that a model should be comprised of the following components: Assumptions, goals of the model, concepts and conceptual relationships.

3.2.1 Assumptions of the theory

The model of e-learning in nursing education was built on the assumptions derived from Rwandan Vision 2020,^[51] National ICT policy in Rwanda,^[52] ICT in education policy,^[53] the transformation of higher education,^[53,54] and a synthesis of the empirical literature. The assumptions are the basic givens or accepted truths that are fundamental to theoretic reasoning.^[55] In addition, assumptions are accepted as true without proof.^[56]

The assumptions that formed the basis of the presented model of e-learning in nursing education related to the way e-learning in nursing is conceptualised. E-learning is conceptualised as a mechanism to advance a political agenda to adopt e-learning or technology-assisted learning across higher education; e-learning used a student-centred approach,

allowing for flexibility and enabling the students to manage their learning depending on the time they have to engage in their studies. E-learning in nursing education is blended learning facilitated by online teaching and learning, face to face teaching and learning, and the use of ICT in teaching and learning. E-learning in nursing education is a tool to open access to education for working nurses and midwives. This is because it is time-saving, cost-effective, and allows access to resources anytime and anywhere. Thus e-learning helps to upgrade the lower level of qualification in nursing from A2-level (Diploma) to A1-level (Advanced Diploma) and decreasing the shortage of skilled and competent nursing and midwifery workforce.

It also assumed that in the context of e-learning in nursing education, in a resource-constrained environment, catalysts or agents of change are crucial such as institutional support for nursing students and nurse educators (instructional and technological), partnership and collaboration, policies and regulations of e-learning, effective working LMS, e-readiness (students, teachers, institutions); bridging the digital divide (political commitment, early socialisation in ICT, emotionally mature students). The presented model assumes that an adequate process should be in place for e-learning in nursing education to achieve its goals. The facilitation and engagement process in e-learning is based on a hybrid model that combines face-to-face and online teaching and learning. This hybrid teaching and learning is done through course development and delivery or implementation. In course development,

it is assumed that a number of activities would be performed, such as analysis, planning, design, development, and evaluation. In the content delivery or implementation phase, the following activities would be performed: orientation and capacity building of students and teachers, facilitation and engagement activities, monitoring, and evaluation.

It is assumed that adequate e-learning would promote quality nursing education, rapidly produce a large increase in the nursing and midwifery workforce, improve the quality of care, enhance collaborative partnership, and promote life-long learning. This model also assumes that this requires linkage with the contextual structure of e-learning, catalysts or agents of change, hybrid teaching and learning through course development and delivery, and outcomes. Finally, the developed model assumes that there are internal and external factors to the context that should be taken into consideration. The internal factors assumed are the nursing students and nurse educators' socio-demographic characteristics, constraints encountered while using e-learning, pedagogical and

ICT literacy, and language literacy. The external factors assumed are the changing nature of national health and educational policies, national health imperatives, and sub-regional and global health and education trends.

It is assumed that e-learning would improve the quality of nursing and midwifery education; upscaling the production of nursing and midwifery workforce, improving the quality of care and services, lifelong learning, and collaborative partnership.

3.2.2 Goal of the model

The middle-range theory presented in this study aimed at providing a framework to guide the implementation of e-learning in nursing education in Rwanda.

3.2.3 Concepts and conceptual relationships

Figure 2 presents the model's structure, which depicts the context of e-learning, conceptualisation of e-learning, catalysts agents, hybrid teaching and learning, and outcomes.

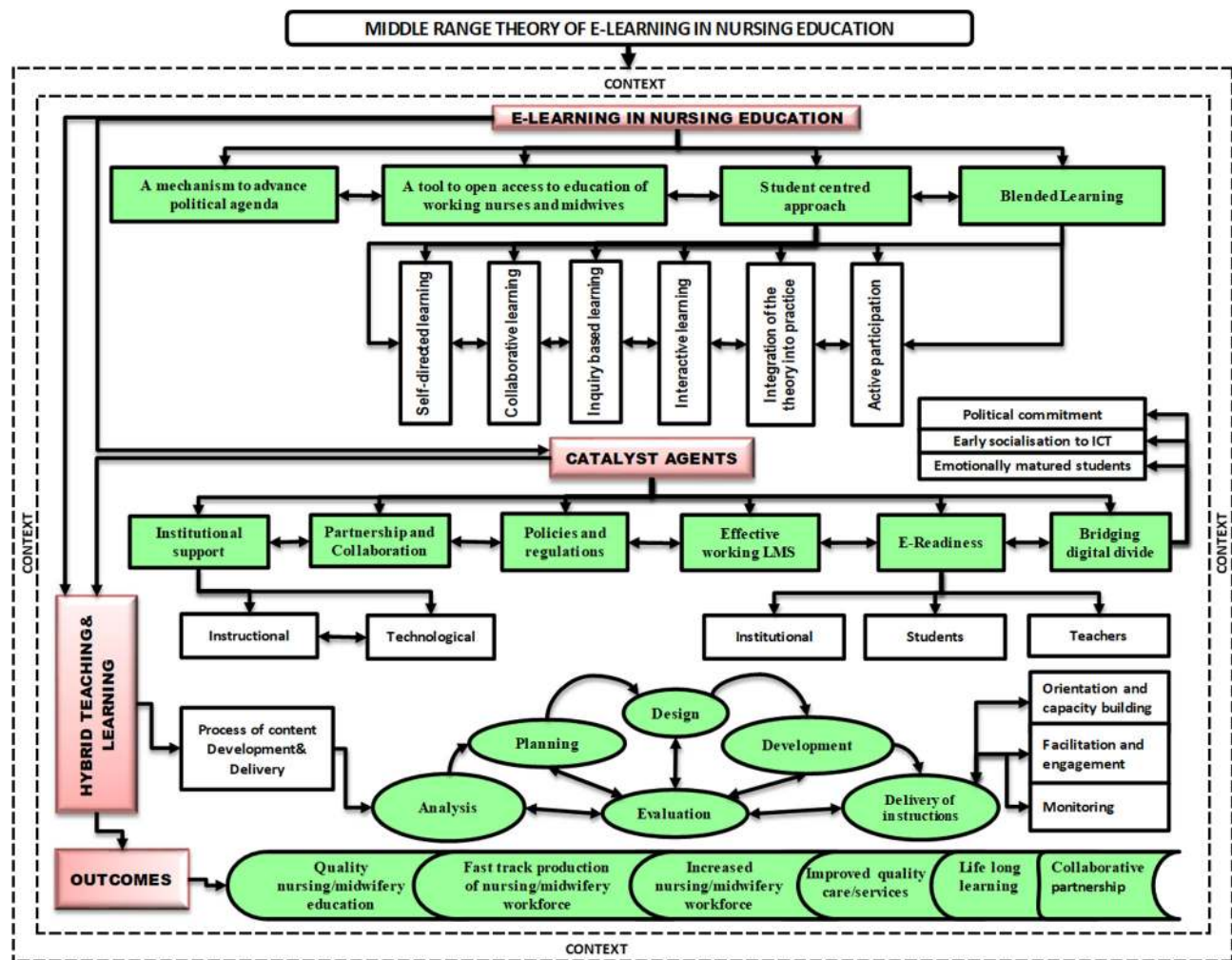


Figure 2. Middle-range theory of e-learning in nursing education

(1) Conceptualisation of e-learning

E-learning was viewed as a mechanism to advance a political agenda to promote technology-assisted learning across the high education sector. Rwanda is transforming education to meet the needs of the country and be credible and comparable internationally. More importantly, the government provided a policy framework that establishes and utilises e-learning across the higher education sector. E-learning was reported to be a flexible tool for widening access to education irrespective of age and location and in a resource-constrained environment. E-learning allows students to study for nurses and midwives in practice, students from rural or remote areas.

E-learning is viewed as a student-centred approach that promotes self-directed learning, encourages collaboration, inquiry-based learning, interactive learning, ICT use in teaching and learning, active participation, and integration of theory and practice. In Rwanda, e-learning was a form of teaching and learning that combines online and face-to-face learning. E-learning allows access to electronic resources anytime and anywhere; thus, e-learning was cost-effective and time-saving. Blended learning allows the participants to

be more engaged, whether face to face or via a web-based learning management system.

(2) Context of e-learning

The contexts referred to are instructional and technological contexts in nursing education in Rwanda. In addition, the context of e-learning in nursing education is influenced by factors from within the actual context and from outside of the context. Those factors include countries vision for education, health and technology, ICT national strategic plan; ICT policy for education, transforming higher education, transforming nursing and midwifery education and practice, and partnership with other higher teaching and learning institutions.

(3) Catalysts agents

The concept of catalyst is used to refer to the prime agents of any change in e-learning. Successful e-learning and future sustainability of the programme require a number of conditions to be in place. These catalysts include institutional support, partnership and collaboration, effective working LMS, policies and regulations of e-learning, e-readiness, and bridging the digital divide. Catalyst agents are further described in Figure 3.

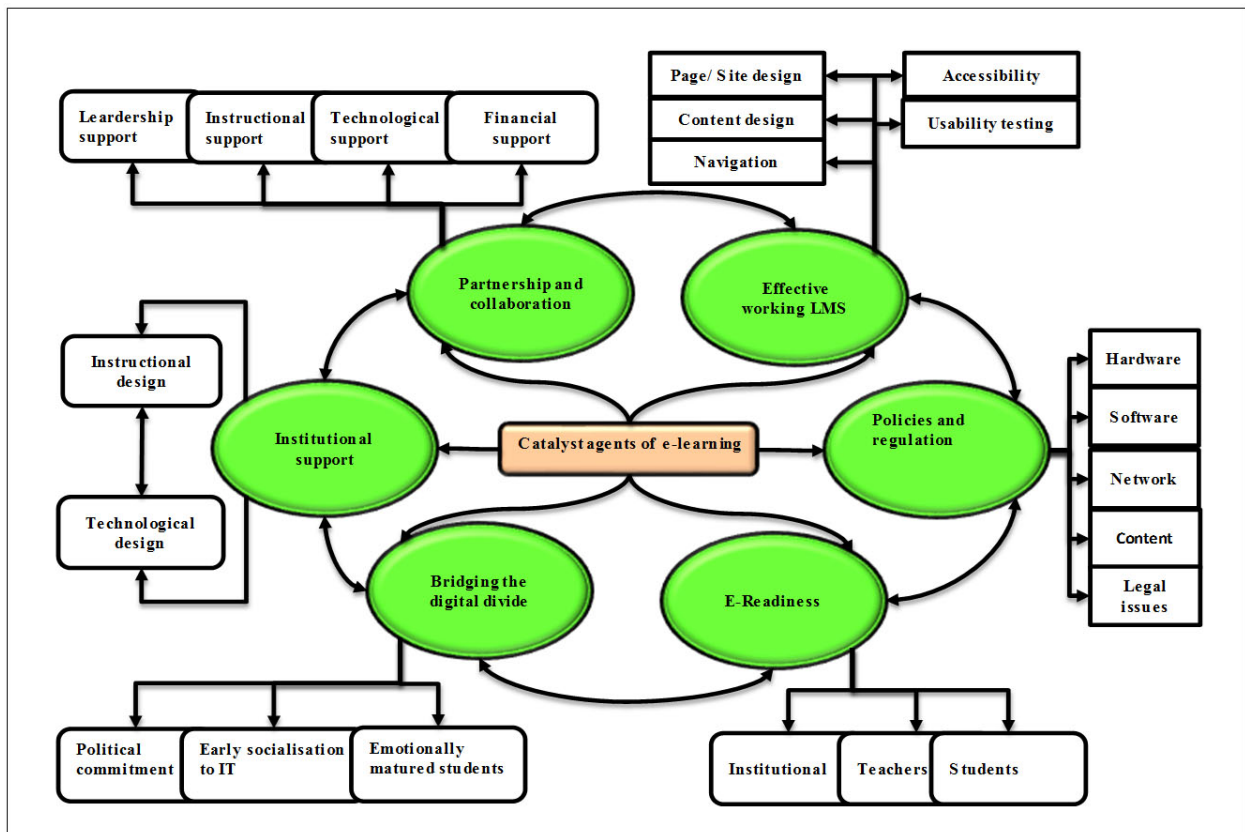


Figure 3. Catalyst agents of e-learning

In a resource-constrained environment, catalysts or agents of change are crucial to the implementation of e-learning. The catalyst includes institutional support for nursing students and nurse educators, and this is based on instructional and technological in place. Partnership and collaboration with various stakeholders were important to e-learning. The partnership with U.S faculty in nursing education has provided technological support, pedagogical support, financial support and research support.

Effective integration of ICT in national education systems requires policy and guidelines measures to be established. The policy puts ICT in context and motivates teachers to make adequate use of the ICT tools and applications, and more generally, to bring about change. Moodle® was the learning management system (LMS) used in the context of Rwanda. Moodle® serves as an LMS to provide students with access to educational resources to facilitate educational delivery and management. Moodle® promotes a collaborative approach and helps teachers design online courses with an emphasis on communication and teamwork.

The e-readiness is essential to support the implementation of e-learning in higher education. E-readiness is concerned with being fully prepared to use technology in teaching and learning in nursing education. It involves institutional readiness, student readiness, and teacher readiness. These three mentioned conditions are interrelated, and if one is missing or inadequate, e-learning facilitation and success becomes problematic.

Institutional e-readiness refers to how prepared the institution is in using ICT in the education sphere. This involves the institution and institutional stakeholders' capacity to generate e-learning opportunities. Nursing student e-readiness refers to being prepared to adopt e-learning and benefit from its advantages. The students' readiness to use technology involves the availability of infrastructure, clear training objectives, trainer support and guidance, and knowledgeable leadership. Nurse-educator e-readiness refers to the educators' preparedness, knowledge, and skills (as e-learners themselves) of instructional and technological design of e-learning courses. E-readiness for nurse educators is also concerned with ease of using technology, and necessary investments in infrastructure and a degree of institutional administrative support of e-learning.

Bridging the gap in ICT is vital for the success of e-learning. Political commitment emerged as a way to bridge the digital divide by setting policies and frameworks for using ICT in education, putting in place infrastructure such as suitably equipped computer laboratories, hardware and software, internet, electrification of the country, staff training in in-

structional and technological approaches to e-learning, funding the expansion of infrastructure, capacity building of the existing academic staff, and recruiting new academic staff. Furthermore, bridging the digital divide includes early socialisation to ICT by introducing computers in primary schools; and emotionally mature students ready to use technology to achieve their learning goals. The introduction of e-learning in nursing education in Rwanda targeted mature students who were nurses and midwives working in various clinical settings to upgrade their educational qualifications from diploma to advanced diploma.

(4) Hybrid teaching and learning

In this model, the concept of hybrid teaching and learning is concerned with course development and e-learning instruction delivery. Effective e-learning starts with a wide-ranging analysis of the context, learning outcomes, instructional content and the students. This process includes several stages: analysis, planning, design, development, delivery and evaluation. This process is dynamic, taking into consideration constructive feedback and integrating it into different stages. The implementation of e-learning includes orientation and capacity building, facilitation and engagement, monitoring, and evaluation. People involved in this process need to contact each other regularly to review the developed materials whenever necessary. The ongoing assessment for perfection needs to be integrated into each stage of the e-learning process. In the context of e-learning in nursing education in Rwanda, face to face learning accounts for 40%, while virtual learning accounts for 60% of the total time allocated to the program.

(5) Outcomes

In this model, e-learning is associated with several outcomes, including quality nursing and midwifery education, fast-track production of nursing and midwifery workforce, increased nursing and midwifery workforce, improved quality care and services, collaborative partnership, and lifelong learning.

In relation to quality nursing and midwifery education, it is expected that the implementation of the middle-range theory of e-learning in nursing and midwifery education would produce competent nurses and midwives who can respond to health-related issues of society. Effective use of an e-learning platform would undoubtedly raise education quality since e-learning promotes student-centred approaches where students are self-directed, learn collaboratively, and do research, promoting inquiry-based learning.

The adoption of innovative, technology-enabled health professional education models is expected to augment capacity to scale up nursing and midwifery education, enhance training quality and relevance, and adopt equity-focused policies.

It is expected that the number of nurses and midwives joining nursing schools through e-learning would increase, thus increasing the number of nurses and midwives graduating each year and increasing the nursing and midwifery workforce nationally. Adequately trained nurses and midwives are able to deal with all health needs at all levels of Rwanda's health sector. Having enough qualified and competent nurses and midwives would be of great value in dealing with health-related issues at all levels due to the knowledge and skills they would have acquired from the e-learning system.

The partnership and collaboration outcomes subcategory in the model relate to more formal and long-term arrangements. The authentic partnership ensures commitment and acknowledgement of responsibility by all parties involved. The partnership is also significant in promoting and monitoring the educative process's quality, ensuring that learning experiences are meaningful and beneficial to both students and teachers. Collaboration and partnership bring stakeholders into a relationship of a shared commitment to a joint purpose. A well-defined communication is required for such collaboration. Collaboration between universities has become essential for sustainable educational development. In the context of Rwanda, collaboration is vital in the implementation of e-learning, involves the joint effort by nursing schools; the National Council for Nurses and Midwives; the Council for Higher Education; the Ministry of Health, the Ministry of Education, and other stakeholders such as Rwanda Human Resource for Health (RHRH). This joint effort is manifested in the planning, implementing, and monitoring of the e-learning platform.

E-learning is expected to equip students with lifelong technological and learning resources – enabling them to address real community problems – which they acquire through experiencing and engaging in learning in practical ways rather than merely focusing on theoretical knowledge. In lifelong learning, transferable skills help the students to engage in proactive actions.

4. DISCUSSION

Rwanda is committed to integrating technology across the higher education sector.^[18, 51–53, 57–60] In nursing education, e-learning was established to scale up nursing and midwifery education and allow nurses and midwives in practice to upgrade their educational qualifications without leaving their work.^[18, 24, 37, 39, 43] E-learning ensures that both instructional and technological designs are harmonised to produce competent nurses and midwives, and this done through blended teaching and learning in face-to-face and virtual/online on LMS.^[61, 62]

The context of nursing education is crucial to the success of e-learning. Many nursing education institutions have embarked on significant curricula changes.^[63] These changes result from intense financial investments in higher education, digitalisation of higher education, government involvement, and collaborative partnerships with international educational institutions.^[40, 63, 64] Recently, the Covid-19 global pandemic has forced educational institutions to review their educational structures and move to online teaching and learning.^[64–67] Curricula design and implementation should support context-based nursing practice needs and reflect current healthcare environment trends.^[68]

The success of e-learning requires that institutions, students and teachers are ready to embrace technology. The open, flexible and distributed nature of the e-learning environment requires reviewing the e-readiness status in all possible domains.^[29, 69, 70] Nwagwu^[29] argues that the domains for e-readiness include lecturer's readiness, public and social readiness, students' readiness, human resources readiness, financial readiness, training readiness, ICT equipment's readiness, and e-learning materials and content readiness. E-readiness should be assessed before integrating e-learning in education and providing ICT resources and capacity building skills based on the identified needs.^[29, 71] Teaching institutions should be committed to full integration of e-learning in their instructional mixes and need to move beyond small grant programs that surface and reward early adopters.^[72] Implementing e-learning requires a multidisciplinary approach, and collaborative partnering is pivotal to the sustainability of e-learning.^[40, 41, 73, 74]

E-learning improves education quality by using innovative and student-centred approaches where students are self-directed, learn collaboratively and promote inquiry-based and lifelong learning.^[75, 76] Furthermore, the literature indicates that using technology would improve patients' quality of care.^[18, 24, 77–80] The integration of e-learning in nursing education in Rwanda responds to the national policies and laws favouring ICT in education.^[51–53] The model emerging from this study supports the existing ICT policies in education and is a tool to guide nurse educators, nursing students and other stakeholders to generate context-driven knowledge and practice by using the technology in nursing education.

5. CONCLUSION

This study highlights the importance of e-learning in nursing education. Adopting the innovative, technology-enabled nursing education models would augment capacity to scale up nursing and midwifery education, enhance training quality and relevance, and adopt equity-focused policies. It is expected that the number of nurses and midwives joining

nursing schools through e-learning would increase, thus increasing the number of nurses and midwives graduating each year. This is because e-learning is viewed as a flexible tool that gives nurses and midwives the chance to upgrade their level of education, irrespective of age or location and without leaving their jobs in the process of phasing out lower academic levels such as a diploma in favour of more advanced qualifications.

The success of e-learning depends on several factors, such as the availability of resources and the students' and teachers' skills to use informatics tools. Furthermore, a collaborative partnership between different expert in e-learning and nursing education is a cornerstone to the implementation

of e-learning, and this should take into consideration the dynamic and evolving nature of the education, health and technology contexts. Teaching institutions are encouraged to use e-learning, particularly in the era of pandemic diseases such as Covid-19, where face to face teaching is forbidden, and lockdowns are imposed. E-learning provides offsite educational opportunities and is flexible to accommodate everyone. This model is a tool to facilitate the establishment of a supported network learning space in nursing education in a fluid and dynamically changing nursing practice context.

CONFLICTS OF INTEREST DISCLOSURE

The authors declare that there is no conflict of interest.

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