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Translating caring competencies to remote working environments: A systematic review protocol

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Keywords:	EDUCATION & TRAINING (see Medical Education & Training), MEDICAL EDUCATION & TRAINING, Information technology < BIOTECHNOLOGY & BIOINFORMATICS, Telemedicine < BIOTECHNOLOGY & BIOINFORMATICS

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Translating caring competencies to remote working environments: A systematic review protocol

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ABSTRACT

Introduction: Caring professions attend to the health, educational, and social needs of society rather than its material needs. Caring professionals are a vital part of the world's response to COVID-19, yet the global pandemic and its aftermath have significantly changed the ways in which care is provided. The rapid pivot to remote care, where the essential caring cues and opportunities are not as readily available, has put unprecedented pressure on caring professions. There is currently a lack of clear understanding and accepted standards for teaching caring profession students how to provide care remotely. The objective of this systematic review is to identify and assess the ways in which educators can integrate online learning opportunities to help students develop effective caring practices and translate these into today's remote and virtual care environments.

Methods and analysis: This systematic review will consider diverse quantitative, qualitative, and mixed-methods studies of innovative online education initiatives and required technology for caring profession education. Articles will be retrieved from academic databases and limited to articles reporting primary data and published in English within the last 10 years. Data extraction procedures will follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses reporting guideline. The methodological quality of all studies will be assessed using the Effective Public Health Practice Project Quality Assessment Tool (EPHPP) and/or the Joanna Briggs Institute Critical Appraisal Checklist for Qualitative Research. Study characteristics will be tabulated and narratively synthesized to integrate and explore relationships within the data.

Ethics and dissemination: No ethics approval is required to conduct this review. Review findings will be disseminated through peer-reviewed publications, conference presentations and be used to inform and guide caring profession education policy, practice, and research agendas

with the goal of improving education for caring profession students, and care for the patients, clients and learners they serve.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- This review will provide a systematic overview of the ways in which educators can integrate online learning opportunities to help students develop effective caring practices and translate them into today's remote and virtual care environments.
- Only English language articles published in the last 10 years will be included, therefore this review may overlook relevant contributions from other widely used languages or those published more than 10 years ago.
- This review will inform and guide caring professional education policy, practice, and research agendas with the goal of improving education for caring profession students and remote care for the patients, clients and learners they serve.

INTRODUCTION

Caring professions, such as Education, Medicine, Nursing, Social Work, and Allied Health disciplines involve attending to health, well-being, and development, and encompass a humanitarian and human science orientation, and require human caring processes.[1] These professionals are employed to meet the health, educational, and social needs of society rather than its material needs[2] and are often in close, face-to-face contact with the recipients of their services.[3] Caring professionals deliver essential services that provide education, promote health and well-being, and support and advocate for individuals, families and communities in need – services at the heart of the world's response to COVID-19.

The COVID-19 pandemic has shone a spotlight on the importance of access to digital tools in the workplace as caring professionals quickly pivoted to using technology to support their students, patients, and clients. Digital skills went from a "nice to have" to a "vital skill" as caring professionals were expected to seamlessly bridge technical competence with caring expertise. Caring work is almost always provided in the context of a relationship and therefore social and relational skills are required[3] as key components of discipline-specific skillsets. However, rapidly changing technological advancements have altered the skills and competencies required of the present and future work force.[4,5]

Caring professionals and higher education institutions are facing the challenges of learning to become proficient with technology for communication, connection, and collaboration. Though expert professionals may be able to more easily shift their focus from face-to-face to remote and virtual care, and back again, novice caring professionals may struggle with translating their caring or teaching skills to digital environments and resources, causing significant personal and professional repercussions.[6,7] When technology fails to help deliver the

expected care, both patients and care providers may experience anguish.[7] The growing use of open educational resources in higher education can address some equity and inclusion issues, but also raise new questions about representation, authorship, and perspective.[8] The onset of COVID-19 highlights the urgent need for caring professionals to develop the skills and competencies required to best meet the needs of the public they serve. Without these skills, the negative education, health, and social outcomes made more apparent by the pandemic, such as economic inequality, food security and inadequate access to health care[9] or schooling, may be exacerbated.

Global attention has largely focused on risks to students going back to school, infected patients and the frontline responders, with some marginalised populations in society being overlooked.[10] Global efforts cannot ignore socio-economic, health and education equity, and it is imperative that digital technologies are used to ensure equal treatment and educational opportunities for all.[11] As specialized technologies are increasingly being developed and implemented to meet the needs of dynamic work environments, more time and resources are required to ensure that educators and students can efficiently use and master the technical aspects of their evolving roles.[12] Despite this pressing need, the literature lacks coherent, evidence-based direction about how educators can best integrate online learning opportunities to help students develop caring competencies and translate them to a digital working environment. This review will provide direction from across caring disciplines; specifically, those which are unified in requiring social skills to manage and maintain interpersonal relationships as central to their profession.

Caring professional training and education

Historically, caring professional education has been delivered using traditional face-to-face lecture, experiential and group in-class learning, and seminar formats. Education was often offered in tandem with work-integrated learning where students work with educators and practicing health professionals in placements to learn the hands-on skills, dispositions, and competencies required in the field (e.g., K-12 classrooms, hospital settings, counselling centers).[5,13] However, COVID -19 caused a sudden pivot to remote online teaching and learning contexts where caring professional training programs were required to implement alternative strategies to provide students with these valuable experiences and learning opportunities.[14-16] Rather than supplementing in-person instruction/experiences, online learning has become the mainstay, highlighting the need for professional programs to ensure the capacity of their students to operate confidently in online learning environments. While higher education has increased formal online learning opportunities for students over the last decade[17] educators often have limited awareness of and proficiency with technology required for today's workforce[18] and few have developed shared epistemic agency for leading these innovations.[19]

Educators must enable caring profession students to become confident and effective users of technology. COVID-19 has demanded that teachers and students become comfortable in the use of various technologies to support teaching and learning. More broadly, the COVID-19 pandemic has highlighted the need for educators to introduce students to technologies that have become crucial for providing essential care, communication, and learning connections. Educators are confronted with the dilemma of responding and adapting quickly to this increasingly critical emphasis on designing and supporting online educational environments. It is imperative to effectively support ongoing education and training to provide caring professionals with the

required skills and competencies to ensure that they are able to persevere through the challenges of the current pandemic and beyond.

GOALS AND OBJECTIVES

The objective of this mixed methods systematic review is to identify the ways in which innovative online education initiatives can best prepare graduates in caring professions for employment and competent and effective practice in the digital economy. We will identify knowledge strengths and gaps, including the applicability and/or transferability of strategies and practices to the wider band of interdisciplinary caring professional education contexts. The research questions that will guide this review are:

1. In what ways have digital technologies transformed the nature of professional education and prepared students to operate in emerging digital economies within the caring professions?
2. In what ways has COVID-19 driven innovation in caring professional education?
3. What educational strategies have proved to be most effective in preparing students to operate effectively in digital economies?

METHODS AND ANALYSIS

This protocol follows the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P) statement.[20] The mixed methods systematic review will follow the best practice outlines by the Centre for Reviews and Dissemination[21] by combining the findings of diverse primary studies within a single review.[22,23] This review will adhere to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA) guidelines for the progress and reporting of systematic reviews.[20,24]

Inclusion criteria

Studies will be included if they: (1) focus on the education of undergraduate and/or graduate students in the caring profession disciplines (Education, Medicine, Nursing, Social Work, and Allied Health); (2) describe current strategies to offer online learning designed to prepare students to operate in emerging digital economies; and (3) report on the impact of implementing these strategies including student and teacher perspectives, learning outcomes, capacity of students to develop career skills and competencies, and patient or learner perspectives.

Exclusion criteria

Studies will be excluded if they: (1) focus on the continuing education of professionals currently in practice; (2) are commentaries, editorials, letters or non-systematic reviews that do not report on outcomes or impact associated with online education; (3) have not been published within the last 10 years; and (4) are non-English language studies. We are limiting our inclusion to studies published within the last 10 years to capture the most recent and relevant online technologies, pedagogies, and practices.

Search strategy

We will search the following multidisciplinary databases to identify English language journal articles suitable for inclusion in this review: CINAHL, Education Research Complete, EMBASE, ERIC, MEDLINE, Social Service Abstracts, Social Work Abstracts, and Scopus. The search strategy will incorporate database-specific subject headings (as appropriate) and keywords (title/abstract words) from three main concepts: (1) students currently registered in caring profession educations programs in academic institutions (allied health, education, medicine, nursing, social work); (2) pedagogical approaches or technologies to facilitate online learning; and (3) outcomes related to preparing students to work in emerging digital economies (e.g.,

learning outcomes and career skills development, as well student, teacher, and stakeholder perspectives). A preliminary search strategy for MEDLINE database was completed by the team's health science librarian DLL, in consultation with the team (see online supplementary file). This search strategy will be further developed and adapted for different databases. We will also hand search the reference lists of all eligible studies to identify additional studies of relevance to this review.

Study Selection

All search results will be exported to Covidence to facilitate data management and the organization and progress of this review. Studies will be screened in three stages. Prior to screening, reviewers will independently screen a random sample of 50 abstracts using a standardized screening tool in Excel to determine inter-rater reliability. Screening of the remaining abstracts will commence when inter-rater agreement reaches 90%, at which point titles and abstracts (Level 1) will be independently screened in duplicate by two reviewers. Disagreements will be resolved by a third reviewer. Full texts of potential studies will be obtained for Level 2 screening, which will be conducted in the same manner as Level 1 screening.

Assessment of methodological quality and risk of bias

The methodological quality of quantitative studies will be assessed using the Effective Public Health Practice Project Quality Assessment Tool (EPHPP),[25] which can be used to assess multiple study designs and has evidence of validity and reliability. Each of six domains—selection bias, study design, confounders, blinding, data collection methods, and withdrawals and drop-outs—are rated as strong, moderate, weak, or not applicable. For qualitative studies, we will use the Joanna Briggs Institute Critical Appraisal Checklist for Qualitative Research. [26] This

coherent tool performs well in assessing intrinsic methodological quality.[27] Ten domains are assessed as yes, no, unclear, or not applicable: philosophy, objective, data collection, data analysis, interpretation of results, theory or cultural location, researcher reflexivity, participant representation, ethical considerations, conclusion. For mixed methods studies, we will use both appraisal tools. These tools will enable us to identify higher quality evidence and practices among the literature. Two reviewers will independently assess the quality of all included studies. Disagreements will be resolved through discussion or adjudication by a third reviewer.

Data extraction

We will use a standardized Excel data extraction tool, which will be pilot tested by the reviewers using a random sample of five studies. Following the pilot test, one reviewer will extract study data; a second reviewer will verify the extracted data for accuracy. The following data items will be extracted: study information (authors, year, country, funding source), study objectives, intervention characteristics, design and methods, participants, descriptions of setting, contextual information (setting), findings, and authors' recommendations or tools.

Data synthesis

We expect considerable heterogeneity between studies; thus, meta-analysis may not be appropriate. Data will be synthesized using the guidance from the Centre for Reviews and Dissemination[21] and Popay et al.[28] Study characteristics will be tabulated and narratively synthesized to integrate and explore relationships within the data. We will also conduct a sensitivity analysis to examine the influence of studies with a low-quality rating on the robustness of review findings.[29,30] To do this, our synthesis (with all studies) will be compared *post hoc* to a synthesis without the methodologically weak studies. The criteria or threshold for *low quality* (e.g., data collection method, sampling) will be established *a priori*. This comparison

can provide insight into whether the low-quality studies contribute unique information and if they impact the generalizability of the findings.[30]

Patient and public involvement

Patients and/or the public were not and will not be involved in the design, conduct, reporting or dissemination plans of this research.

ETHICS AND DISSEMINATION

We are taking an integrated knowledge translation/mobilization approach[31] to this research in which our team of researcher/knowledge users have worked together to craft our research questions and refine our methodology. Our study team consists of knowledge users who are committed to utilizing their knowledge networks, existing relationships with internal/external policy makers, and dissemination pathways to accelerate the mobilization and uptake of our review findings at local, provincial, national, and international levels. The purpose of engaging a diverse interdisciplinary team of researchers and knowledge users to conduct this research is to accelerate, spread, and make use of this co-created knowledge, and yield evidence-based recommendations to inform innovative best practices in caring professional education.

End-of-grant approaches to knowledge dissemination will be mindful of COVID impacts on travel and will include virtual presentations at international, national, and local meetings and conferences. All team members, including graduate students, will be invited to participate in the publication of the review findings in a high impact, peer reviewed journal. We will leverage the connections of our knowledge users to develop an infographic, a short video, and an interactive website about digital technologies and educational innovations for caring professional education. Furthermore, the findings from this synthesis project will be leveraged into a future research on

implementation and evaluation of evidence-based digital technology and education innovation within caring professional education.

Author Contributions: LN and DLL were responsible for the conceptualisation of the research question, approach, and rationale. LN and DLL developed the methods to be used for this review. LN, DLL, MJ, LL, and EOP provided initial research into existing literature and developed the introduction to this manuscript. LN prepared the first draft of the manuscript, which was reviewed and revised by DLL, MJ, LL, and EOP. All authors read and approved the final manuscript.

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Supplementary File

Database: Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily <1946 to December 15, 2020>
Search Strategy:
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1 exp education, medical, graduate/ or education, medical, undergraduate/ or education, nursing/ or education, nursing, baccalaureate/ or education, nursing, diploma programs/ or education, nursing, graduate/ or teacher training/ (152632)
2 ((clinician* or doctor* or health profession* or medical student* or nurs* or physician* or psycholog* or psychiatr* or social work* or teacher*) adj3 (educat* or professional development or train*)).tw,kf. (101954)
3 1 or 2 (226009)
4 Telemedicine/ or Educational Technology/ or informatics.tw,kf. (41786)
5 telemedicine/ or remote consultation/ (29366)
6 exp Therapy, Computer-Assisted/ (66286)
7 ((care or consultation* or educat* or healthcare or learning) adj3 (computer* or digital or electronic or online)).tw,kf. (15071)
8 (digital therapeutic* or digital technolog* or ehealth or e-health or e-support* mobile health or mhealth or m-health or remote consult* or teleconsult* or tele-consult* or telehealth or tele-health* or telemedic* or tele-medic* or telepsychiatr* or tele-psychiatr* or teletherap* or tele-therap*).tw,kf. (35571)
9 (online instruction or online learning or online teaching or digital econom*).tw,kf. (2166)
10 ((education* or information*) adj3 technolog*).tw,kf. (22885)
11 4 or 5 or 6 or 7 or 8 or 9 or 10 (161050)
12 3 and 11 (6078)
13 limit 12 to english language (5780)
14 limit 13 to yr="2010 -Current" (3702)

Reporting checklist for protocol of a systematic review.

Based on the PRISMA-P guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

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		Reporting Item	Page Number
Title			
Identification	#1a	Identify the report as a protocol of a systematic review	Title page
Update	#1b	If the protocol is for an update of a previous systematic	N/A

		review, identify as such	
Registration			
	#2	If registered, provide the name of the registry (such as PROSPERO) and registration number	N/A
Authors			
Contact	#3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	Title page
Contribution	#3b	Describe contributions of protocol authors and identify the guarantor of the review	13
Amendments			
	#4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	N/A
Support			
Sources	#5a	Indicate sources of financial or other support for the review	13
Sponsor	#5b	Provide name for the review funder and / or sponsor	13
Role of sponsor or funder	#5c	Describe roles of funder(s), sponsor(s), and / or institution(s), if any, in developing the protocol	13
Introduction			

Rationale	#6	Describe the rationale for the review in the context of what is already known	5
Objectives	#7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	8
Methods			
Eligibility criteria	#8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	9
Information sources	#9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	9
Search strategy	#10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	9
Study records - data management	#11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	10
Study records - selection process	#11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	10
Study records -	#11c	Describe planned method of extracting data from reports	11

data collection process		(such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	
Data items	#12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	11
Outcomes and prioritization	#13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	11
Risk of bias in individual studies	#14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	10
Data synthesis	#15a	Describe criteria under which study data will be quantitatively synthesised	11
Data synthesis	#15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I2, Kendall's τ)	11
Data synthesis	#15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	11
Data synthesis	#15d	If quantitative synthesis is not appropriate, describe the type of summary planned	11
Meta-bias(es)	#16	Specify any planned assessment of meta-bias(es) (such as	11

		publication bias across studies, selective reporting within studies)	
Confidence in cumulative evidence	#17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	11

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Translating caring competencies to remote working environments: A systematic review protocol

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ABSTRACT

Introduction: Caring professions attend to the health, educational, and social needs of society rather than its material needs. Caring professionals are a vital part of the world's response to COVID-19, yet the global pandemic and its aftermath have significantly changed the ways in which care is provided. The rapid pivot to remote care, where the essential caring cues and opportunities are not as readily available, has put unprecedented pressure on caring professions. There is currently a lack of clear understanding and accepted standards for teaching caring profession students how to provide care remotely. The objective of this systematic review is to identify and assess the ways in which educators can integrate online learning opportunities to help students develop effective caring practices and translate these into today's remote and virtual care environments.

Methods and analysis: This systematic review will consider diverse quantitative, qualitative, and mixed-methods studies of innovative online education initiatives and required technology for caring profession education. Articles will be retrieved from academic databases and limited to articles reporting primary data and published in English within the last 10 years. Data extraction procedures will follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses reporting guideline. The methodological quality of all studies will be assessed using the Effective Public Health Practice Project Quality Assessment Tool (EPHPP) and/or the Joanna Briggs Institute Critical Appraisal Checklist for Qualitative Research. Study characteristics will be tabulated and narratively synthesized to integrate and explore relationships within the data.

Ethics and dissemination: No ethics approval is required to conduct this review. Review findings will be disseminated through peer-reviewed publications, conference presentations and be used to inform and guide caring profession education policy, practice, and research agendas

with the goal of improving education for caring profession students, and care for the patients, clients and learners they serve.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- This is the first systematic review to appraise and synthesize existing studies on integrating online learning opportunities to help students develop effective caring practices and translate them into today's remote and virtual care environments.
- We adhere to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P) statement to ensure a systematic and rigorous approach to our review.
- The integration of both quantitative and qualitative data from multiple caring professions will generate evidence from multiple paradigms and disciplines.
- Only English language articles published in the last 10 years will be included, therefore this review may overlook relevant contributions from other widely used languages or those published more than 10 years ago.
- The diverse studies included in this review may include a variety of heterogeneous factors, making synthesis more challenging.

INTRODUCTION

Caring professions, such as Education, Medicine, Nursing, Social Work, and Allied Health disciplines involve attending to health, well-being, and development, and encompass a humanitarian and human science orientation, and require human caring processes.[1] These professionals are employed to meet the health, educational, and social needs of society rather than its material needs[2] and are often in close, face-to-face contact with the recipients of their services.[3] Caring professionals deliver essential services that provide education, promote health and well-being, and support and advocate for individuals, families and communities in need – services at the heart of the world's response to COVID-19.

The COVID-19 pandemic has shone a spotlight on the importance of access to digital tools in the workplace as caring professionals quickly pivoted to using technology to support their students, patients, and clients. Digital skills went from a "nice to have" to a "vital skill" as caring professionals were expected to seamlessly bridge technical competence with caring expertise. Caring work is almost always provided in the context of a relationship and therefore social and relational skills are required[3] as key components of discipline-specific skillsets. However, rapidly changing technological advancements have altered the skills and competencies required of the present and future work force.[4,5]

Caring professionals and higher education institutions are facing the challenges of learning to become proficient with technology for communication, connection, and collaboration. Though expert professionals may be able to more easily shift their focus from face-to-face to remote and virtual care, and back again, novice caring professionals may struggle with translating their caring or teaching skills to digital environments and resources, causing significant personal and professional repercussions.[6,7] When technology fails to help deliver the

expected care, both patients and care providers may experience anguish.[7] The growing use of open educational resources in higher education can address some equity and inclusion issues, but also raise new questions about representation, authorship, and perspective.[8] The onset of COVID-19 highlights the urgent need for caring professionals to develop the skills and competencies required to best meet the needs of the public they serve. Without these skills, the negative education, health, and social outcomes made more apparent by the pandemic, such as economic inequality, food security and inadequate access to health care[9] or schooling, may be exacerbated.

Global attention has largely focused on risks to students going back to school, infected patients and the frontline responders, with some marginalised populations in society being overlooked.[10] Global efforts cannot ignore socio-economic, health and education equity, and it is imperative that digital technologies are used to ensure equal treatment and educational opportunities for all.[11] As specialized technologies are increasingly being developed and implemented to meet the needs of dynamic work environments, more time and resources are required to ensure that educators and students can efficiently use and master the technical aspects of their evolving roles.[12] Despite this pressing need, the literature lacks coherent, evidence-based direction about how educators can best integrate online learning opportunities to help students develop caring competencies and translate them to a digital working environment. This review will provide direction from across caring disciplines; specifically, those which are unified in requiring social skills to manage and maintain interpersonal relationships as central to their profession.

Caring professional training and education

Historically, caring professional education has been delivered using traditional face-to-face lecture, experiential and group in-class learning, and seminar formats. Education was often offered in tandem with work-integrated learning where students work with educators and practicing health professionals in placements to learn the hands-on skills, dispositions, and competencies required in the field (e.g., K-12 classrooms, hospital settings, counselling centers).[5,13] However, COVID -19 caused a sudden pivot to remote online teaching and learning contexts where caring professional training programs were required to implement alternative strategies to provide students with these valuable experiences and learning opportunities.[14-16] Rather than supplementing in-person instruction/experiences, online learning has become the mainstay, highlighting the need for professional programs to ensure the capacity of their students to operate confidently in online learning environments. While higher education has increased formal online learning opportunities for students over the last decade[17] educators often have limited awareness of and proficiency with technology required for today's workforce[18] and few have developed shared epistemic agency for leading these innovations.[19]

Educators must enable caring profession students to become confident and effective users of technology. COVID-19 has demanded that teachers and students become comfortable in the use of various technologies to support teaching and learning. More broadly, the COVID-19 pandemic has highlighted the need for educators to introduce students to technologies that have become crucial for providing essential care, communication, and learning connections. Educators are confronted with the dilemma of responding and adapting quickly to this increasingly critical emphasis on designing and supporting online educational environments. It is imperative to effectively support ongoing education and training to provide caring professionals with the

required skills and competencies to ensure that they are able to persevere through the challenges of the current pandemic and beyond.

GOALS AND OBJECTIVES

The objective of this mixed methods systematic review is to identify the ways in which innovative online education initiatives can best prepare graduates in caring professions for employment and competent and effective practice in the digital economy. We will identify knowledge strengths and gaps, including the applicability and/or transferability of strategies and practices to the wider band of interdisciplinary caring professional education contexts. The research questions that will guide this review are:

1. In what ways have digital technologies transformed the nature of professional education and prepared students to operate in emerging digital economies within the caring professions?
2. In what ways has COVID-19 driven innovation in caring professional education?
3. What educational strategies have proved to be most effective in preparing students to operate effectively in digital economies?

METHODS AND ANALYSIS

This protocol follows the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P) statement.[20] The mixed methods systematic review will follow the best practice outlines by the Centre for Reviews and Dissemination[21] by combining the findings of diverse primary studies within a single review.[22,23] This review will adhere to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA) guidelines for the progress and reporting of systematic reviews.[20,24]

Inclusion criteria

Studies will be included if they: (1) focus on the education of undergraduate and/or graduate students in the caring profession disciplines (Education, Medicine, Nursing, Social Work, and Allied Health); (2) describe current strategies to offer online learning designed to prepare students to operate in emerging digital economies; and (3) report on the impact of implementing these strategies including student and teacher perspectives, learning outcomes, capacity of students to develop career skills and competencies, and patient or learner perspectives.

Exclusion criteria

Studies will be excluded if they: (1) focus on the continuing education of professionals currently in practice; (2) are commentaries, editorials, letters or non-systematic reviews that do not report on outcomes or impact associated with online education; (3) have not been published within the last 10 years; and (4) are non-English language studies. We are limiting our inclusion to studies published within the last 10 years to capture the most recent and relevant online technologies, pedagogies, and practices.

Search strategy

We will search the following multidisciplinary databases to identify English language journal articles suitable for inclusion in this review: CINAHL, Education Research Complete, EMBASE, ERIC, MEDLINE, Social Service Abstracts, Social Work Abstracts, and Scopus. The search strategy will incorporate database-specific subject headings (as appropriate) and keywords (title/abstract words) from three main concepts: (1) students currently registered in caring profession educations programs in academic institutions (allied health, education, medicine, nursing, social work); (2) pedagogical approaches or technologies to facilitate online learning; and (3) outcomes related to preparing students to work in emerging digital economies (e.g.,

learning outcomes and career skills development, as well student, teacher, and stakeholder perspectives). A preliminary search strategy for MEDLINE database was completed by the team's health science librarian DLL, in consultation with the team (see online supplementary file). This search strategy will be further developed and adapted for different databases. We will also hand search the reference lists of all eligible studies to identify additional studies of relevance to this review.

Study Selection

All search results will be exported to Covidence to facilitate data management and the organization and progress of this review. Studies will be screened in three stages. Prior to screening, reviewers will independently screen a random sample of 50 abstracts using a standardized screening tool in Excel to determine inter-rater reliability. Screening of the remaining abstracts will commence when inter-rater agreement reaches 90%, at which point titles and abstracts (Level 1) will be independently screened in duplicate by two reviewers. Disagreements will be resolved by a third reviewer. Full texts of potential studies will be obtained for Level 2 screening, which will be conducted in the same manner as Level 1 screening.

Assessment of methodological quality and risk of bias

The methodological quality of quantitative studies will be assessed using the Effective Public Health Practice Project Quality Assessment Tool (EPHPP),[25] which can be used to assess multiple study designs and has evidence of validity and reliability. Each of six domains—selection bias, study design, confounders, blinding, data collection methods, and withdrawals and drop-outs—are rated as strong, moderate, weak, or not applicable. For qualitative studies, we will use the Joanna Briggs Institute Critical Appraisal Checklist for Qualitative Research. [26] This

coherent tool performs well in assessing intrinsic methodological quality.[27] Ten domains are assessed as yes, no, unclear, or not applicable: philosophy, objective, data collection, data analysis, interpretation of results, theory or cultural location, researcher reflexivity, participant representation, ethical considerations, conclusion. For mixed methods studies, we will use both appraisal tools. These tools will enable us to identify higher quality evidence and practices among the literature. Two reviewers will independently assess the quality of all included studies. Disagreements will be resolved through discussion or adjudication by a third reviewer.

Data extraction

We will use a standardized Excel data extraction tool, which will be pilot tested by the reviewers using a random sample of five studies. Following the pilot test, one reviewer will extract study data; a second reviewer will verify the extracted data for accuracy. The following data items will be extracted: study information (authors, year, country, funding source), study objectives, intervention characteristics, design and methods, participants, descriptions of setting, contextual information (setting), findings, and authors' recommendations or tools.

Data synthesis

We expect considerable heterogeneity between studies; thus, meta-analysis may not be appropriate. Data will be synthesized using the guidance from the Centre for Reviews and Dissemination[21] and Popay et al.[28] Study characteristics will be tabulated and narratively synthesized to integrate and explore relationships within the data. We will also conduct a sensitivity analysis to examine the influence of studies with a low-quality rating on the robustness of review findings.[29,30] To do this, our synthesis (with all studies) will be compared *post hoc* to a synthesis without the methodologically weak studies. The criteria or threshold for *low quality* (e.g., data collection method, sampling) will be established *a priori*. This comparison

can provide insight into whether the low-quality studies contribute unique information and if they impact the generalizability of the findings.[30]

Patient and public involvement

Patients and/or the public were not and will not be involved in the design, conduct, reporting or dissemination plans of this research.

ETHICS AND DISSEMINATION

We are taking an integrated knowledge translation/mobilization approach[31] to this research in which our team of researcher/knowledge users have worked together to craft our research questions and refine our methodology. Our study team consists of knowledge users who are committed to utilizing their knowledge networks, existing relationships with internal/external policy makers, and dissemination pathways to accelerate the mobilization and uptake of our review findings at local, provincial, national, and international levels. The purpose of engaging a diverse interdisciplinary team of researchers and knowledge users to conduct this research is to accelerate, spread, and make use of this co-created knowledge, and yield evidence-based recommendations to inform innovative best practices in caring professional education.

End-of-grant approaches to knowledge dissemination will be mindful of COVID impacts on travel and will include virtual presentations at international, national, and local meetings and conferences. All team members, including graduate students, will be invited to participate in the publication of the review findings in a high impact, peer reviewed journal. We will leverage the connections of our knowledge users to develop an infographic, a short video, and an interactive website about digital technologies and educational innovations for caring professional education. Furthermore, the findings from this synthesis project will be leveraged into a future research on

implementation and evaluation of evidence-based digital technology and education innovation within caring professional education.

Author Contributions: LN and DLL were responsible for the conceptualisation of the research question, approach, and rationale. LN and DLL developed the methods to be used for this review. LN, DLL, MJ, LL, and EOP provided initial research into existing literature and developed the introduction to this manuscript. LN prepared the first draft of the manuscript, which was reviewed and revised by DLL, MJ, LL, and EOP. All authors read and approved the final manuscript.

Data availability: Data sharing not applicable as no datasets generated and/or analysed for this study

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Competing interests: None declared

Patient consent of publication: Not required

Provenance and peer review: Not commissioned; externally peer reviewed.

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Supplementary File

Database: Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily <1946 to December 15, 2020>
Search Strategy:
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1 exp education, medical, graduate/ or education, medical, undergraduate/ or education, nursing/ or education, nursing, baccalaureate/ or education, nursing, diploma programs/ or education, nursing, graduate/ or teacher training/ (152632)
2 ((clinician* or doctor* or health profession* or medical student* or nurs* or physician* or psycholog* or psychiatr* or social work* or teacher*) adj3 (educat* or professional development or train*)).tw,kf. (101954)
3 1 or 2 (226009)
4 Telemedicine/ or Educational Technology/ or informatics.tw,kf. (41786)
5 telemedicine/ or remote consultation/ (29366)
6 exp Therapy, Computer-Assisted/ (66286)
7 ((care or consultation* or educat* or healthcare or learning) adj3 (computer* or digital or electronic or online)).tw,kf. (15071)
8 (digital therapeutic* or digital technolog* or ehealth or e-health or e-support* mobile health or mhealth or m-health or remote consult* or teleconsult* or tele-consult* or telehealth or tele-health* or telemedic* or tele-medic* or telepsychiatr* or tele-psychiatr* or teletherap* or tele-therap*).tw,kf. (35571)
9 (online instruction or online learning or online teaching or digital econom*).tw,kf. (2166)
10 ((education* or information*) adj3 technolog*).tw,kf. (22885)
11 4 or 5 or 6 or 7 or 8 or 9 or 10 (161050)
12 3 and 11 (6078)
13 limit 12 to english language (5780)
14 limit 13 to yr="2010 -Current" (3702)

Reporting checklist for protocol of a systematic review.

Based on the PRISMA-P guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

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In your methods section, say that you used the PRISMA-Preporting guidelines, and cite them as:

Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart LA. Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015 statement. Syst Rev. 2015;4(1):1.

		Reporting Item	Page Number
Title			
Identification	#1a	Identify the report as a protocol of a systematic review	Title page
Update	#1b	If the protocol is for an update of a previous systematic	N/A

		review, identify as such	
Registration			
	#2	If registered, provide the name of the registry (such as PROSPERO) and registration number	N/A
Authors			
Contact	#3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	Title page
Contribution	#3b	Describe contributions of protocol authors and identify the guarantor of the review	13
Amendments			
	#4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	N/A
Support			
Sources	#5a	Indicate sources of financial or other support for the review	13
Sponsor	#5b	Provide name for the review funder and / or sponsor	13
Role of sponsor or funder	#5c	Describe roles of funder(s), sponsor(s), and / or institution(s), if any, in developing the protocol	13
Introduction			

Rationale	#6	Describe the rationale for the review in the context of what is already known	5
Objectives	#7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	8
Methods			
Eligibility criteria	#8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	9
Information sources	#9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	9
Search strategy	#10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	9
Study records - data management	#11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	10
Study records - selection process	#11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	10
Study records -	#11c	Describe planned method of extracting data from reports	11

data collection process		(such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	
Data items	#12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	11
Outcomes and prioritization	#13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	11
Risk of bias in individual studies	#14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	10
Data synthesis	#15a	Describe criteria under which study data will be quantitatively synthesised	11
Data synthesis	#15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I2, Kendall's τ)	11
Data synthesis	#15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	11
Data synthesis	#15d	If quantitative synthesis is not appropriate, describe the type of summary planned	11
Meta-bias(es)	#16	Specify any planned assessment of meta-bias(es) (such as	11

		publication bias across studies, selective reporting within studies)	
Confidence in cumulative evidence	#17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	11