

# Ethics and Health Informatics in Contemporary Healthcare Delivery: Evaluating Collaborative Student Engagement Through Virtual Learning

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## ABSTRACT

**Background:** Contemporary learning has changed the dynamic of how students acquire new knowledge, and the prevalent use of social media has influenced the way in which students develop insight and learn new theoretical knowledge. Graduate students obtaining degrees in the field of healthcare, health sciences, and related allied health professions, are academically and professionally prepared to address complex challenging scenarios in varied healthcare settings using diverse learning strategies. The aim of this project was to explore student engagement when using a virtual discussion forum to discuss the principles of ethics and health informatics in contemporary healthcare delivery. **Methods:** This was a retrospective process evaluation on student engagement when using a virtual discussion forum to discuss ethics and health informatics in contemporary healthcare delivery. **Results:** Two main themes emerged from this process evaluation. Critical reflective dialogue on ethics and health informatics was evident through student interaction and the ability to reflect on personal experiences relating to the concepts explored. Interactive peer learning using critical reflection techniques supported the process of academic critical reasoning within the discussions. The critical reflection technique was student-led and independently facilitated to promote an engaging virtual learning environment. **Conclusion:** The critical reflective dialogue promoted a peer learning, student-led experience that was supported by Socratic questioning. Interactive peer learning was evident as the critical reflective technique enabled students to receive real-time feedback from their peers relating to ethics and health informatics through virtual learning.

**Keywords:** Contemporary, Ethics, Health, Informatics, Virtual

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## 1. Introduction

Contemporary learning has changed the dynamic of how students acquire new knowledge, and the prevalent use of social media has influenced the way in which students develop insight and learn new theoretical knowledge (Giroux & Moreau, 2022). The shift to online higher education over the past 6 years has increased (Seaman et al., 2018), and the implementation of contingency learning due to the COVID-19 pandemic (Marsicano, 2020), instigated a greater need for diverse teaching and learning strategies within higher education. Online learning is a teaching and learning method that requires skillful dissemination of content, with a requirement to effectively transfer knowledge to a diverse student population group (Lockee, 2021). Student

engagement using virtual discussion forums influences students' ability to reason critically, challenge concepts using objective perspectives and develop an interactive approach to peer learning (Kanuka & Garrison, 2004; Shea & Bidjerano, 2009). Graduate students obtaining degrees in the field of healthcare, health sciences, and related allied health professions, are academically and professionally prepared to address complex challenging scenarios in varied healthcare settings using diverse learning strategies (Sezgin & Bektas, 2023), thus supports the concept of active involvement in the teaching and learning process. Interactive teaching and learning strategies such as virtual discussion forums, play a pivotal role in the development of cognitive critical reasoning and knowledge exchange relating to various health conditions (Fox, 2011). Person-centered care is taught to facilitate meaningful learning in a clinical setting within online pedagogy (Avilés et al., 2024). Technology enhanced learning through virtual discussions has increased in healthcare education to stimulate active learning, using interactive and real-life simulations where students develop new skills, previously thought to be under-utilized through effective discussions and debate (Moule et al., 2011). Real-life scenarios presented in a virtual learning environment enables students to reflect on and relate personal experiences to practice, which enhances understanding of concepts being explored (Adamson & Dewar, 2015). Virtual discussions provide learners the opportunity to interact and discuss important health related topics with peers, facilitators and clinical champions and at the same time reflect on their current practice and acquired knowledge from their work environment (DeSouza et al., 2020). Thus, this offers students a space to apply their digital skills and experiment with technologies when presenting their ideas and thoughts in a virtual environment (Elshami et al., 2022).

An analysis of current and dated literature highlights the requirements for effective virtual discussions, focusing on independent student engagement and learners adopting a strong sense of commitment to virtual healthcare education among health professionals and their peers (Moehead et al., 2020). Virtual discussions are found to be effective when there is constant interactive dialogue and sustained engagement throughout the learning process which develops into a non-judgmental scholarly environment exploring sensitive healthcare topics (Goldberg et al., 2015). In order for virtual discussions to be effective in online healthcare education, a multimodal approach needs to be adopted and this includes presentation and relevance of topic being explored; a flexible approach when contributing to the discussion, such as asynchronous, offering prompt feedback on assessments, and developing an effective and efficient means of contributing to a virtual discussion using a learning management system (Carroll et al., 2009). The role of open learning and self-awareness in particular to receiving feedback from peers, is an effective peer learning strategy (Tang et al., 2022). Exploring student engagement through virtual discussion forums allows academics to examine and discern the amount of research, knowledge, and reflection students have put into their forum posts. Through exploratory and reflective questions, academics should ask themselves, Are these learning strategies effective? Are students comprehending the information given and found through their research and review of evidence-based literature? Healthcare education is specific with a language that requires study and familiarity; through virtual forums and ideas that are shared and discussed, which enhances learning by engaged students. Perceptions and beliefs often play a part in student's virtual forum posts; leading to deeper student engagement which encourages looking 'outside of the box' of their own perceptions (Lesko et al., 2017).

de Lima et al., (2019) explored the benefits and difficulties of using virtual discussion forums from the instructors' perspective, to identify strategies that could improve the challenges associated with participatory online learning. Thus, four observations were identified when exploring student engagement using virtual discussion forums.

- 1) The benefits perceived by instructors. This related to the depth of the discussion, elaborate answers to questions and conversations that incorporated different perspectives.
- 2) The difficulties faced in discussion forums, which related to the motivation of student engagement and the influences on student participation.
- 3) The strategies used by instructors, which included instructor presence in the virtual discussion forum and moderation processes on how students are accessing the course content.
- 4) The improvements that can be made to the forum tool such as multimedia resources, educational resources and collaborative resources.

The aim of this project was to explore student engagement when using a virtual discussion forum to discuss the principles of ethics and health informatics in contemporary healthcare delivery. This was to determine the effectiveness of the four observations identified by de Lima et al., for online student engagement. There is evidence that virtual discussion forums offer creative and interactive learning in higher education, a teaching and learning strategy frequently used in health professions education to diversify peer learning (Donlan, 2019). We present this study in accordance with the guidelines for reporting evaluations based on observational methodology (GREOM) (Portell et al., 2015), as this study was conducted as a retrospective process evaluation to explore student engagement when using a virtual discussion forum to discuss the principles of ethics and health informatics.

## 2. Materials and Methods

We adopted the process evaluation framework developed by Saunders et al., (2005), as it is a theoretical framework that facilitates a comprehensive evaluation for teaching and learning methods in healthcare programs. According to Saunders et al., the primary goal of a process evaluation is to monitor and document program implementations that help to understand the relationship between program elements and program outcomes. Saunders et al., (2005), describes the elements of a process evaluation with formative and summative applications. There are 7 components of the process evaluation plan:

1. Fidelity (quality): The extent to which an intervention was implemented as planned.
2. Dose delivered (completeness): The amount or number of intended units of each intervention or component delivered or provided as part of the intervention.
3. Dose received (exposure): The extent to which participants actively engage with, interact with, are receptive to, and/or use materials or recommended resources.
4. Dose received (satisfaction): Participant (primary and secondary audiences) satisfaction with program and interactions.
5. Reach (participation rate): The proportion of the intended priority audience that participates in the intervention; often measured by attendance; includes documentation of barriers to participation.
6. Recruitment Procedures used to approach and attract participants at individual or organizational levels; includes maintenance of participant involvement in intervention and measurement components of study.
7. Context Aspects of the environment that may influence intervention implementation or study outcomes.

The aim of this process evaluation was to monitor student engagement and interaction when using a virtual discussion forum to discuss the principles of ethics and health informatics in contemporary healthcare delivery. Saunders et al., provide a systematic approach for developing a process evaluation plan which facilitated the structure of this work.

## 2.1. Evaluation Design

This was a retrospective process evaluation on student engagement when using a virtual discussion forum. Process evaluations enables qualitative observation which includes unobtrusively and systematically documented encounters within a program (Coyle et al., 1991), and facilitates the assessment of processes used and the activities or characteristics of the subject that is explored (Haltaufderheide et al., 2022). The 7 components of the process evaluation plan described by Saunders et al., (2005) guided this study. Fidelity (quality), determined the extent to which engagement and interaction was evident within the virtual discussion forum. The dose delivered (completeness), guided the number of questions posted to the virtual discussion forum as part of the intervention. The dose received (exposure), determined the extent to which students actively engaged with each other, interacted with virtual platforms, and were receptive to the academic task at hand. The dose received (satisfaction), focused on student satisfaction with the discussion forum interactions. The reach (participation rate), was measured by online attendance and identifying the barriers to participation, which connected to retention of students participating in the academic activity and the online learning environment that could influence student participation.

## 2.2. Socratic Questioning

The data were presented as interactive discussions using the virtual discussion forum guided by Socratic questioning, which are used to investigate perspectives, assumptions, viewpoints and evidence (Zare & Mukundan, 2015). Developed by the Greek Philosopher Socrates, the Socratic maieutics (Brunschwig et al., 2003) is an educational strategy, based on the foundation that thinking has structured logic, and allows underlying thoughts to be interrogated, focusing on essential concepts, principles, theories, issues, or problems, as the art of questioning contributes to the excellence of thought (Dowie, 2023). The Socratic approach is instigated by the continual probing of questions by the instructor to unravel underlying beliefs and perceptions that shape the students' views and opinions. It is used to explore the complexity, difficulty, and uncertainty of understanding rather than to elicit factual information about a concept (Conor, 2023). The process of Socratic questioning enables ethical reasoning and critical thinking (Torabizadeh et al., 2018), of which was required to effectively evaluate the discussion forum as to whether or not it promoted student engagement. Socratic questions were developed by exploring the perspectives students have on the increasing use of mobile health records, and patient understanding of test results. Socratic questioning is a pedagogy that strengthens an open learning approach and encourages students to delve into deeper scholarly concepts (Overholser & Beale, 2023). Socratic questioning in this case, was used as an analytical logic of the unknown; as it allows academics to draw students out and discern their understanding of a subject and aids them in reaching logical conclusions (Vale, 2013). The why? when? where? and how? of a topic can often be discovered by continual questioning and probing. Socratic questions can be a powerful teaching tool used to enhance contemporary healthcare delivery. And when applied effectively, it can lead to inquiry, interest, and knowledge, especially in healthcare which requires critical thinking, reasoning, and forethought.

The theoretical basis used to formulate the first question was based upon Socratic questioning for ethical and critical reasoning (Torabizadeh et al., 2018) and reaching a logical conclusion utilizing question probing (Vale, 2013). The question, *In what way does the increasing use of mobile health records, such as patient portals and apps, affect the patients' confidence about their understanding of test results? And why?* (Table 1) explores ethics in digital health and patient comprehension of healthcare information. The theoretical basis used to formulate the

second and third question was based upon Socratic questioning to investigate perspectives, assumptions, viewpoints and evidence (Zare & Mukundan, 2015). The questions *How can health informatics be utilized to treat mental health conditions like depression, anxiety, and PTSD for patients that live in rural areas? What was the justification for your perspective? How will the use of health informatics and advance technology redirect patients away from going to a hospital?* were developed based upon points of view relating to health informatics and its use in a population group diagnosed with mental health. Again, this explores ethics in digital healthcare delivery from a broader perspective of treatment and health management in rural settings. Socratic questioning plays an important role in critical thinking of complex concepts, and each of the questions were developed to incite opinions, underlying beliefs and highlight subjective assumptions. The process evaluation was implemented as a formative process to monitor and adjust teaching and learning delivery as required, to ensure theoretical integrity and academic quality assurance.

### **2.3. Setting and Context**

The discussion forum context was focused on the topic of ethics and health informatics. The hosting software for the asynchronous virtual discussion forum was Moodle, a learning management system (LMS). Teaching, learning and discussion forum content were embedded within the graduate Health Informatics course. This course was password protected and only accessible to academics and the six students who were enrolled and had permission to access the content. The graduate students who had access to the virtual discussion forum were undertaking a master's degree in Population Health Management and discussions relating to ethics and health informatics was part of their formative assessment embedded within the virtual discussion.

### **2.4. Data Collection**

A retrospective process evaluation exploring student engagement when using a virtual discussion forum to discuss the principles of ethics and health informatics was conducted upon completion of a sixteen week academic semester. An inductive approach was used to analyze the data (Pope, 2006), which was guided by the evaluation objective and Socratic questioning. The evaluation objective and Socratic questioning guided the process evaluation. The virtual discussion forum performance was determined by the four observations identified by de Lima et al., (2019) which were:

1. The benefits perceived by instructors.
2. The difficulties faced in discussion forums.
3. The strategies used by instructors.
4. The improvements that can be made to the forum tool.

### **2.5. Data Analysis**

The analysis was carried out through rigorous, careful reading and identification of key ideas and concepts emerging from the discussion forum, guided by the adaptation of de Lima et al., four observations.

#### **1. The benefits perceived by instructors**

Benefits perceived by the instructors focuses on engagement, critical dialogue, reflective discussion, the ability to reflect on personal experiences relating to ethics and health informatics and presenting this information in a coherent manner.



## 2. The difficulties faced in discussion forums

Difficulties faced in discussion forums focus on lack of engagement, non-productive discussions and limited interaction.

## 3. The strategies used by instructors

Strategies such as incorporating external literature sources to defend academic arguments and presenting questions that stirred up academic discussion and debate.

## 4. The improvements that can be made to the forum tool

Identifying interactive limitations and using data to enhance and improve future curriculum by adopting advanced and creative digital applications.

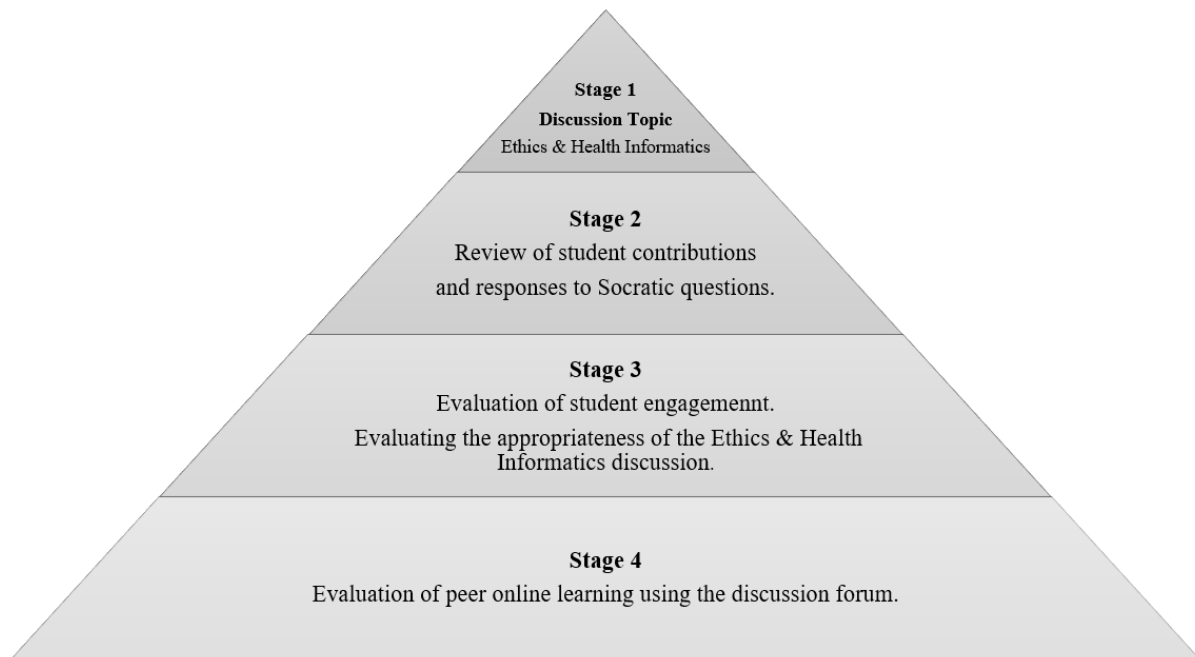
Coyle et al., (1991) describes this as record keeping and a consistent administrative reporting system that monitors uniformity in the scope and depth of analyzing the data that has been collected. The students' textualized discussions were not included within the data analysis, as we wanted to focus on student engagement based upon de Lima et al., four observations, as opposed to worded responses from the students. We sought to identify whether the topic of ethics and health informatics promoted student engagement using an online learning platform. This was done by reviewing student contributions in response to the Socratic questions relating to ethics and health informatics shown in Table 1.

Table 1.

*Discussion Forum Questions*

<b>Questions on Ethics and Health Informatics</b>
1. In what way does the increasing use of mobile health records, such as patient portals and apps, affect the patients' confidence about their understanding of test results? And why?
2. How can health informatics be utilized to treat mental health conditions like depression, anxiety, and PTSD for patients that live in rural areas? And what was the justification for your perspective?
3. How will the use of health informatics and advance technology redirect patients away from going to a hospital? And expand on your objective contribution.

The 7 components of Saunders et al., (2005) process evaluation plan was used to evaluate Fidelity (quality), for engagement and interaction; the dose delivered (completeness), for the number of questions posted; the dose received (exposure), to determine the extent of active engagement; the dose received (satisfaction), focusing on student satisfaction; reach (participation rate), for online attendance; recruitment procedures that attract active participation; and the learning environment influencing student involvement. The frequency of responses from each of the students were coded to determine whether the 7 components of the process evaluation plan were implemented accordingly. Figure 1 illustrates the process evaluation at four different stages.



*Figure 1.* Four Stage Evaluation Process

## 2.6. Ethical Considerations

Students were provided with information about the process evaluation upon commencement of the course. They were also informed that the discussion forum would be moderated and evaluated throughout the interactive process and thereafter. Students were made aware that the discussion forum textualized responses would not be analyzed, but an evaluation on student engagement would be conducted as part of evaluating the process of teaching and learning. Students were also informed that their names and student ID numbers would be not identified and reassured about the process of anonymity and confidentiality. Implied consent was obtained through each students' active interaction and willingness to participate in critical discussions as described by University of California San Francisco human research protection program (Program, 2022). The process evaluation was conducted in accordance with the Declaration of Helsinki (as revised in 2013) (The World Medical Association, 2016).

The Institutional Review Board (IRB) at Southeastern Louisiana University, found this project worthy of being conducted and granted an IRB approval [IRB Number: 2022-146].

## 3. Results

All students responded to the presented questions with several responses, which were relevant and focused on the topic being discussed. Thirty-nine asynchronous responses were available for the three questions uploaded to the virtual discussion forum. Each response was received at different times of the day, and there was a continuous flow of online interaction throughout the duration of the active discussion. Two main themes emerged from this process evaluation. Theme one: Critical reflective dialogue on ethics and health informatics. Theme two: Interactive peer learning using critical reflection techniques. Critical reflective dialogue was initiated by the Socratic questioning for ethical, critical reasoning and reaching logical conclusions, guided by the 7 components of the process evaluation plan.

### 3.1. Critical Reflective Dialogue on Ethics and Health Informatics

Critical reflective dialogue was evident through student interaction and the ability to reflect on personal experiences relating to ethics and health informatics. 4 components from the process evaluation plan *Fidelity (quality)*, *Dose delivered (completeness)*, *Dose received (exposure)*, *Dose received (satisfaction)*, guided this section of the evaluation. Observations from the discussions highlighted personal reflective dialogues were broad, but evident that discussions on digital health access in rural settings were presented as a significant challenge.

Financial implications such as insurance and provider coverage were prominent factors when exploring alternatives to hospital care and the experiences of data breach, health records and test results were simultaneously explored from individual experiences. Whilst these critical reflections addressed sensitive concepts relating to ethics and health informatics, the healthcare providers, health services, clinicians and healthcare professionals remained confidential and anonymous. The critical reflective process was unguided. There was no implementation of a reflective tool however, the students had an understanding of what was defined a reflective dialogue and the reflective process was supported by students positioning their thoughts and experiences that were encountered during the COVID-19 pandemic, and the impact of the pandemic on ethics, contemporary healthcare delivery and health informatics. Students elaborated on the concept of patients receiving clinical results through digital platforms, and the consequences of misunderstanding information when patients read lab results or clinical reports. Critical reflection on ethical consequences enabled students to further delve into dialogue that focused on the impact of health informatics on a population group who may not be digitally literate. The Socratic questioning method was a dialogue facilitating strategy that encouraged critical reflection on ethics and health informatics, promoting shared knowledge and experiences that were once masked but further explored through the method of Socratic questioning (Clark & Egan, 2015).

### 3.2. Interactive Peer Learning Using Critical Reflection Techniques

3 components from the process evaluation plan, *Reach (participation rate)*, *Recruitment Procedures and Context Aspects of the environment* guided this part of the evaluation. Interactive peer learning was evident through constant and frequent interaction, and the ability to receive real-time feedback from their peers relating to the discussion explored. The online learning environment supported the reflective process, enabling students to actively upload evidence-based literature that focused on contemporary healthcare delivery, justifying their academic critical reasoning within the discussions. The learning environment created a safe space for question probing, follow-up of discussions and the integration of supporting content. The critical reflection technique was student-led and independently facilitated to promote recruitment to the virtual discussions, promoting student engagement throughout the learning process.

## 4. Discussion

Exploring student engagement whilst using a virtual discussion forum to discuss the principles of ethics and health informatics in contemporary healthcare delivery, highlighted the importance of virtual critical reflective dialogue and peer learning in higher education. There are many ways to engage students in virtual forums that make learning more meaningful and interesting, and integrate theory into the teaching and learning process to make a better connection with the topic and the content. The use of critical reflective dialogue demonstrated an inclusive learning environment that helped students understand the principles of ethics and health informatics from an asynchronous peer learning approach. Evidence has shown that



asynchronous discussion forums help students to articulate a deeper understanding of teaching and learning content and facilitates a proficient understanding of core subject content (Aloni & Harrington, 2018; Perrotta, 2020).

A deeper understanding of core content was evident through the exchange of critical reflective dialogue and supportive evidence-based literature. Various scholars have emphasized on the significance of asynchronous discussions being a collaborative teaching and learning method, that encourages collective peer learning (Alzahrani et al., 2023; Dewiyanti et al., 2007; Falcione et al., 2019; Gronseth & Bauder, 2022; Liu et al., 2018). Thus, supports the development of higher order, critical thinking and advanced cognitive skills (Tuma & Aljazeera, 2021), all of which the student's exhibited through this retrospective evaluation. The relevance of this concept appeared to be true for these students as they facilitated the critical reflective dialogue and assumed a student-led peer learning approach (Hew & Cheung, 2011; Waters, 2012).

Fundamentally, the critical reflective dialogue promoted a peer learning, student-led experience that was supported by Socratic questioning. According to Chen et al., (2019) asynchronous interactive discussion platforms facilitated by various discursive questions helps to promote active student participation and positively has an impact of cognitive presence. The evidence of cognitive presence was consistent, as interactive peer learning was a dominant influence on knowledge exchange, understanding of teaching and learning content and comprehension of theory into practice. This learning process is what Komives et al., (2013) describes as a cognitive and emotional process. Alternative student contributions within the teaching and learning process such as student-led videos expressing their knowledge and opinions on a topic, has the ability to increase engagement; along with having their peers critique their videos or posts to promote a deeper peer learning bond between students (Cents-Boonstra et al., 2021). This relates to the observation that de Lima et al., (2019) identified when exploring the benefits of discussion forums, and particularly highlighted the significance of in-depth discussions, elaborate answers to questions and conversations that incorporated different perspectives.

The inclusion of evidence-based literature, uploading of external materials and actively scrutinizing discussion forum responses promoted critical reflective dialogue and interactive peer learning when discussing ethics and health informatics in contemporary healthcare delivery. The student-led defense within the academic critical discussion heightened the peer learning approach. And although online learning has been identified as a substandard method of teaching and learning in comparison to in-person teaching and learning methods (Allen & Seaman, 2016; Singh & Hurley, 2017), this retrospective evaluation can argue against this perspective.

A critical statement could focus on the effectiveness of online teaching and learning, and its dependance on an experienced instructor who has the ability to promote student engagement through critical questioning techniques and methods (Jaschik & Lederman, 2018), but the final determination of online engagement relies on student active participation in the teaching and learning process. It is fundamental that students identify the enthusiasm from the instructor about the topic being explored to fully comprehend the importance of what is being discussed. An experienced instructor has the ability to deploy motivational skills to engage students in forums, by showing support and interest in their posts and responses to peers. Instructor presence is what de Lima et al., observed as a useful strategy to enhance virtual discussions and facilitate the moderation processes, supporting the concept of critical thinking skills for students.

#### **4.1. Methodological Considerations**

To ensure the credibility of this study, it is essential that we address research rigor and quality with regards to participant involvement (Johnson et al., 2020). Although we evaluated student engagement through virtual learning, this was primarily focused on the students enrolled into the graduate Health Informatics course and poses a potential lack of represented engagement of other students on the Population Health Management program. Enabling other students on the program to access the virtual discussion as part of a formative assessment may have overcome this challenge. Generalizability is a threat when dealing with a small sample within any study (Malik & Norman, 2023). With the continual growth of online learning, the potential for increasing sample bodes well for researchers. The findings from this study are not exhaustive and provide further topics for student engagement, online virtual discussions and healthcare education. Generalization is not the totality of a study alone and the population of online graduate students at Southeastern Louisiana University and in other regional universities offering online graduate programs, would be a target population to further explore the concepts from this study. Having six students enrolled into the Health Informatics course does limit wider insight of the study results. A true determination of critical reflective dialogue and interactive peer learning requires an increased number of students to thoroughly explore critical discussions, evidence-based practice (Gagnon et al., 2015), ethics and health informatics. However, having six students did offer more in depth conversations, as students may have felt safer to disclose personal feelings or experiences thus, getting to know their peers better and having a coherent rapport with one another.

#### **5. Recommendations for Future Practice**

It is recommended that virtual discussion forums are embedded within continual professional development (CPD) in order to support the knowledge, skills and professional growth of qualified healthcare professionals. Online programs that incorporate virtual discussions may contribute to a more accomplished healthcare workforce when complex scenarios, clinical cases and critical discussions are embedded throughout the learning process (DeSouza et al., 2020). In terms of digital skills, data protection and data breaches, healthcare professionals will be able to discuss sensitive matters relating to healthcare practice confidentially. However, the academic institution needs to make sure that the facilitators are trained to deliver such forums, incorporating appropriate ground rules that are agreed and consented to by the students, such as being kind to one another; not posting peer perspectives and opinions on social media and so forth. An esteemed level of professionalism is a factor that needs to be re-enforced by the facilitator. Other topics such as healthcare policy and reform, healthcare regulatory law and further discussion on ethics in healthcare past and present, are all important topics that could be explored through online virtual discussions within healthcare education.

#### **6. Conclusion**

Exploring student engagement when using a virtual discussion forum to discuss the principles of ethics and health informatics in contemporary healthcare delivery, has highlighted the importance of critical reflective dialogue and interactive peer learning using critical reflection. The critical reflective dialogue promoted a peer learning, student-led experience that was supported by Socratic questioning. Interactive peer learning was evident as the critical reflective technique enabled students to receive real-time feedback from their peers relating to ethics and health informatics. The final determination of online student engagement is reliant on active participation in the online teaching and learning process.

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## Authors' contributions

- (I) Conception and design: L Collins
- (II) Administrative support: All authors
- (III) Provision of study materials or patients: All authors
- (IV) Collection and assembly of data: L Collins
- (V) Data analysis and interpretation: L Collins
- (VI) Manuscript writing: All authors
- (VII) Final approval of manuscript: All authors

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