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Roots, prefixes, and suffixes: Decoding medical terminology using an online Enquiry-Based Learning intervention for Nursing Associates

Abstract

Aim/Objective: The aim of this pilot study was to establish the impact of a virtual, short-term, EnquiryBased Learning (EBL) intervention on students' ability to accurately decode medical terms and determine students' perspectives on the value of learning medical terminology to their academic success and professional practice.

Background: Undergraduate Nursing Associate Apprenticeship (NAA) students are required to learn a range of medical terminology to orientate them for practice. Dedicating time to teaching students skills to comprehend and gain confidence with medical terms is central to their success.

Design: The pilot study used a non-experimental before and after design, alongside a cross-sectional survey. Undergraduate NAA students were included in this pilot study. The pilot study was conducted at a UK-based, Widening Participation university in the School of Nursing, Midwifery and Allied Health.

Methods: Pre- and post-assessments were completed by all participants and quantitative analysis was performed using SPSS to assess impact. An anonymous, online questionnaire was shared with all participants to understand their perspectives on the value of learning medical terminology and the instructional tools and materials used in the intervention. *Setting:* The pilot study was conducted at a UK-based, Widening Participation university in the School of Nursing, Midwifery and Allied Health.

Results: Following the teaching intervention, a paired samples t-test showed that participants' post-assessment results were significantly higher ($p < 0.001$) than those obtained in the pre-assessment, with a mean difference in results of 5 marks, specifically a 20% gain. The questionnaire responses indicated that participants value the opportunity to learn medical terminology, and perceive a benefit in doing so. Overall, participants agreed that the EBL intervention increased knowledge and skills in decoding medical terminology.

Conclusions: The findings suggest that the virtual EBL intervention had a beneficial impact, and students perceive value in learning medical terminology for application to both academic study and professional practice.

Keywords: decoding medical terminology, online teaching intervention, barriers to technology, Nursing Education, Enquiry-Based Learning.

1. Introduction

Medical terminology forms the foundation of a universal language for medicine (Dahm, 2011; Willis, 2006). It facilitates efficient and unambiguous communication between different healthcare professionals and supports improved patient safety and experiences (Karaca and Aslan, 2018). Medical terms, however, can be long and complicated as well as difficult to pronounce and spell, which can prove challenging for many students. Adding to the challenge is the sheer volume of medical terms to grasp. Supporting students to develop skills to become competent in medical terminology has the potential to not only promote student retention and academic success, but also contribute positively to generating a workforce capable of delivering high quality care (Pastae, 2017).

2. Background literature

The terminology used today in all areas of theoretical and practical healthcare is deeply rooted in Latin and Greek origins (Lysanets and Bieliaieva, 2018). The use of centuries old nomenclature in modern medicine provides the means for health professionals to succinctly and effectively convey a message using terms that are consistent and internationally understood. Medical terms often comprise Latin or Greek roots with affixes. Affixes are the prefixes and suffixes attached to words that alter meaning. For example, the term ‘hypothermia’ consists of a Greek prefix, root, and suffix. The prefix ‘hypo-’ means ‘low, under or below normal’, the root ‘therm’ refers to ‘heat or temperature’ and the suffix ‘-ia’ pertains to a ‘disease or abnormal condition’. By decoding the various word parts, the term’s meaning is ascertained. In this example, it is possible to establish that ‘hypothermia’ refers to an abnormally low body temperature. There are studies that purport the benefits of teaching terminology with reference to Greek and Latin word parts (Kolodnytska, and Vorona, 2019; Tindall, 2018; Rasinski et al., 2011) and this notion underpins the teaching intervention developed for this pilot study.

In recent years, innovative pedagogical strategies have evolved that prioritise a more student-centred approach to learning (Moxley et al., 2021). Amongst these, is Enquiry-Based Learning (EBL), which is considered a high-impact, learner-centred pedagogical strategy that supports knowledge transfer through students’ active involvement in the learning process (Murray, Lachowsky, and Green, 2017). Research suggests that terminology instruction, which focuses on learning strategies that actively engage students with the content, can enhance students’ knowledge and understanding while potentially improving their overall achievement and academic success (Seidlein et al., 2020; Blachowicz et al., 2006). Furthermore, it is recognised that the preferred learning style of nursing students is largely kinaesthetic or visual (Zhu et al., 2019; Stirling, 2017; Frankel, 2009) with a preference to learn through concrete experiences or by ‘doing’ (Vinales, 2015; Kolb, 2007). To foster these learning preferences,

this teaching intervention embodied EBL activities. In breakout groups, students reviewed and shared learnings from medical terminology presented in case studies. In class groups, students participated in quizzes and brief question and answer sessions. Individually, students were tasked with creating, sharing, and viewing video clips that demonstrated how to decode a particular medical term. The TikTok-style videos facilitated peer-to-peer learning, using the University's Virtual Learning Environment (VLE) as a sharing platform

Virtual pedagogy has transformed the way in which knowledge and learning is delivered. It is not new to higher education, however, the COVID-19 pandemic has served as a potent stimulus for the widespread transformation and integration of virtual strategies into current study programmes (Moxley *et al.*, 2021). Technology forms an essential component of virtual pedagogy. There is an extensive range of educational technology and tools available that promotes learning via exploration and engagement with the topic rather than content consumption (Konrad *et al.*, 2021). Recent research indicates that a dynamic approach to content delivery and the use of visual, technology-based strategies can be particularly effective where teaching medical terminology is concerned (Aravind and Rajasekaran, 2020; Kingsley and Grabner- Hagen, 2018; Wolsey, Smetana, and Grisham, 2015). As such, the inclusion of visual representations of medical terms was a core component of the videos created by the students. Designing and producing the videos enabled students to become actively involved in the learning process while providing the freedom to self-direct their learning, by practicing the skill of decoding and verbalising medical terminology on a personal selection of terms (Tekin *et al.*, 2020; Gallagher and Anderson, 2016; Manyak *et al.*, 2014).

The motivation for devising this research was to provide additional support to students during the COVID-19 pandemic, by offering the opportunity to learn the requisite skills for decoding medical terms. To understand the effectiveness of the teaching intervention, this research was run as a pilot in the first instance, to inform future research and curriculum development. The Nursing Associate Apprenticeship (NAA) students were selected using convenience sampling for the pilot sample. Nursing Associates (NA) are a relatively new role that is regulated by the Nursing Midwifery Council (NMC, 2018) in the United Kingdom (Taylor and Flaherty, 2020). This role evolved to fill a knowledge and skill gap between the duties of healthcare assistants and qualified, registered nurses. Like any student studying a medical or healthcare-related programme, undergraduate NAs are expected to become familiar with a vast range of medical terminology. NAs are a characteristically heterogeneous group. Students vary in age and personal commitments, have a broad range of practical experiences and differing levels of academic skills. Consequently, the extent to which learning outcomes are achieved vary and can affect student retention and success. Whilst effective communication and knowledge of human anatomy and physiology when delivering care are included in the NMC Standards of Proficiency

for Nursing Associates (2018), students are generally expected to learn medical terms through lectures, clinical practice and self-study. Support for learning medical terminology is often limited (Tekin et al., 2020). The purpose of this study is two-fold. The first aim is to establish the impact of an online shortterm teaching intervention on students' knowledge of medical terminology. The second is to determine the students' perceptions of medical terminology; specifically, the value of learning medical terms and the perceived benefit to academic success and application to practice.

3. Methods

3.1. Study Design

This pilot study followed a quantitative approach using a non-experimental before and after design, to investigate the effect of a short-term teaching intervention on NAA students' knowledge and ability to decode medical terminology. This approach was complemented with a cross-sectional survey to explore students' experiences of the teaching intervention while ascertaining their perceptions on the value of learning medical terminology in dedicated teaching sessions for their academic and clinical practice.

3.2. Participants

The participants for this pilot study were a convenience sample of first year students enrolled onto a NAA programme. The study was advertised during the programme's induction, where the aims and delivery methods were explained to the students and all questions were answered. In the spirit of inclusivity, students were also informed that they could attend the teaching intervention regardless of their participation in the research. Of the possible 43 students that comprised the 3 cohorts of NAA students, a total of 21 students were recruited. Of these, 20 provided written informed consent to participate in the research and from this sample, 16 participants completed both the pre- and post-assessments with 14 also completing the questionnaire. Participants' ages ranged from 29 to 59 years with a mean age of 41 years. Participants possessed a wide range of healthcare-related work experience.

3.3. Setting

The research was conducted at a UK-based, Widening Participation university in the School of Nursing, Midwifery and Allied Health. The programmes offered at this institution range from undergraduate (level 4) to postgraduate (level 7) across five Nursing fields (Adult, Child, Mental Health, Learning Disability, and Midwifery). While medical terminology is used and occasionally explained throughout the current curriculum, there is no teaching dedicated to supporting this fundamental knowledge. This

gap in the curriculum presented an opportunity to develop and explore the value of incorporating adjunct instruction specific to decoding medical terminology.

3.4. Teaching intervention

The virtual teaching intervention was delivered during the first three weeks of the participants' NAA programme. It consisted of three, one-hour long online seminars, supplemented with student-directed learning in the form of creating and reviewing TikTok-style videos. The seminars were conducted on a weekly basis, using Prezi EDU Plus software and delivered via Blackboard Collaborate. The seminar content developed by the researchers is briefly outlined in Table 1, and the expected total time commitment from participants in this study was approximately five to six hours. This time period was considered the minimum necessary to attend the seminars and complete the online pre- and post-assessments and self-directed learning tasks.

Participants were encouraged to create short TikTok-style videos with visual representations and upload them to a Discussion Board for review by their peers. There is evidence that peer-to-peer learning promotes greater confidence and a deeper understanding of the subject matter (Topping et al., 2017; Boud and Cohen, 2014). Participants identified medical terms that were of personal interest, they researched the word, and produced visual representations, which clearly demonstrated the different word parts (roots, prefixes, and suffixes) and the meaning of the term. On video, participants then used the visuals to teach their peers the meaning of the selected medical term. A total of 84 videos were uploaded by the 16 participants. Each video was clearly titled with the medical term that was being taught, in order to facilitate easy identification and selection of medical terms for students to review and learn. This strategy was utilised to foster independence and self-determination in the learning process. Although encouraged to produce and watch a minimum number of video clips each week, participants were not expected to watch all video clips. Participants had the freedom and responsibility to direct their own learning to meet their personal needs and goals.

The pre- and post-assessments were another integral component of the teaching intervention. Not only did the assessments provide data for the research, but the assessments provided a feedback mechanism to support improved future outcomes for participants. The results of both assessments, along with general feedback on performance, were given to participants upon completion of the post-assessment. Participants could reflect on this information to gauge progress, build confidence and adopt skills, practices and knowledge to enhance learning success on the NAA programme.

Insert Table 1: Outline of teaching intervention

<i>PRE-ASSESSMENT</i>		
SESSION	THEME	CONTENT
Seminar 1	<i>The basics of decoding medical terminology</i>	Introduced students to different word parts including roots, prefixes, and suffixes found in medical terms. Students were taught how to deconstruct terms into their word parts before assigning meaning to each component in order to reconstruct the word and provide its correct meaning. This session was predominantly didactic instruction, although examples were provided to support concept-based learning so students could build on prior knowledge, integrate the information and begin to consider application to practice.
<i>STUDENT-LED ACTIVITY: CREATE AND UPLOAD VIDEO CLIPS TO DISCUSSION BOARD. VIEW PEER VIDEO CLIPS.</i>		
Seminar 2	<i>Medical terms in context</i>	Focused on learning the meanings of specific roots, prefixes, and suffixes in particular contexts. For example, prefixes that relate to quantity and size, such as <i>micro-</i> , <i>mega-</i> , <i>bi-</i> , were discussed. Students were encouraged, where possible, to make connections with already familiar words and formative assessment exercises were used to gauge student retention of knowledge and understanding, using both the chat and microphone functions.
<i>STUDENT-LED ACTIVITY: CREATE AND UPLOAD VIDEO CLIPS TO DISCUSSION BOARD. VIEW PEER VIDEO CLIPS</i>		
Seminar 3	<i>Application and reflection on learning</i>	Encouraged students to apply the learned knowledge. In breakout rooms, students worked in small groups to extract medical terms from an allocated case study. The group worked together to identify medical terms, decode the meanings and upon return to the main room, share their conclusions with the rest of the class. The final aspect of this session was reflection. Students were encouraged to reflect upon their experiences and progress during the teaching intervention and consider how this new knowledge could be used for both academic and clinical practice success.
<i>POST-ASSESSMENT AND QUESTIONNAIRE</i>		

3.5. Data collection procedures

Data were collected in April and May 2021, during the first three weeks of the NAA study programme, when the teaching intervention was delivered. Participants completed a thirty-minute online pre-assessment that was made available on the VLE prior to the first teaching session. Participants then completed the post-assessment that was made available after the final teaching session of the intervention. The questions in both online assessments were posed at random and students were not aware that the assessments were the same. The timed assessments included various multiple choice-

style questions. These assessments were developed to establish participants' baseline knowledge of medical terminology at the intervention's outset, and measure knowledge upon its completion.

Participants were also invited to complete an anonymous online questionnaire after the teaching intervention. To access this, a QR code was presented during the last teaching session and a link to the online questionnaire was also made available in the VLE. Participants were informed of the anonymous nature of the questionnaire to encourage its completion and promote honest responses to the questions. The questionnaire used a combination of closed, Likert-scaled and open-ended questions to measure students' experiences and perceptions of the teaching intervention in an effort to ascertain its value to their learning and practice.

3.6. Data analysis

Analysis was performed using the Statistical Package for Social Sciences Version 25.0 (SPSS). Descriptive and frequency statistics were calculated for the continuous variables. The Shapiro-Wilk test for normality was performed to determine the suitability of the data for parametric testing and a paired samples t-test was conducted on the pre- and post-assessment data. The two-tailed, paired t-test was considered statistically significant if it had a p-value < 0.001.

A Thematic Analysis of the questionnaire responses was conducted in this study. A key feature of Thematic Analysis is undertaking systematic coding to examine the meaning derived from the dataset, while acknowledging themes as the main products resulting from the analysis (Vaismoradi *et al.*, 2016; Riger and Sigurvinsdottir, 2016; Braun and Clarke, 2012). This process involved identifying frequently emerging patterns in the data, otherwise known as "recurring regularities" (Guba cited in Ryan and Bernard, 2003, p. 89). The themes were used to ascertain participants' experiences of the virtual teaching intervention and perceived impact on their learning and practice.

3.7. Ethical considerations

Ethical approval was granted by the University's Research Ethics Panel. All eligible participants were advised of the voluntary nature of their involvement and were reassured that they were permitted to withdraw at any time, without needing to provide a reason and with no repercussions for their programme of study. Written informed consent was obtained from participants prior to the inclusion of data in the analysis and participants were aware that all data would be anonymised and securely stored throughout the study's duration. Access to the VLE for the teaching intervention was restricted to the eligible cohorts of students, researchers, and VLE administrators to protect participants' confidentiality.

Furthermore, the virtual delivery method utilised for this teaching intervention reduced risk to participants, as the research was undertaken during the COVID-19 pandemic.

4. Results

4.1. Pre- and post-assessment results

Table 2 presents the basic descriptive statistics for the pre- and post-assessment data. 20 participants completed the pre-assessment test and of these, 16 also completed the post-assessment. 1 participant did not complete the post-assessment but no reason was offered for this omission. The range for the pre-assessment results was 17, with the lowest score being 2 out of 25 marks and the highest being 19. The mean result for the pre-assessment was 13.10 marks or 52.4%. The range for the post-assessment results was smaller at 12, with the lowest score being 10 out of 25 marks and the highest being 22. The mean result for the post-assessment was 18.44 marks or 73.75%.

The median for pre-assessment results was 13.5 marks, indicating that 50% of participants achieved 54% or less in the test. While the percentiles showed that 25% of participants achieved less than 39% in the pre-assessment. After completion of the intervention, post-assessment results yielded a median of 19 marks, indicating that 50% of participants achieved 76% or less in the test. The post-assessment percentiles show that 25% of participants achieved 65% or less in the test and in fact the lowest result achieved was 40%.

Due to the sample size, the Shapiro-Wilk test for normality was used to assess the distribution of both sets of data. The Sig value of the pre-assessment and post-assessment data is 0.085 and 0.066 respectively. Both values are >0.05 , indicating that the data is normally distributed. The assumptions for the t-test were met and a paired samples t-test provided comparative analysis of the data.

Results showed that participants achieved a higher result on the post-assessment (mean=18.44, SD=3.265) than the pre-assessment (mean=13.44, SD=4.788). The paired samples t-test showed this to be a significant difference $t(15) = 6.956$, $p < 0.001$. The mean difference between pre- and post-assessments highlights that a 5 mark increase or 20% gain was achieved on average by participants. However, for some participants the gain was much more substantial, for example, a 44% improvement from 32% in pre-assessment to 76% post-assessment.

Table 2: Descriptive and frequency statistics generated by SPSS for pre- and post-assessment data

	Valid N	Missing	Range	Min	Max	Mean	SD	Median	Percentiles:		
									25	50	75
Pre-result	20	1	17	2	19	13.10	4.800	13.50	9.75	13.50	17.00
Post-result	16	5	12	10	22	18.44	3.265	19.00	16.25	19.00	21.00
Pre % grade	20	1	68	8	76	52.40	19.201	54.00	39.00	54.00	68.00
Post % grade	16	5	48	40	88	73.75	13.061	76.00	65.00	76.00	84.00

4.2. Questionnaire results

Of the 20 participants who consented, 14 completed the questionnaire, which is a 70% response rate. Over half of the respondents (57%, n=8) were in the 45-54 age category, 14% (n=2) were older and the remaining were aged between 25-44 years of age. Thematic Analysis of the responses identified 3 key themes:

4.2.1 Theme 1: Understanding barriers to technology: digital literacy vs. digital poverty

This theme identified some of the common barriers participants experienced in relation to technology. Whilst all participants indicated that they had consistent and reliable access to a device that could connect to the internet (such as a smartphone, tablet, or computer) they still experienced barriers to optimal virtual learning. 38% (n=6) of participants identified limited understanding of technology as a key barrier, with a further 13% (n=2) citing a lack of confidence in its usage. An additional 13% (n=2) stated privacy issues as a contributing barrier to their online experience. One participant's comment was *'my children also needing access'*, which highlights a particular barrier associated with technology and virtual learning and can impact the student experience.

4.2.2 Theme 2: Impact of an online Enquiry-Based Learning teaching intervention

Virtual tools and activities were incorporated into the teaching intervention to actively engage participants in learning to decode medical terminology. Responses to the participants' experiences with the teaching materials and activities were collected using a 5-point Likert scale (strongly agree; agree; neutral; disagree; strongly disagree). 85.7% of participants agreed or strongly agreed that the

instructional materials provided were beneficial to their learning. More specifically, 64.3% strongly agreed, whilst 21.4% agreed. Similarly, 85.7% of participants acknowledged that creating their own video clips and reviewing those posted by others increased their knowledge of and confidence in decoding medical terminology. However, the experiences were less positive, with 35.7% strongly agreeing and 50% agreeing. Some of the comments made by participants to identify the parts of the intervention that they found most beneficial included the following coded responses: *'The videos were very helpful'*; *'Quizzes and repeating information'*; *'Lectures'* and *'the way it was constructed and taught'*. Some of the comments made by participants to identify the challenging aspects of the teaching intervention included: *'Uploading video'*; *'Shortness of the course'*; *'Timetabling'*. A reliability analysis was carried out on the 3 questions relating to the tools used in this teaching intervention. Cronbach's alpha equalled 0.74, indicating an acceptable level of reliability, particularly with the small sample size.

4.2.3 Theme 3: Perceived value of decoding medical terminology in practice

The participants' perception of the value of learning to decode medical terminology was collected using the same 5-point Likert scale. 92.9% (n=13) agreed or strongly agreed that the intervention would be helpful towards achieving their qualification, with one neutral response. Similarly, 57.1% (n=8) of participants strongly agreed that the intervention was helpful in their clinical practice and 57.1% agreed that what they were being asked to learn was important. In fact, 79% (n=11) of participants acknowledged that they had already applied what they had learned to their practice. Notably, 100% of participants confirmed they would retake this teaching intervention (or one like it) if given the opportunity in future, with 100% of participants recommending the course to others. A reliability analysis was carried out on the 3 questions relating to the perceived value of learning medical terminology. Cronbach's alpha showed that this aspect of the questionnaire reached acceptable reliability with alpha = 0.94.

5. Discussion

In an increasingly competitive Higher Education market, it is more important than ever that universities are committed to providing a world-class student experience (Shah, Nair, and Richardson, 2016; Bultjens and Robinson, 2011). Innovative teaching and learning is a core pillar of the student experience and can empower students to achieve their full potential, improve student retention and progression rates for universities, while benefiting the communities that the alumni then go on to serve. This research sought to explore an opportunity to contribute to teaching and learning innovation within the School. This approach was undertaken by creating a short, virtual teaching intervention focussing on developing students' ability to decode medical terms and determine their correct meanings for later

application in practice. This pilot study investigated the impact of this teaching intervention quantitatively. Additionally, it examined the participants' experiences of the teaching intervention and perspectives on the value of learning about medical terminology in a purposeful way.

The findings showed that there was a significant difference ($p < 0.001$) between the participants' results for the pre-assessment, which was undertaken prior to the teaching intervention, and the results of the post-assessment, which was undertaken following completion of the teaching intervention. Participants demonstrated an average improvement of 20% in the post-assessment results. Additionally, on post-assessment, all participants achieved a result of 40% or more, meaning that all participants would have met the minimum grade requirement for passing. Although this improvement cannot be attributed directly to the teaching intervention, it does reflect significant terminology gains within the first 3 weeks of higher education.

A variety of measures were taken to mitigate the potential threats to validity. The pre- and post-assessments were designed to assess skills in decoding medical terminology (using roots, prefixes, and suffixes) rather than focus on learning the isolated meanings of medical terms. The online assessment method was kept constant between the pre- and post-assessment. Although this can bolster internal validity, it was acknowledged that there is a risk of testing threat, which could potentially influence the outcome through transference of knowledge between assessment sessions. Essentially, using the same instrument in both assessment instances poses a threat to the tool's internal consistency due to the repetition of the measure (Bennett *et al.*, 2018). To minimize this threat, students were not informed that they would be answering the same questions on both assessments and the assessments were programmed to deliver the questions in a random order on both occasions.

Participants received their pre- and post-assessment results upon completion of the teaching intervention to minimize any negative effects that a low score could potentially have on a participant and to minimize drop-out from the study. The results were released with feedback that could be used by participants to review the progress made, and from an early stage in their higher education journey, consider how to enhance their learning success.

In addition to the pre- and post-assessments, participants were asked to share their views on the teaching intervention; the value of the decoding skills learned to their practice; the instructional materials utilised throughout the teaching intervention; and the usefulness of the self-directed learning task. With 92.1% of participants indicating that what they learnt during the intervention was important and 100% of participants expressing that they would take a similar medical terminology intervention again and would recommend it to peers, it is clear that participants perceived value in allocating valuable time to learning

medical terminology. Responses suggest that participants perceived knowledge of medical terminology as beneficial to both their academic success and their clinical practice.

Scrutiny of the intervention itself showed that 85.7% of participants felt that the instructional materials provided were beneficial to their learning. Furthermore, 85.7% agreed that creating and reviewing videos both increased their medical vocabulary, while improving their confidence in using medical terms. This feedback is encouraging, given that many participants experienced technical difficulties when attempting to upload videos to the Discussion Board on the VLE. Further investigation is required to understand the perceptions of the remaining 14.3% (n=2) of participants. None-the-less, these findings suggest that an EBL approach to teaching medical terminology can be successfully applied virtually, while demonstrating that the intervention is an engaging method of learning for NAs, which can be applied to other cohorts of nursing students.

Overall, participants expressed a willingness to learn about medical terminology and the findings suggest that a virtual EBL teaching intervention for medical terminology would be a welcome and valuable addition to the NAA curriculum within the School for future cohorts. Although further investigation could prove informative, as participation in this pilot study was voluntary and those who opted out were not required to provide a reason for this decision. Consequently, no data was collected from non-participants to understand their perceptions on the value of the intervention. Anecdotally, however, the late afternoon delivery of the teaching sessions (at 16:30 after a full day of online seminars) was identified as challenging. For others, it coincided with additional responsibilities, including travelling to and from practice shifts, as well as child care. While most participants adapted well to the teaching intervention's duration, some indicated that they would have preferred seminars to be scheduled over a longer period of time to allow them to fully engage with the uploaded materials.

6. Limitations

there are limitations with this research. The conscious ethical decision to offer the learning opportunity to all the first year students enrolled onto the NAA program meant there was no provision for a control group in the research design. As a consequence, it is not possible from this non-experimental design to determine causality. Steps were taken to limit influencing factors, such as recruiting only first year students and delivering the intervention during the first few weeks of the academic programme, however it is not possible to identify or eliminate all influential elements. For example, at the time of post-assessment, the participants had engaged in 3 weeks of teaching and learning activities that formed part of their standard study programme, which is likely to have impacted their knowledge of medical terminology to some extent.

The small sample size and convenience sampling method applied in this research limits the generalisability of the results. However, this was an exploratory pilot study and future research can extend recruitment to increase sample size and gain further insights.

This research was undertaken during the COVID-19 pandemic, which provided a unique opportunity to be creative and utilise unfamiliar resources and tools in the delivery of the teaching intervention. However, the pedagogical strategies employed in this study were ultimately selected based on the practicalities and restraints of delivering the intervention via the university's VLE. Also, given the unprecedented challenges endured by students on nursing programmes during this crisis, it was essential that the online learning seminars and activities were manageable and that participants felt included and supported to be successful with the tasks.

7. Recommendations

While the findings obtained from this pilot study represent the views and experiences of a relatively small sample of students on the NAA programme, its findings are promising. The data suggests that students could benefit from the addition of a short teaching intervention on decoding medical terminology within the curriculum. Furthermore, students see value in learning about this topic. To increase the generalisability of the findings, the impact of the teaching intervention and the students' perspectives needs to be measured using a larger sample. Additionally, further longitudinal studies could be conducted to ascertain the value-added impacts of the intervention to undergraduate nursing students' academic learning and practice.

In response to participants' concerns regarding the teaching intervention's duration and timetabling, the intervention should be extended to four seminars delivered over four weeks, instead of the piloted three weeks. During the first session, participants should be inducted more thoroughly regarding the technology that will be applied throughout the intervention while providing clear contextualisation for the intervention's content. Where possible, the seminars should also be timetabled earlier in the day to facilitate student participation and improve the student experience.

8. Conclusion

This online teaching intervention encouraged students to actively engage with the process of decoding medical terminology using roots, prefixes, and suffixes. The findings of the pilot study demonstrate a positive impact of the EBL teaching intervention and a positive perception of participants towards

learning medical terminology. Participants perceived value in developing further knowledge and understanding of medical terminology for both academic study and professional practice. While instructors should remain cognisant of the potential barriers associated with the application of technology as a learning tool, the results remain optimistic, indicating the potential benefits for applying similar online teaching interventions focusing on decoding medical terminology for future cohorts.

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What is currently known about this topic:

- Students are required to learn a range of medical terminology to orientate them for practice and academic study. While numerous glossaries exist to support the development of this knowledge, there is no bespoke teaching intervention or module, which dedicates time to teaching these skills.

What the paper adds to the existing knowledge:

- Dedicating time by way of a bespoke teaching intervention helps students to develop the required skills to comprehend and gain confidence with medical terms, which is central to their success. Following the teaching intervention, participants' post-assessment results were significantly higher than those obtained in the pre-assessment, with a mean difference in results of 5 marks, specifically a 20% gain. The questionnaire responses indicated that participants value the opportunity to learn medical terminology, and perceive a benefit in doing so.

How the information in your manuscript can be applied to practice:

- Being able to decode medical terminology is crucial to students' academic learning and practice. This teaching intervention supports students' ability to communicate more effectively with colleagues and patients, while promoting safe practice.

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Ethical Approval

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Declaration of competing interest

The authors declare there are no competing interests.

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Nicole McAllister: Conceptualisation, Methodology, Formal Analysis, Investigation, Resources, Data Curation, Writing - Original Draft, Review & Editing, Visualisation, Project Administration, Funding acquisition.

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CONFLICT OF INTEREST

Roots, prefixes, and suffixes: Decoding medical terminology using an online Enquiry-Based Learning intervention for Nursing Associates Declaration of competing interest

The authors declare there are no competing interests.