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RESEARCH ARTICLE

Establishing pharmacy perceptions of e-learning format, design and development for general practice continuing professional development in Scotland

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Abstract

Background: This study explores an important area for Continuing Professional Development in pharmacy education and digital learning. Increased demand has generated the necessity for reviewing e-learning module development that successfully meets user needs and learner experience. **Objective:** This study investigates learners' perceptions of standard and segmented e-learning modules and their impact on learner experience to inform future healthcare educational module development. **Methods:** Semi-structured interviews were conducted with pharmacists (14) and pharmacy technicians (1) on the General Practice Clinical Pharmacist programme. Participants were randomised to either single or segmented module design. Fifteen interviews were conducted and data were thematically analysed. **Results:** The format allowed for expressing opinions regarding the experience of using the module and highlighted key issues. The analysis identified 125 codes, which resulted in nine themes: Navigation, Interactivity, Structure, Time, Presentation, Resource, Content, Actions and Language. **Conclusion:** Results reassure educational providers that e-learning modules suit standard or segmented formats. Findings imply that module format is less important than easy-to-use, well-structured modules with high-quality content. Constructive feedback provided potential improvements to usability, which will help focus future resources and development. More work is needed to explore the translation of learning into practice and the benefit of the segmented format for diverse or interprofessional learners.

Introduction

The increasing use of digital learning formats to facilitate pharmacy practice education has prompted the need to explore how the design of e-learning modules can be developed to support it. Pharmacy professionals in Scotland have varied work patterns and availability, which may affect how they undertake education and their preferred learning styles (Cunningham *et al*., 2019). The ability to attend in-person courses or secure large uninterrupted blocks of time to partake in activities such as e-learning modules can be challenging (O'Loan, 2019). It is partly in response to this that asynchronous education has become more available and acceptable as mainstream delivery of Continuing Professional Development (CPD), allowing for enhanced flexibility and accessibility (Childs *et al*., 2005).

NHS Education for Scotland (NES) is a national health board within the National Health Service (NHS) responsible for developing and delivering healthcare education and training for the healthcare workforce in Scotland. Within NES, the pharmacy team provide CPD opportunities for pharmacists and pharmacy technicians registered with the General Pharmaceutical Council (GPhC) and helps fulfil the regulatory requirement of pharmacy revalidation (Council, 2017). Since 2014, NES has provided CPD through face-to-face events, webinars, e-learning modules, virtual patients and Practice Based Small Group Learning (PBSGL) (Cunningham *et al*., 2014; Cunningham *et al*., 2016; Cunningham & Zlotos, 2016; Zlotos *et al*., 2016; Zlotos

& Stewart, 2022). Over the last five years, the use of e-learning systems has increased and further accelerated the response to the restrictions in place through the COVID-19 pandemic. Recent work by NES has suggested the estimated total hours of e-learning completed have risen from 2,805 hours in 2013 to 10,839.5 in 2019. This is in contrast to a reduction in total hours of participation in both face-to-face events and webinars during the same period (Zlotos & Stewart, 2022).

Given this increasing demand for more convenient and accessible methods of CPD for pharmacists and pharmacy technicians, developing and improving e-learning has become even more desirable. It allows for increased access, cost-effective production and the ability to update and manage content easily (Ellaway & Masters, 2008; McCutcheon *et al*., 2015). The challenge faced by NES is to ensure that the modules are created and developed in a way that supports Adult Learning Principles, i.e. learning from experience and self-directed learning, whilst successfully meeting the user needs and ensuring a satisfactory user experience (Knowles, 1984). The goal of creating effective digital resources in a growing and diverse learning population (e.g. experience levels, cultural differences, and neurodiversity) is essential to successful learning (Le Cunff *et al*., 2024).

The recent Scottish Government's Strategy "*Achieving Excellence in Pharmaceutical Care*" includes a commitment to ensure every General Practice in Scotland has access to a pharmacist with advanced clinical skills (Scottish Government, 2017). To facilitate this, NES has developed a General Practice Clinical Pharmacist (GPCP) pathway to support pharmacists new to working in General Practice. This pathway includes structured training and support and a series of self-directed e-learning modules which include clinical topics such as stroke, diabetes, pain, and mental health. The standard format for NES Pharmacy e-learning modules consisted of a single module for each clinical topic, including a multiple-choice question (MCQ) assessment at the end to capture completion. Through routinely collected online feedback, early informal reactions to these modules indicated positive comments related to the modules' comprehensive nature, negative comments regarding module length, and the inability to target individual learning needs.

Segmented e-learning for healthcare professionals involves breaking down complex medical or clinical content into smaller, focused segments to enhance understanding and retention. The singular module approach attempts to cover all learning outcomes in one module. This ensures all learners cover the same material, but as a result, the module is larger and can be more challenging to complete if the study is interrupted or targets the specific learning needs of each learner. Facilitators of this approach include improved cognitive processing, as smaller chunks of information are easier to digest, leading to better retention and application in real-world scenarios. For instance, pharmacy staff can master specific skills or knowledge (such as pharmacology or diagnostic procedures) in bite-sized modules, allowing for deeper engagement with each topic. However, barriers may arise when poorly designed segmentation leads to disjointed learning experiences. In healthcare, where understanding the relationship between different concepts is crucial, excessive fragmentation can disrupt the flow of knowledge and hinder the ability to see how individual pieces fit together in clinical practice. Furthermore, learners may struggle with a lack of continuity, feeling overwhelmed if the content is too segmented without a clear overarching structure. Educators must balance segmentation while ensuring coherence and context with the overall learning outcomes.

For digital learning to be fully embraced, the complexity of the systems in which it operates must also be considered, including the environments, interpersonal relationships, and the interactions between people and technology (Vallo Hult & Byström, 2022). These factors all aid in how e-learning is currently perceived and accepted. This is especially true when addressing barriers like access, as well as the workload pressures commonly experienced in the NHS (Micallef *et al*., 2020). Previous research shows an increased preference for e-learning within the pharmacy professions in Scotland, which suggests traditional barriers (such as inadequate technology) are less prevalent than they once were (Brandy *et al*., 2018). Workforce pressures may, however, still exist, with learners choosing to access education in their time (Zlotos & Stewart, 2022).

It is widely acknowledged that segmented learning will aid improvement in learning and memory function; however, with this study, the researchers wanted to explore whether this also has an impact on learner experience (Norris & Kalm, 2021). Although the effectiveness of e-learning is considered comparable to traditional methods, more research is required to better understand the learner experience concerning the design and format (Ruggeri *et al*., 2013; Salter *et al*., 2014).

This study investigated learners' feedback on two versions of the same module: standard and segmented (divided into multiple shorter modules). Although both formats contained the same content, the study aimed to explore and compare the perceptions of segmented

educational material, for which the benefits of working memory capacity are widely accepted (Thalmann *et al*., 2019). The results will inform future e-learner module development.

The question was posed "*What are learner perceptions of e-learning modules which are segmented compared with those in the standard single format*?"

Methods

Design

This study tested two versions of the same module, "*Mental Health – Depression*". One was in the standard format, and the other was in a segmented format in which key chapters were separated into individual modules. The standard format provides a module that contains all content in one block, and the segmented format is broken down into chapters that can be accessed individually. The content is the same for both modules. The module content was written by a specialist pharmacist identified by the National Scottish Pharmacy in Mental Health (SPMH) Special Interest Group (SIG), with NES standard development processes followed. The final module content was reviewed and approved by NES educators in the pharmacy and psychology disciplines, and the pharmacy SIG and SPMH. Modules were published in SCORM (Sharable Content Object Reference Model) format and hosted on the Learning Management System (Turas Learn) in two versions: a standard single module and a segmented format (which comprised six short modules).

Study recruitment was sought from pharmacists and pharmacy technicians working in general practice in Scotland to reflect the population of interest. At the time of the study, there were 861 pharmacists and 168 pharmacy technicians employed in a primary care setting in Scotland (NHS Education for Scotland, 2024). To ensure participants were practising clinically, they had to be enrolled on the NES Clinical Pharmacists in General Practice (GPCP). The programme leads identified 20 pharmacists and 14 pharmacy technicians who had previously expressed a willingness to participate in the review of NES Pharmacy learning resources. These individuals were invited to enrol in the study via Questback, where they were offered early access to the new learning content. Upon consenting to participate they were randomly allocated to one of two groups: standard single module group or segmented modules group. The recruitment process resulted in 20 pharmacists and 14 pharmacy technicians based in primary care settings covering all NHS Health Board regions of Scotland. Of these, 19 (55.9%) agreed to an interview; however, only 15 were conducted, and interviews ceased once data saturation was achieved. The research team deemed saturation to be complete after this point as no new themes were identified in the five consecutive interviews, and the cost of conducting and continuing data analysis would yield no new results (Kiger & Varpio, 2020).

A direct link to the content was provided with a completion deadline of two weeks. Participants were not informed that there were two different versions of the module. One-to-one face-to-face semi-structured interviews were conducted via Microsoft Teams with a research team member. These interviews were recorded, generating automatic transcriptions using MS Teams functionality, which could be used by the research team to analyse. To clarify the purpose and guide structure, interviewers were provided with a topic guide (Appendix Table I) which was developed by the research team to prompt discussion in areas of interest and ensure that the same topics are covered with each participant.

The interviews included open-ended questions focusing on specific areas of interest, such as structure, layout, and usability. The exact wording of the questions was not predetermined but followed the basic format in the topic guide, helping guide the conversation, though this could be tailored to each individual. The typical transcript began with introductions and an explanation of the research, followed by prompts on topics such as:

Ease of use and navigation within the module

The size of the module and the time it takes to complete

The module's appearance, including its professionalism and appropriateness

Participants were notified via email about the interview process and given instructions on accessing the modules. The purpose of the interview was aimed at gathering feedback on the overall user experience of the module rather than focusing on its content.

Participants were also asked if they had suggestions for future module improvement.

Data from the transcripts were thematically analysed as a method of identifying, analysing and interpreting themes. This widely used qualitative analytical method allows for flexibility and can be a useful method with accessible results following the six steps laid out in current research: Step one: Become familiar with the data, Step two: Generate initial codes, Step three: Search for themes, Step four: Review themes, Step five: Define themes, Step six: Write-up (Braun & Clarke,

2006). The data collection period was two months, and the research team met regularly during this period to identify themes following reach a consensus.

The qualitative analysis was conducted collaboratively by all four research team members. Participants were divided among the team, with each researcher responsible for conducting their allocated interviews. Two additional researchers independently reviewed the recordings and transcripts, highlighting comments relevant to the study objectives. The highlighted sections from all transcripts were compiled by one researcher (AF), who then identified initial emerging themes. These themes were subsequently reviewed by the entire research team, leading to a consensus on the final key themes.

Raw data from interviews or responses were reviewed, and meaningful segments were identified. These segments were assigned codes that captured the essence of the content. As themes began to form, similar codes were grouped, refining the analysis. The final set of 125 codes represents distinct concepts or patterns that were significant in understanding the experiences and perceptions of participants related to the e-learning modules. This process allowed for a comprehensive data exploration while ensuring that various aspects of the participants' feedback were captured.

The NHS Research and Ethics Committee online tool guided that no formal ethical approval was required as participants were service providers rather than service users. However, the authors ensured that ethical and data protection considerations were thoroughly addressed despite the exemption from formal approval. Participation in the evaluation was entirely voluntary, and all participants were informed of their right to withdraw at any stage without any consequences. Informed consent was obtained from each participant, ensuring they were fully aware of the purpose of the evaluation, the nature of their involvement, and how their data would be used.

As this study was an evaluation of an educational service with no risk to patients or participants, the authors determined that formal ethical approval was unnecessary. This decision was confirmed by the advice from the NHS Research Ethics Committee, which clarified that the study fell outside the scope of formal approval processes due to the nature of the participants and the focus of the research.

Results

Fifteen interviews were conducted, with seven completed the standard format and eight completed the segmented format. Participants included: Independent Prescribing (IP) pharmacists (n=10), a superintendent pharmacist who was an IP (n=1), non-IP pharmacists (n=3), and a pharmacy technician (n=1). Seven completed the standard format of the module, and eight completed the segmented format.

The duration of the interviews ranged from five minutes and 40 seconds to 30 minutes and 58 seconds, with an average of 12 minutes and 42 seconds. Analysis of the transcripts identified 125 codes, of which the research team agreed upon nine: Structure, Time, Presentation, Resource, Content, Actions, and Language. Comments from the interviews were captured and gave an indication of positive and negative experiences for each of these themes (Appendix Table II) Each comment is examined to extract meaningful units of information, which are then assigned a code (code = n) that becomes the building block for the themes. Navigation (standard n=9 and segmented n=9) and structure (standard n=9 and segmented n=13) were the most frequently commented-on themes.

Standard format

Regarding the standard format, the highest number of positive comments was related to navigation (n=9) and structure (n=9). Within the navigation theme, five comments from different participants reported on how easy the module was to navigate, for example, "*the module was relatively easy and logical to follow*" and "*I found the navigation straightforward.*" For the structure theme, the most frequently reported comments related to the familiar layout (n=3), for example, "*I liked that it was a familiar layout*". The most frequently mentioned negative comments related to resources (n=6) and included concerns with hyperlinking, for example *"(I was) unable to cover all the reading in the various links*." and "*some of the links just didn't work*." Interestingly, comments on potential improvements (n=2) suggest that it would be useful to break the module down into smaller segments "*Breaking it down to smaller chunks or topics would make it easier*" indicating a preference for a segmented format.

Segmented format

As in the standard format, positive comments predominantly related to Structure (n=13), and in particular, the way in which modules were broken down. The second most frequent positive comments

related to Navigation (n=9), specifically the ease of navigation. "*Resources*" were again the most frequently raised negative comments (n=4) and were related to hyperlinking.

The suggestions made by participants that could potentially improve the learner experience of e-learning are summarised in (Appendix III). Some comments were unique to the standard or segmented format, but most suggestions could be applied to either format. Examples of where similar comments were made in both formats include an option for printable resources (n=8) and more videos (n=4). Example quotes that were extracted from the transcripts of both standard and segmented formats and could therefore be applied to either format include "*more videos on consultations skills and case studies*", "*including suggestions for future e-learning modules at the end*" and "*being able to print references and further reading text and guidelines*".

Discussion

This study aimed to investigate learner feedback on two versions of the same module: standard and segmented (divided into multiple shorter modules). Although both formats contained the same content, the study aimed to explore and compare the perceptions of segmented educational material, for which the benefits of the capacity of working memory are widely accepted (Thalmann *et al*., 2019). The results will inform future e-learner module development.

The question was posed "*What are learner perceptions of e-learning modules which are segmented compared with those in the standard single format?"*

A strength of this study is the use of thematic analysis, a flexible and powerful method for interpreting qualitative data, that allowed for a deeper understanding of user experiences with the e-learning modules (DeJonckheere & Vaughn, 2019). Following the established six-step approach, the research team aimed to produce relevant findings grounded in a solid theoretical framework, ensuring the results were credible and applicable (Kiger & Varpio, 2020).

A potential weakness was the influence of researcher interpretation when defining the nine themes, which could introduce bias. The research team collaboratively agreed on each theme and descriptor to minimise this (Appendix IV). Additionally, while the frequency of comments was used to gauge theme importance, caution was needed to avoid overemphasising data quantity at the expense of quality (Braun & Clarke, 2006; Nowell *et al*., 2017).

The analysis categorised comments as positive or negative for each format. Positive feedback was more prevalent in the segmented format than in the standard format, with a higher proportion of positive comments. Navigation and structure emerged as the most frequently discussed themes in both formats, suggesting their importance in shaping the learner experience relative to other areas.

In contrast, negative comments, which indicate areas of dissatisfaction, were most often related to resources in both formats. Specifically, issues with the quantity of hyperlinks and broken links were identified as the primary sources of frustration. This finding emphasises the need to ensure that additional resources enhance the learning experience without overwhelming learners or causing frustration, regardless of the module format.

These results are consistent with previous studies that have evaluated e-learning where convenience, user-tailored learning and faster skill development were reported as positive aspects, whereas reduced levels of satisfaction are reported relating to non-user-friendly interfaces, inaccessibility and lack of IT skills (Harun *et al*., 2001; Klein & Ware, 2003). Information collected as suggestions for improvements was insightful for exploring learner experience. Some of the comments were unique to one format, but the authors agreed that suggestions for improvement were equally applicable to both formats and could be incorporated into the design of future module development. For example, adding a contents page to support navigation or downloadable or printable resources to help further learning. It is, however, interesting to note that comments on the standard formatting suggest that it would be easier if this was broken down into more focused topics, suggesting that the segmented form would be preferable.

The strengths of this study lie in the methodology that has allowed for a qualitative technique using interviews with open-ended questions providing a wide range of feedback. Selected participants were representative of the end users of the module, ensuring the results would apply to the target audience. Multiple researchers were involved in conducting the coding of the thematic analysis, reducing bias and improving consistency within the methodology (Barbour, 2001).

Limitations

There were also some weaknesses, as, despite attempts to recruit a wide range of participants, the selective group for representation had a low number of pharmacy technicians and only 19 respondents (although data saturation was achieved). The data analysis relies on the researchers' skills and may be

variable or result in the introduction of bias. Only one module was studied, and participants were only able to give feedback on one format of this module, in addition, the average time to complete the modules was not explored (e.g. they could not compare and contrast). Previous work has explored the comparative completion of clinical or non-clinical modules, and this may have an impact on preference, though it was not considered in this study (Zlotos *et al*., 2023). Finally, this study does not consider the impact on learning or change in practice.

Further work

This study focused on the learner perceptions and experience on two formats of e-learning module. The overall structure, standard or segmented, was not as important to the participants in this study as other key features. Future studies should investigate how pharmacy learners, including those with diverse learning needs, utilise segmented e-learning modules in practice (e.g. do they complete all segments in one or more sittings), and if this format supports transfer of learning into practice.

Conclusion

This study has shown that whether the module was standard or segmented in format may be less significant to learners than a well-structured and easy-to-use module with good content. It highlighted areas perceived to be more important such as structure and navigation, and key areas of dissatisfaction. The result of this study assures NES that profession-specific modules may be suitable in either format. In addition, useful feedback has been gained from the suggestions made during interviews on how the modules could be improved e.g., the functionality of the resources and hyperlinks not working. These proposed changes could easily be incorporated into the structure of future modules regardless of standard or segmented format.

NES is a multi-professional organisation, so education that is of value to a diverse audience, including nursing and allied health professions, is desirable. As such, a segmented format may facilitate separating generic and context (profession) specific content to improve inclusivity to this diverse audience. These findings, along with earlier studies, would indicate it would be reasonable to conclude that future education for CPD should be adapted and developed to reflect a diverse learner population, nationally and globally (Zlotos *et al*., 2023).

Conflict of interest

The authors declare no conflict of interest.

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References

Barbour R. S. (2001). Checklists for improving rigour in qualitative research: A case of the tail wagging the dog? *BMJ (Clinical research ed.)*, **322**(7294), 1115–1117. https://doi.org/10.1136/bmj.322.7294.1115

Brandy, J., Polak, S., Mendyk, A., & Polak, M. (2018). An e-learning system for pharmacist continuing education in Poland. *Pharmacy Education,* **6**(1). https://pharmacyeducation.fip.org/pharmacyeducation/article/view/119

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology,* **3**(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Childs, S., Blenkinsopp, E., Hall, A., & Walton, G. (2005). Effective e-learning for health professionals and students—barriers and their solutions. A systematic review of the literature—findings from the HeXL project. *Health Information & Libraries Journal,* **22**, 20–32. https://doi.org/10.1111/j.1470-3327.2005.00614.x

Council, G. P. (2017). *Standards for pharmacy professionals*. Retrieved from https://www.pharmacyregulation.org

Cunningham, D. E., Alexander, A., Luty, S., & Zlotos, L. (2019). CPD preferences and activities of general practitioners, registered pharmacy staff and general practice nurses in NHS Scotland - A questionnaire survey. *Education for Primary Care,* **30**(4), 220–229. https://doi.org/10.1080/14739879.2019.1617644

Cunningham, D. E., Ferguson, J., Wakeling, J., Zlotos, L., & Power, A. (2016). GP and pharmacist inter-professional learning - A grounded theory study. *Education for Primary Care,* **27**(3), 188–195. https://doi.org/10.1080/14739879.2016.1163645

Cunningham, D. E., & Zlotos, L. (2016). Ten years of practice-based small group learning (PBSGL) in Scotland - A survey of general practitioners. *Education for Primary Care*, **27**(4), 306–313. https://doi.org/10.1080/14739879.2016.1179597

Cunningham, D. E., Zlotos, L., & Power, A. (2014). Scottish pharmacists' perceptions and experiences of a practice-based small group learning pilot: A qualitative study. *Education for Primary Care,* **25**(3), 155–162. https://doi.org/10.1080/14739879.2014.11494266

DeJonckheere, M., & Vaughn, L. M. (2019). Semistructured interviewing in primary care research: A balance of

relationship and rigour. *Family Medicine Community Health,* **7**(2), e000057. https://doi.org/10.1136/fmch-2018-000057

Ellaway, R., & Masters, K. (2008). AMEE Guide 32: e-Learning in medical education Part 1: Learning, teaching and assessment. *Medical Teacher,* **30**(5), 455–473. https://doi.org/10.1080/01421590802108331

Harun, M. H. (2001). Integrating e-learning into the workplace. *The Internet and Higher Education,* **4**(3-4), 301–310. https://doi.org/10.1016/S1096-7516(01)00073-2

Kiger, M. E., & Varpio, L. (2020). Thematic analysis of qualitative data: AMEE Guide No. 131. *Medical Teacher,* **42**(8), 846–854. https://doi.org/10.1080/0142159X.2020.1755030

Klein, D., & Ware, M. (2003). E-learning: New opportunities in continuing professional development. *Learned Publishing*, **16**, 34–46. https://doi.org/10.1087/095315103320995078

Knowles, M. S. (1984). *Andragogy in action: Applying modern principles of adult education*. Jossey Bass.

Le Cunff, A. L., Giampietro, V., & Dommett, E. (2024). Neurodiversity and cognitive load in online learning: A focus group study. *PLoS One,* **19**(4), e0301932. https://doi.org/10.1371/journal.pone.0301932

McCutcheon, K., Lohan, M., Traynor, M., & Martin, D. (2015). A systematic review evaluating the impact of online or blended learning vs. face-to-face learning of clinical skills in undergraduate nurse education. *Journal of Advanced Nursing,* **71**(2), 255–270. https://doi.org/10.1111/jan.12509

Micallef, R., Huet, I., & Kayyali, R. (2020). Current reality and preferences for continuing professional development of pharmacists in England – supporting pharmacists to achieve their CPD requirements. *Pharmacy Education,* **20**(1), 103–115. https://pharmacyeducation.fip.org/pharmacyeducation/article/view/866

NHS Education for Scotland. (2024). *NHS Scotland pharmacy workforce (managed service) dashboard*. https://turasdata.nes.nhs.scot/data-and-reports/official-workforce-statistics/all-official-statistics-publications/03-december-2024-workforce/dashboards/nhsscotland-pharmacy-workforce-managed-service/

Norris, D., & Kalm, K. (2021). Chunking and data compression in verbal short-term memory. *Cognition,* **208**, 104534. https://doi.org/10.1016/j.cognition.2020.104534

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic analysis: Striving to meet the trustworthiness criteria. *International Journal of Qualitative Methods,* **16**(1), 1609406917733847. https://doi.org/10.1177/1609406917733847

O'Loan, L. (2019). Continuing Professional Development (CPD) for pharmacists: Implications for professional practice. *Pharmacy Education,* **19**(1), 26–33. https://pharmacyeducation.fip.org/pharmacyeducation/article/view/613

Ruggeri, K., Farrington, C., & Brayne, C. (2013). A global model for effective use and evaluation of e-learning in health. *Telemedicine and e-Health,* **19**(4), 312–321. https://doi.org/10.1089/tmj.2012.0175

Ruiz, J. G., Mintzer, M. J., & Leipzig, R. M. (2006). The impact of E-learning in medical education. *Academic Medicine,* **81**(3), 207–212. https://doi.org/10.1097/00001888-200603000-00002

Salter, S. M., Karia, A., Sanfilippo, F. M., & Clifford, R. M. (2014). Effectiveness of e-learning in pharmacy education. *American Journal of Pharmaceutical Education,* **78**(4), 83. https://doi.org/10.5688/ajpe78483

Scottish Government. (2017). *Achieving excellent in pharmaceutical care: A strategy for Scotland*. https://www.gov.scot/publications/achieving-excellence-pharmaceutical-care-strategy-scotland

Thalmann, M., Souza, A. S., & Oberauer, K. (2019). How does chunking help working memory? *Journal of Experimental Psychology: Learning, Memory, and Cognition,* **45**(1), 37–55. https://doi.org/10.1037/xlm0000578

Vallo Hult, H., & Byström, K. (2022). Challenges to learning and leading the digital workplace. *Studies in Continuing Education,* **44**(3), 460–474. https://doi.org/10.1080/0158037X.2021.1879038

Zlotos, L., Hamilton, P., Park, V., & Stewart, F. (2023). What can the uptake of online pharmacy education in Scotland, during the COVID-19 pandemic, tells us about the future of CPD? *Education for Primary Care,* **34**(5-6), 277–286. https://doi.org/10.1080/14739879.2023.2272859

Zlotos, L., Power, A., Hill, D., & Chapman, P. (2016). A scenario-based virtual patient program to support substance misuse education. *American Journal of Pharmaceutical Education,* **80**(3), 48. https://doi.org/10.5688/ajpe80348

Zlotos, L., & Stewart, F. (2022). Measuring the evolution of online pharmacy education in a national CPD programme, in Scotland, pre-pandemic (2013-14 vs 2018-19). *Education for Primary Care,* **33**(1), 46–52. https://doi.org/10.1080/14739879.2021.1970026

Appendix I: Topic guide provided to interviewers

Topic guide for e-learning evaluation interviews
• A brief introduction to yourself, the rest of the team and the purpose of this small study – to test 2 different methods of structuring our new Depression e-learning module to gauge which format is preferable for us to use for this and future modules (**Don't disclose what the 2 different formats are or which one they tested as this could influence their feedback**).
• Explain that the purpose of the meeting is to have an informal discussion with them to get their honest feedback on the structure/layout/usability/user experience of the module as opposed to the content itself. We're also keen to capture any suggestions they might have for improving our modules.
• Confirm that the participant is happy for the team's call to be recorded. Explain that the reason for recording is so that we can just focus completely on what they're saying without interrupting the flow of the conversation to pause and take notes. The results will be anonymised, and the recording will not be shared with the four members of the research team.
• Once the recording has started, confirm for the purposes of the recording who you are and invite the participant to do the same.
• Start the interview: o Initiate the conversation by asking them to tell you what they thought about the module. o Let them do the talking but keep the focus of their comments on the structure and try and steer them back if they start critiquing the content of the module. o For any comments on something they didn't like about the module, ask them why they didn't like it and how they think this could be addressed. What are their suggestions for improvement? o Stay in the role of the interviewer – if the participant starts asking questions about our modules (e.g. can we add a particular feature to our modules), divert the question back to them ("*Is that something you would want?*" or "*Why is that important to you?*")
• Closing the interview: o Confirm how we intend to use this information. o Ask if they have any questions, or anything further they would like to add.

Appendix II: Overview of themes and number of comments identified for each module format

	Standard format		**Segmented format**	
	Positive comments	**Negative comments**	**Positive comments**	**Negative comments**
Navigation	9 e.g. "*a Relatively easy and logical to follow*"	3 e.g. "*The 'Next' button not always highlighted*"	9 e.g. "*resume where left off*"	2 e.g. "*Navigation at the end was confusing. Was not able to go back to previous sections and ended up with lots of tabs open*."
Interactivity	5 e.g. "*Interactive diagrams very useful*"	1 e.g. "*Interactive formats were too varied - too many styles*"	3 e.g. "*good interactive sections*"	0
Structure	9 e.g. "*I liked the familiar format and layout*"	3 e.g. "*Too many different formats- not enough consistency*"	13 e.g. "*Separate modules allow for easier access for revision*"	0
Time	5 e.g. "*Length of the module is good*"	1 e.g. "*Not long enough - too short*"	3 e.g. "*Not forced to do it in one sitting*"	3 e.g. "*Within a module, not being able to see how much is left of it*"
Presentation	3 e.g. "*Looks professional*"	2 e.g. "*Some slides were too busy – overwhelming*"	5 e.g. "*Looked professional and appropriate*"	0
Resources	5 e.g. "*Would like to see a guidelines tab at the top for referral*"	6 e.g. "*Too many hyperlinks*"	6 e.g. "*Links to further reading/resources*"	4 e.g. "*some of the links did not work at times*"
Content	3 e.g. "*Introduction prepared user for what lay ahead*"	1 e.g. "*Too much description and information and not enough knowledge testing*"	5 e.g. "*Case scenarios very good*"	3 e.g. "*too theoretical and would have benefitted from something practical e.g. Another scenario*"
Actions	0	1 e.g. "*Compelled to write notes*"	5 e.g. "*Easy to take notes*"	3 e.g. "*Not being able to print out the useful guides*"
Language	0	0	4 e.g. "*Easy to understand*"	0

Appendix III: Summary table to show participants' suggestions for module improvement

Unique to standard format	Unique to segmented format	Common to both formats
Would prefer separate slides rather than links within the page	Have the text/resource of the link transposed onto the page or incorporated onto the same page (n=2)	More videos (n=5)
More interactive pages	Incorporate the learning outcomes into the module itself	Downloadable and printable guidelines and reference sheet at the end (n=8)
Breaking it down into smaller chunks/topics would make it easier. (n=2)	More on how to conduct an antidepressant review	Suggested further related modules (n=3)
Check-ins or Q & A to check to understand	Would like more scenarios/case studies	Summary page (n=3)
Expected completion time should be noted to enable learners to plan their time	Back/previous button is needed for navigation.	Links for further reading and resources (n=2)
Inclusion of a content page		

Appendix IV: The descriptors used to categorise themes from the interview data

Themes	Description
Navigation	Finding your way around the module by using the menu, buttons and accessibility.
Interactivity	How well the interactive functions work throughout the module
Structure	The way the module is set up, layout
Time	How much time participants spent on the module
Presentation	The overall look of the module, including images
Resources	Additional content for extra reading
Content	The information and text in the modules
Actions	Any additional work required to move through the module or maximise learning
Language	Terminology and medical jargon used within the text