Medical Teacher

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/imte20

Understanding online self-directed learning using point of care information systems (POCIS): A plot study using a capability approach perspective

Da Zhang, Li Xiao, Jingqi Duan, Xinxin Chang, Kieran Walsh, John Sandars, Jeremy Brown, Xiaorong Dang, Wei Shen, Junjie Du & Yanjie Cao

To cite this article: Da Zhang, Li Xiao, Jingqi Duan, Xinxin Chang, Kieran Walsh, John Sandars, Jeremy Brown, Xiaorong Dang, Wei Shen, Junjie Du & Yanjie Cao (2022): Understanding online self-directed learning using point of care information systems (POCIS): A plot study using a capability approach perspective, Medical Teacher, DOI: 10.1080/0142159X.2022.2100251

To link to this article: https://doi.org/10.1080/0142159X.2022.2100251

MEDICAL TEACHER
https://doi.org/10.1080/0142159X.2022.2100251

Understanding online self-directed learning using point of care information systems (POCIS): A plot study using a capability approach perspective

Da Zhang[a], Li Xiao[a], Jingqi Duan[b], Xinxin Chang[b], Kieran Walsh[c], John Sandars[d], Jeremy Brown[d], Xiaorong Dang[e], Wei Shen[e], Junjie Du[f] and Yanjie Cao[b,g]

[a]Department of Endocrinology, Air Force Medical Center, People's Liberation Army, Beijing, China; [b]Department of Geriatrics, Air Force Medical Center, People's Liberation Army, Beijing, China; [c]BMJ Publishing Group, BMA House, London, United Kingdom; [d]Edge Hill University Medical School, Edge Hill University, Lancashire, United Kingdom; [e]Department of Medical Research, Air Force Medical Center, People's Liberation Army, Beijing, China; [f]Department of Orthopedics, Air Force Medical Center, People's Liberation Army, Beijing, China; [g]Teaching and Research Division of Internal Medicine, Air Force Medical Center, People's Liberation Army, Beijing, China

ABSTRACT

Purpose of the study: Understanding self-directed learning (SDL) when using point of care information systems (POCIS) can inform educational providers of the usefulness of the system for continuing medical education (CME). Sen's capability approach can offer a unique perspective to understand SDL, which considers the extent to which individual valued learning needs can be achieved. The aim of the study was to pilot the use of a questionnaire informed by the capability approach for understanding SDL when using POCIS in the context of CME.

Methods: A semi-structured questionnaire aligned to the capability approach (Capability Approach for SDL with POCIS Questionnaire - CA-SPQ) in the context of CME was developed and implemented with 200 users of a POCIS (BMJ Best Practice).

Results: The response rate was 92 and 78% of users considered that their valued outcomes were achieved and that they could apply their new learning to practice. The questionnaire had high content, face, and construct validity.

Conclusion: The CA-SPQ can offer a practical instrument to provide data and useful information for understanding SDL, when using POCIS in the context of CME. It also has the potential for adaptation to other areas of medical education.

KEYWORDS

Decision-making; information handling; medical education research; continuing; e-learning/computers

Introduction

There has been increasing interest in online point of care information systems (POCIS), especially to enable a self-directed learning (SDL) approach for continuing medical education (CME) (Moja and Kwag 2015). In SDL, the learner is internally motivated to take responsibility for their own learning by a process in which they identify their own learning needs, use a variety of resources to meet these needs and evaluate their learning to ensure that their learning needs have been achieved (Knowles 1975). An essential aspect of SDL for CME is the identification of learning needs in response to questions generated by the wide range of different learners' interactions with patients, with the intention that the new learning can be applied to the care of their patients (Sandars and Walsh 2016). These learning needs in CME can be met by using information sources that are widely available on the internet, but these are often of variable quality. In response to this situation, several different online POCIS have been developed to provide updated online summaries of evidence-based information for use at the site of clinical practice (Kwag et al. 2016). The increased availability of mobile devices and internet connectivity within a wide variety of clinical settings has also enabled the widespread global adoption of online POCIS (Adepoju et al. 2017).

Practice points

- Understanding self-directed learning (SDL) when using point of care information systems (POCIS) can inform educational providers of the usefulness of their systems.
- Sen's capability approach offers a unique perspective to understand SDL since it considers the extent to which individual valued learning needs can be achieved, and also the factors that enable and constrain this process.
- A questionnaire to understand SDL when using POCIS was developed and aligned to the capability approach.
- Response rate and validation of the questionnaire was high, suggesting its potential for understanding SDL when using POCIS but also its potential in other areas of medical education.

CONTACT Yanjie Cao 18610089727@163.com Department of Geriatrics, Teaching and Research Division of Internal Medicine, Air Force Medical Center, People's Liberation Army, Beijing, China

Supplemental data for this article can be accessed online at https://doi.org/10.1080/0142159X.2022.2100251.

Understanding SDL with the use of online POCIS is important for medical educators, CME providers and developers of POCIS. Studies suggest that online POCIS can improve clinical outcomes, with greater diagnostic accuracy, improved quality of care and reduced length of hospital stay (Shimizu et al. 2018; Tao et al. 2020). However, these clinical outcomes will be dependent on two important factors related to SDL. First is the extent to which an individual's learning needs can be met by the resources provided by the POCIS, and second is the transfer of new learning to the environment within which this learning is expected to be applied (Blume et al. 2010). Greater understanding of these aspects, and also the factors that enable and constrain transfer, has the potential to improve clinical outcomes by providing a focus for improving the design and implementation of a POCIS, as well as making changes to clinical environments to increase transfer of learning, such as ensuring alignment of content with local policies and priorities.

There has been increasing interest in primary, secondary, and higher education in understanding how individuals meet their learning needs and apply new learning using insights from Sen's capability approach (Gladstone et al. 2021). Amartya Sen, a Nobel Laureate for Economics, proposed his capability approach in response to the increasing demands to demonstrate the effectiveness of development intervention programmes (Hamilton 2019). The main focus of the capability approach is on the individual; it highlights that each individual has their own unique needs that are important for them to achieve in enhancing their life (Hamilton 2019). Sen proposes that the evaluation of the effectiveness of an intervention should measure the extent to which the needs of an individual can be achieved by the intervention (Hamilton 2019). Sen also highlights that an essential role for anyone providing development opportunities is to understand the factors that constrain an individual from achieving their needs, with the intention to minimise the constraints (Hamilton 2019).

Recently, the capability approach has been applied to understanding SDL when using internet resources (Hatakka and Lagsten 2012), with the identification of the learning needs of the learners. The key constructs of the capability approach and SDL are highly aligned, with both having a focus on the achievement of the valued needs of individuals (Song and Hill 2007). We are not aware of studies seeking to understand SDL from a capability approach perspective in medical education but the practical application and potential usefulness of the capability approach for medical education has been recently discussed (Sandars and Hart 2015).

An important challenge for any future research in the application of the capability approach to SDL in medical education is the collection of data that are aligned to the capability approach. Interviews have been used in previous educational research applying the capability approach, such as the learning needs of learners from disadvantaged communities, but these are time-consuming to both conduct and analyse (Chiappero-Martinetti et al. 2020). A self-administered survey instrument using a questionnaire format offers a highly practical method, especially for large cohorts of learners. We are not aware of previous questionnaires that have applied the capability approach to SDL in medical education.

The aim of the study was to pilot the use of a questionnaire informed by the capability approach for understanding SDL when using POCIS in the context of CME.

Method

A pilot study has the intention of evaluating the procedures and measurement instruments in preparation for a subsequent and more detailed research project.

The study was conducted in three phases:

- Phase 1: An adaptation of the capability approach as a conceptual framework for understanding SDL with POCIS in the context of CME, which we have called the Capability Approach for SDL with POCIS) (CA-SP) framework.
- Phase 2: The development of a questionnaire based on the CA-SP framework, which we have called the CA-SP Questionnaire (CA-SPQ).
- Phase 3: Validation of the CA-SPQ.

Phase 1: Development of the CA-SP conceptual framework

The principles of Sen's capability approach, and the different terminologies used in the various publications on this approach, have been adapted for medical education (Sandars and Hart 2015), and this informed the development of our CA-SP conceptual framework. The framework is presented in Figure 1. We consider that our CA-SP framework offers an innovative and potentially useful method for understanding SDL and clinical outcomes associated with the use of online POCIS in the context of CME.

The CA-SP framework proposes that each learner who approaches SDL in the context of CME has one or more unique, specific, and individualised learning needs that are valued as being important by the learner for the clinical care of patients. The learner has an aspiration that these 'valued learning needs' can be achieved from the variety of different resources provided by the POCIS and subsequently applied to clinical practice. This is called their 'Aspiration Set'. The new learning that is achieved is known as the learner's 'Capability Set'. A major aspect of CME is learning in response to an individual's learning needs identified through clinical practice, with the intention to transfer the learning to clinical care. In the transfer of learning to practice, the learner's capability set is applied to their clinical practice and the achieved change in clinical performance and outcomes is known as the 'Functionings'. Sen also highlights that a variety of enabling and constraining factors (known as 'Conversion Factors') will determine the extent to which the individual can choose or achieve both their capability set and their functionings (Hamilton 2019).

The CA-SP framework is important since it highlights that an important aspect of SDL with a POCIS in the context of CME is that an individual's valued learning needs may be achieved by using a POCIS but may not be able to transfer this learning to clinical practice, which many learners aspire to achieve in CME. Also, an individual's learning needs may not be achieved by using the POCIS. The conversion factors may be similar or different for the learning from the POCIS and transfer of learning to clinical practice.

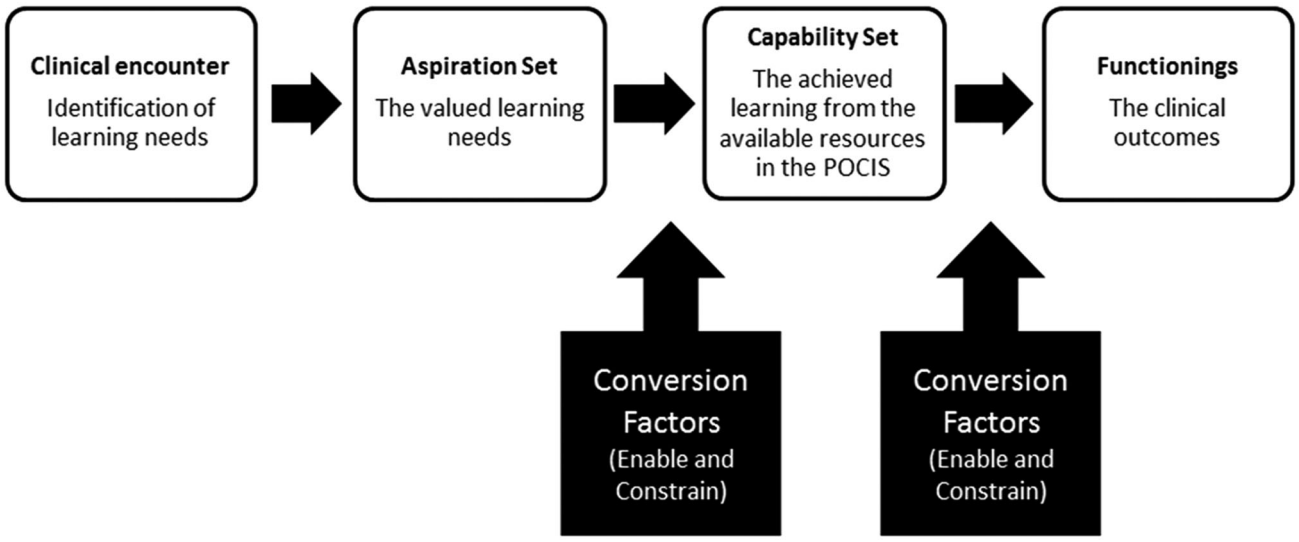

Figure 1. CASP conceptual framework.

For example, a constraint to achieving their capability set could be the lack of relevant learning content and a constraint to achieving their functionings could be lack of facilities to implement evidence-based practice.

Phase 2: Development of the CA-SPQ

We followed best practice recommendations in developing the questionnaire by having a clear conceptual framework of the key constructs under study, identifying any previous similar instruments, determining the format of the items so that they are aligned to the key constructs and iterative development with appropriate validity and reliability testing (Oppenheim 2000). The initial draft of the questionnaire was informed by a validated instrument to understand the valued aspects of work, including the extent to which the valued aspects could be achieved (Abma et al. 2016). Our questionnaire was iteratively developed over several cycles by two of the authors (JS/KW), four residents in the Health Education England Northwest (HEENW) School of Paediatrics and a medical educationalist with expertise in questionnaire development (JB).

Our questionnaire was semi-structured, with items that were a mix of Likert type scales and open text questions (Appendix 1). The items were aligned to the CA-SP conceptual framework and were designed to identify:

- the learning needs valued as being important by the learner for the clinical care of patients (the aspiration set). We limited the valued learning needs to three domains: making an evidence-based diagnosis; providing evidence-based treatment; and sharing decision-making with patients and their carers. This approach was taken since previous evaluation in the development of the BMJ Best Practice POCIS identified that these three domains were consistently rated as highly important and valued by clinicians in the context of CME.
- the extent to which the learner achieved their learning needs from the POCIS (the capability set).
- the factors that the learner considers to have enabled and constrained them in obtaining their learning needs from the POCIS (the conversion factors).
- the extent to which the learner could apply their new learning to change their clinical practice (the functionings).
- the factors that the learner considers to have enabled and constrained them if they are applying their new learning to change their clinical practice (the conversion factors).

Phase 3: Validation of the CA-SPQ

All questionnaires should be evaluated for their validity to ensure that the instrument measures what it is intended to measure (Bolarinwa 2015). We conducted content and face validity (how well does the questionnaire make sense to the user) and also construct validity (how well does the questionnaire measure in a way that is consistent with the theoretical hypothesis). Concurrent validity and predictive validity were not conducted due to the limited time and resources available to the research team.

Content and face validity

The content validity of the items was evaluated by the initial development group to ensure that the items were aligned to the principles of the capability approach and the CA-SP conceptual framework, and the face validity was conducted with four residents in the Health Education England Northwest (HEENW) School of Paediatrics to ensure that the questions were not ambiguous, and the format was easy to use. The CA- SPQ was subsequently translated into Mandarin by XD and face validity was conducted individually by DZ with ten doctors from the Air Force Medical Center, Beijing, China.

Construct validity

Statistical confirmatory factor analysis was not appropriate (Fink and Litwin 1995), and construct validity was evaluated by hypothetical validation. Construct validity of the questionnaire was conducted by application of the questionnaire to an exploration of SDL using BMJ Best Practice as an example of a POCIS in the context of CME. There was a discussion between three members of the research team (JS/JB/KW) about how well the questionnaire performed in a way that was consistent with the theoretical hypothesis

(Bolarinwa 2015). The theoretical hypothesis of the CA-SPQ was that the questionnaire items were aligned to the constructs of the CA-SP framework and that the questionnaire could identify useful data about each of the CA-SP constructs when applied for the exploration of SDL using BMJ Best Practice as an example of a POCIS in the context of CME. An independent judgement of the extent to which there was alignment was made by each researcher and consensus was achieved by discussion.

Participants and recruitment

All doctors and residents (200) at the Air Force Medical Center, Beijing, China were invited to take part in the study by an email from the lead researcher. A Participant Information Sheet was attached to the email with further details of the study and how to register. Registration for the study, which also obtained their consent to participate in the study, was by completion of a Google Form.

Intervention

Participants were given free access to BMJ Best Practice. BMJ Best Practice (http://bestpractice.bmj.com) is a unique self-directed POCIS to support evidence-based diagnosis and treatment decisions, including shared decision-making with patients and their carers. Learners are offered continually updated, evidence based and practical clinical content. The content is peer reviewed by independent experts to ensure relevance and quality of content (Blume et al. 2010).

All participants were expected to identify their own learning needs, based on the situations that they faced in daily clinical practice, and to use the available educational resources provided by BMJ Best Practice to support their decision making. To motivate participants to use the resources, participants received three email reminders to use BMJ Best Practice during the study period. All participants accessed BMJ Best Practice by Wi-Fi using their mobile phones.

Data collection

After 12 weeks of access to BMJ Best Practice, all participating doctors were sent an email with an invitation to complete the online questionnaire (CA-SPQ). Reminders to complete the survey were sent out one and three weeks after the initial mailing. Doctors were thanked for their participation and the study closed on the 17th week.

Data analysis

Quantitative data from the questionnaires were exported and analysed using SPSS for descriptive frequencies. Qualitative data from the questionnaires were exported to Excel, translated from Mandarin to English, and themes related to the conversion factors (satisfying their learning needs with BMJ Best Practice and the extent to which the individual learner could apply their new learning to change in their clinical practice) were identified using Framework Analysis (Smith and Firth 2011). The Framework Analysis was conducted by JS/JB and followed a systematic process with initial sensitisation to the themes by repeatedly reading through the comments, which was followed by initial coding identification of commonalities and differences in the data, before focusing on the relationships between different parts of the data to identify themes. Any differences in initial coding and their relationship with the themes were discussed until consensus was reached. Illustrative comments were selected for each of the themes.

Data handling

Electronic data from the online questionnaire was stored on password protected computers. Hard copies of research project documentation were stored in a locked cabinet in a locked office. The procedures for handling, processing, storage, and destruction of data from the study were compliant with relevant national legislation.

Ethical issues

All participants provided informed consent. This was obtained by providing a Participant Information Sheet and asking participants to indicate on the registration form that they gave consent to take part. Participants needed to provide names and email addresses to register with BMJ Best Practice and this personal identifying data were used to communicate with the participants for reminders and for the link to the online questionnaire. However, each participant was given a unique identifying number, and this was the only identifying data that was exported, analysed, and stored. This process provided anonymity and confidentiality for information governance purposes. The study was approved by the Air Force Medical Center for Research Data (No. 2020-143-PJ01).

Results

184 (92% of eligible participants) completed the online questionnaire, including 20 interns, 78 residents and 86 attending doctors.

Quantitative data

Evidence-based diagnosis

84.2% (155/184) of participants had a valued outcome of being able to make an evidence-based diagnosis and 84.8% (156/184) had used BMJ Best Practice to help them make an evidence-based diagnosis.

71.1% of participants 'agreed' and 15.2% 'strongly agreed' that the information provided by BMJ Best Practice had enabled them to achieve their valued outcome by reinforcing their existing knowledge of a topic. Also, (a) 66.3% 'agreed' and 15.2% 'strongly agreed' that the information provided by BMJ Best Practice provided them with new knowledge of a topic, (b) 71.2% 'agreed' and 14.7% 'strongly agreed' that the information provided by BMJ Best Practice on the topics was useful, and (c) 70.7% 'agreed' and 14.7% 'strongly agreed' that they could apply the information obtained from BMJ Best Practice to make an evidence-based diagnosis in clinical practice (Table 1).

16.3% (30/184) of the participants had encountered barriers that hindered them from using the information from BMJ Best Practice in making an evidence-based diagnosis.

Table 1. Extent of transfer of learning from BMJ best practice.

	Evidence-based diagnosis (mean Likert score ± standard deviation)	Evidence-based treatment (mean Likert score ± standard deviation)	Shared decision-making (mean Likert score ± standard deviation)
The information provided by BMJ Best Practice helped reinforce your existing knowledge of the topic?	4.02 ± 0.58	4.06 ± 0.55	3.95 ± 0.63
The information provided by BMJ Best Practice provided you with new knowledge of the topic?	3.96 ± 0.65	4.02 ± 0.58	3.93 ± 0.65
The information provided by BMJ Best Practice on this topic was useful?	4.00 ± 0.60	3.99 ± 0.60	3.99 ± 0.58
You could apply the information you obtained from BMJ Best Practice on this topic in your clinical practice?	4.01 ± 0.58	3.99 ± 0.60	3.99 ± 0.56

Likert Scale Response (5 = Strongly Agree, 4 = Somewhat Agree, 3 = Neutral, 2 = Somewhat Disagree, 1 = Strongly Disagree).

Evidence-based treatment

79.9% (147/184) of participants achieved a valued outcome of being able to provide evidence-based treatment and 80.4% (148/184) had used BMJ Best Practice to help them provide evidence-based treatment.

69.0% of participants 'agreed' and 16.8% 'strongly agreed' that the information provided by BMJ Best Practice helped reinforce their existing knowledge. Also, (a) 65.8% 'agreed' and 15.2% 'strongly agreed' that the information provided by BMJ Best Practice provided them with new knowledge, (b) 65.8% 'agreed' and 15.2% 'strongly agreed' that the information provided by BMJ Best Practice was useful, and (c) 66.3% 'agreed' and 14.7% 'strongly agreed' that they could apply the information obtained from BMJ Best Practice to provide evidence-based treatment in clinical practice (Table 1).

13.0% (24/184) of participants encountered barriers that hindered them from using the information from BMJ Best Practice to provide evidence-based treatment.

Shared decision-making

70.1% (129/184) of participants achieved a valued outcome of being able to share decision-making with patients and their carers, and 65.8% (121/184) had used BMJ Best Practice to help them achieve their valued outcome of sharing decision-making with patients and their carers.

64.7% of participants 'agreed' and 14.1% 'strongly agreed' that the information provided by BMJ Best Practice helped reinforce knowledge that would enable shared decision-making with patients and their carers. Also, (a) 64.1% 'agreed' and 13.6% 'strongly agreed' that the information provided by BMJ Best Practice provided them with new knowledge to share decision-making with patients and their carers, (b) 65.2% 'agreed' and 14.7% 'strongly agreed' that the information provided by BMJ Best Practice was useful, and (c) 67.4% 'agreed' and 14.1% 'strongly agreed' that they could apply the information obtained from BMJ Best Practice to share decision-making (see Table 1).

13.0% (24/184) of participants encountered barriers that hindered them from using the information from BMJ Best Practice to share decision-making with patients and their carers.

Qualitative data

Similar comments were obtained for using BMJ Best Practice when making an evidence-based diagnosis, providing evidence-based treatment and shared decision-making with patients and carers. In view of this finding, the results are presented as over-arching themes. There were few specific comments related to the enabling conversion factors, such as 'I think BP is a very good tool'; 'BP is a very good resource platform, very helpful'; 'BP is practical, simple and authoritative'.

Three themes related to the constraining conversion factors were identified as: technological barriers, relevance of content and depth of content.

Technological barriers

Slow connectivity ('The loading speed is slow') was experienced by some participants and this led to difficulties in opening images ('Some pictures cannot be opened') and automatic log outs. There were some usability issues related to navigation of the website which led to difficulties in finding information ('Not very easy to use') and being unable to download content ('I can't download the content').

Relevance of content

Some participants noted a lack of relevant local guidelines ('I can't find local guideline in Infectious mononucleosis topic') and information about some of the diseases that they encountered in practice ('I can't find content of eosinophilic gastroenteritis').

Depth of content

A lack of sufficiently detailed information ('The relevant content is insufficient') was stated by some participants.

Discussion

The study adapted Sen's capability approach to develop a conceptual framework for understanding SDL when using POCIS in the context of CME (the CA-SP framework). This new framework informed the development of a questionnaire (the CA-SPQ), which was then tested for validity. Reliability testing to evaluate the extent to which there are consistent findings on re-testing was considered not to be appropriate since the learning needs are highly individual and situational, being dependent on the specific features of a clinical encounter.

The questionnaire had a high completion rate (92%) with good content and face validity. The questionnaire was considered to have good construct validity based on the data and depth of useful information obtained within each item. Most users valued the three pre-determined domains

as being important and users were able to achieve new learning (capability set) and to transfer their learning to practice (functionings). About 14% of participants identified constraints (conversion factors) that limited their achievement and transfer of learning. In addition to the validation of the questionnaire, we obtained useful information about SDL using BMJ Best Practice in the context of CME.

Our study design and data had several limitations. We only used BMJ Best Practice as a POCIS and the study was carried out in a single centre in China, which is a large tertiary care medical institution. We also did not directly measure in quantitative terms the extent to which participants utilized BMJ Best Practice and applied the learning to practice but all participants had logged into BMJ Best Practice. The valued learning needs were limited to only three domains and doctors of different grades took part in the study, and we did not explore responses by individual groups of doctors (such as those of different grade or those who were high or low users of BMJ Best Practice). Similar to all questionnaires, the responses were self-reported, and this can be associated with several biases, including recall and social desirability (Harrison and McLaughlin 1993). Also, the qualitative data obtained by the questionnaire about the conversion factors could not be verified and some of the responses obtained were superficial. Finally, it was not possible to measure concurrent validity and predictive validity due to the limited time and resources available to the research team.

Despite the limitations, we consider that our pilot study has several major strengths that are of interest and importance for medical educators. First, it is the first study to our knowledge that has developed a questionnaire to apply the capability approach to understand SDL when using POCIS in the context of CME. Second, the study was 'ecologically valid' and conducted in a real-life context in which the participants were doctors actively caring for patients. Third, the response rate and content, face and construct validation were good. Finally, we consider that useful information was obtained about the extent to which an individual's valued learning needs can be achieved using a POCIS and the transfer of learning to clinical practice, including insights into the important factors that enabled and constrained this process. We plan to use the feedback to continually improve the format and content of the POCIS.

Overall, the intention is to understand SDL when using POCIS in the context of CME and the important practical aspect is to ensure that the resources available in the POCIS for meeting the valued learning needs and the transfer of the learning to clinical practice can be achieved. This requires an in-depth understanding of the types of valued learning needs, the different types of POCIS and the extent of learning and transfer achievement, including the important conversion factors. We recommend further research using the CA-SPQ in different formats. Pre-determined domains of valued learning needs could be determined by discussions with the target population, such as by focus groups or Delphi exercises, and these offer an easier approach to data analysis than using individual selected specific valued learning needs, although an approach similar to goal attainment scales could be used (Kiresuk et al. 2014). We also recommend larger studies with learners in different contexts and with different POCIS systems, including comparison across systems. A questionnaire limits the depth of qualitative data that can be collected about conversion factors but an important contribution of the CA-SPQ could be as an initial screening tool to identify a purposive sample for subsequent in-depth interviews to explore and obtain a greater understanding of the conversion factors, which can lead to new design and implementation of POCIS but also changes to healthcare environments that can limit transfer of learning. The questionnaire used in this study can be used in any evidence-based POCIS intervention. In further studies of POCIS, the researchers may wish to enable learners to use their preferred tools to enhance their knowledge and apply it to patient care.

Conclusion

We have presented the first study of a questionnaire (CA-SPQ) to apply the capability approach for understanding SDL when using POCIS in the context of CME. There was a high completion rate and good content, face, and construct validity. In addition, useful information was obtained about SDL using POCIS in the context of CME. These findings suggest that the CA-SPQ can offer a practical instrument to provide data and useful information, but also that the CA-SP framework and CAS-SPQ has the potential for adaptation to other areas of medical education. We hope that medical educators will be stimulated to apply Sen's capability approach to understand SDL in the context of CME.

Acknowledgements

We would like to thank all the participants and colleagues involved in the BMJ Best Practice Study.

Ethical approval

The study was approved by the Air Force Medical Center for Research Data (No. 2020-143-PJ01).

Disclosure statement

KW works for BMJ which produces the BMJ Best Practice POCIS. The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

Funding

This work was supported by Teaching Research Project of Air Force Medical Center [2021JX001, 2021JX016] and Quality Improvement Project of Resident Training of Beijing Health Commission [RT2021049].

Glossary

Self-directed learning: A definition of self-directed learning is that the learner is internally motivated to take responsibility for their own learning by a process in which they identify their own learning needs, use a variety of resources to meet these needs and evaluate their learning to ensure that their learning needs have been achieved.

Knowles M S. 1975. Self-directed learning: a guide for learners and teachers. New York (NY): Association Press.

Notes on contributors

Associate Professor Da Zhang, MD, Teaching Secretary of Internal Medicine, Endocrinologist at Air Force Medical Center, China.

Li Xiao, MM, Attending Doctor of Department of Endocrinology at Air Force Medical Center, China.

Jingqi Duan, MD, Attending Doctor of Department of Geriatrics at Air Force Medical Center, China.

Xinxin Chang, MM, Attending Doctor of Department of Geriatrics at Air Force Medical Center, China.

Kieran Walsh, MB, MCH, BAO, Clinical Director at BMJ and Adjunct Associate Professor at Monash University.

John Sandars, MBChB (Hons), MSc, MD, MRCP, MRCGP, Professor of Medical Education in the Faculty of Health, Social Care and Medicine at Edge Hill University, Ormskirk, UK.

Jeremy Brown, BSc (Hons), PhD, Professor of Clinical Education in the Faculty of Health, Social Care and Medicine at Edge Hill University, Ormskirk, UK.

Xiaorong Dang, MD, Director of Department of Medical Research at Air Force Medical Center, China.

Wei Shen, MM, Vice Director of Department of Medical Research at Air Force Medical Center, China.

Junjie Du, MD, Director of Department of Orthopedics at Air Force Medical Center, China.

Professor Yanjie Cao, MD, Deputy Director of Internal Medicine, Director of General Practice Medicine at Air Force Medical Center, China.

At the time of this study LX, JQD, XXC, XRD, WS and JJD all worked at Air Force Medical Center with roles in the teaching of clinical skills to residents.

ORCID

Da Zhang http://orcid.org/0000-0002-6574-0910
Kieran Walsh http://orcid.org/0000-0003-1268-4676
John Sandars http://orcid.org/0000-0003-3930-387X
Jeremy Brown http://orcid.org/0000-0002-0653-4615
Yanjie Cao http://orcid.org/0000-0002-5756-1330

Data availability statement

The datasets collected in this study are available from the corresponding author on reasonable request.

References

Abma FI, Brouwer S, de Vries HJ, Arends I, Robroek SJ, Cuijpers MP, van der Wilt GJ, Bültmann U, van der Klink JJ. 2016. The capability set for work: development and validation of a new questionnaire. Scand J Work Environ Health. 42(1):34–42.

Adepoju IOO, Albersen BJA, De Brouwere V, van Roosmalen J, Zweekhorst M. 2017. mHealth for clinical decision-making in sub-Saharan Africa: a scoping review. JMIR Mhealth Uhealth. 5(3):e7185.

Blume BD, Ford JK, Baldwin TT, Huang JL. 2010. Transfer of training: a meta-analytic review. J Manage. 36(4):1065–1105.

Bolarinwa OA. 2015. Principles and methods of validity and reliability testing of questionnaires used in social and health science researches. Niger Postgrad Med J. 22(4):195–201.

Chiappero-Martinetti E, Osmani S, Qizilbash M, editors. 2020. The Cambridge handbook of the capability approach. Cambridge (UK): Cambridge University Press.

Fink A, Litwin MS. 1995. How to measure survey reliability and validity. Thousand Oaks (CA): Sage.

Gladstone B, Exenberger S, Weimand B, Lui V, Haid-Stecher N, Geretsegger M. 2021. The capability approach in research about children and childhood: a scoping review. Child Indic Res. 14(1):453–475.

Hamilton L. 2019. Amartya Sen. New York (NY): Wiley.

Harrison DA, McLaughlin ME. 1993. Cognitive processes in self-report responses: tests of item context effects in work attitude measures. J Appl Psychol. 78(1):129–140.

Hatakka M, Lagsten J. 2012. The capability approach as a tool for development evaluation–analyzing students' use of internet resources. Inform Technol Dev. 18(1):23–41.

Kiresuk TJ, Smith A, Cardillo JE. 2014. Goal attainment scaling: Applications, theory, and measurement. London (UK): Psychology Press.

Knowles MS. 1975. Self-directed learning: a guide for learners and teachers. New York (NY): Association Press.

Kwag KH, González-Lorenzo M, Banzi R, Bonovas S, Moja L. 2016. Providing doctors with high-quality information: an updated evaluation of web-based point-of-care information summaries. J Med Int Res. 18(1):e5234.

Moja L, Kwag KH. 2015. Point of care information services: a platform for self-directed continuing medical education for front line decision makers. Postgrad Med J. 91(1072):83–91.

Oppenheim AN. 2000. Questionnaire design, interviewing and attitude measurement. London (UK): Bloomsbury Publishing.

Sandars J, Hart SC. 2015. The capability approach for medical education: AMEE Guide No. 97. Med Teach. 37(6):510–520.

Sandars J, Walsh K. 2016. Self-directed learning. Educ Prim Care. 27(2):151–152.

Shimizu T, Nemoto T, Tokuda Y. 2018. Effectiveness of a clinical knowledge support system for reducing diagnostic errors in outpatient care in Japan: a retrospective study. Int J Med Inform. 109:1–4.

Smith J, Firth J. 2011. Qualitative data analysis: the framework approach. Nurse Res. 18(2):52–62.

Song L, Hill JR. 2007. A conceptual model for understanding self-directed learning in online environments. J Interact Online Learn. 6(1):27–42.

Tao L, Zhang C, Zeng L, Zhu S, Li N, Li W, Zhang H, Zhao Y, Zhan S, Ji H. 2020. Accuracy and effects of clinical decision support systems integrated with BMJ best practice–aided diagnosis: interrupted time series study. JMIR Med Inform. 8(1):e16912.