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What do physiotherapists find useful in e-learning interventions to improve their knowledge, attitudes and beliefs on low back pain management: a nested qualitative study from an educational randomized clinical trial

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Abstract

Background Physiotherapists encounter many barriers in their management of low back pain (LBP). However, little attention has been paid to what content physiotherapists find useful to improve their LBP management. We aimed to: (1) explore the experiences of physiotherapists regarding the educational content after completing either an "experimental" or "traditional" e-learning intervention, (2) identify in both interventions which content physiotherapists reported beneficial or lacking in order to enhance their management of LBP.

Methods A purposive, criterion-based sampling strategy was employed to process-evaluate the experiences of 269 Dutch-speaking physiotherapists who participated in an RCT consisting of two different interventions aimed to improve LBP management. Both interventions were based on the same clinical guidelines, but emphasized different aspects. While the traditional e-learning discussed these guidelines in a more theoretical approach, the experimental e-learning demonstrated them in a concrete, practical, and interactive way. An inductive thematic framework approach was used to analyse and categorise responses to seven open-ended questions in a post-intervention online.

Results All 269 physiotherapists' responses were analysed, identifying four broad themes. The first theme, 'Practical application', revealed contrasting views between groups: physiotherapists in the "experimental" intervention highly appreciated the inclusion of concrete communication strategies, whereas those in the "traditional" group criticized the absence of such content as a major shortcoming. Both groups emphasized the need for clearer examples of effective exercises to treat LBP.

The second theme, 'Relevancy and adequacy of the intervention', highlighted divergent attitudes. While some participants valued content on red flags, spinal pathologies, and pain mechanisms, others considered such

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information irrelevant or outside their professional scope. The third theme, 'Knowledge', showed more consistency: participants in both interventions appreciated content that offered practical tools and biopsychosocial strategies.

The final theme, 'Confirmation of practice', captured the view of physiotherapists who felt reassured that their current clinical approach aligned with scientific recommendations.

Conclusion These qualitative findings suggest that educational interventions to enhance LBP management may benefit from prioritising clear communication strategies, supporting physiotherapists' confidence in prescribing individualised exercise therapy, and considering tailored approaches that reflect differing views on spinal pathologies and red flags.

Keywords Education content, Physiotherapy, Clinical guidelines, Experiences, Management, Low back pain

Introduction

Although several (inter)national guidelines about the management of low back pain (LBP) have been published [1–4], it remains a challenge for physiotherapists to adequately manage patients with LBP in a guideline-consistent way [2, 3, 5–9]. Firstly, recent research has demonstrated that physiotherapists still struggle to recognize signs of specific spinal pathologies [5]. This is worrisome as excluding a specific underlying cause of LBP (i.e., by assessing "red flags") should be the first step according to the evidence-based guidelines [3, 7, 8, 10, 11]. Secondly, physiotherapists do not fully integrate the biopsychosocial model when managing LBP, and they are facing challenges recognizing multiple factors when explaining the cause of the patient's LBP [5, 6, 9]. Yet, the identification of unhelpful beliefs, attitudes, emotions, behaviours, social factors, etc. of the patient (i.e., psychosocial factors often referred to as "yellow flags") is crucial as these are predictors of poor outcome and might explain the persistence of pain in some patients [1, 12–18]. Both young and experienced physiotherapists report to feel unprepared to fully incorporate the biopsychosocial framework in their management [19–21]. Therefore, it is imperative for health-care professionals (HCPs), such as physiotherapists, to adopt a biopsychosocial framework when treating patients with LBP, instead of sticking to the outdated biomedical model [5, 6, 9, 19, 20, 22].

To meet this need, various educational interventions have been developed to improve the knowledge, attitudes, and beliefs of HCPs according to the clinical guidelines of LBP [23–26]. A recent randomized controlled trial (RCT) investigated the effectiveness of two e-learning interventions (i.e. an 'experimental e-learning' intervention (EEI) and a 'traditional e-learning' intervention (TEI)) aiming to facilitate the improvement of knowledge, attitudes, and beliefs of physiotherapists on their LBP management [27]. Both EEI and TEI provided all the necessary information described in the clinical guidelines of LBP. However, the interventions were different regarding the educational format (interactive modules versus lecture modules) and additional content (see further). So far, previous studies have mainly explored barriers physiotherapists experience when implementing a biopsychosocial approach in their management, such as patient's beliefs and expectations, self-management skills, lack of knowledge/expertise on addressing psychosocial factors, lack of time [19, 28–31]. Little attention has been paid to what kind of content physiotherapists find useful to improve their LBP management. To the best of our knowledge, this is the first study to adopt a nested qualitative design to evaluate physiotherapists' perspectives on two different e-learning interventions for LBP management.

Therefore, the aim of this study is two-fold. First, to explore and thematically analyse the experiences of physiotherapists regarding the educational content after completing either an "experimental e-learning" intervention (EEI) or a "traditional e-learning" intervention (TEI). Second, to identify in both e-learning interventions which content physiotherapists reported as beneficial or lacking in order to enhance their management of LBP within a biopsychosocial approach.

Materials and methods

The RCT

This qualitative study was a process evaluation, part of the post-assessment of an RCT examining solely the intervention effect on physiotherapists [27]. The RCT used an e-learning intervention to implement guideline-adherent care in physiotherapists, to enhance knowledge, attitudes, and beliefs of physiotherapists towards a biopsychosocial approach in LBP management [27]. This RCT found that the EEI, which provided concrete clinical examples, communications strategies to reassure patients about the safety of activity and explain their pain, and emphasized the importance of screening for psychosocial factors, had more impact than the TEI in improving physiotherapists' knowledge, attitudes, beliefs, and clinical decision-making regarding LBP management [27]. More information regarding the content of EEI and TEI can be found below.

Content of the e-learning interventions of the RCT

The e-learning interventions were developed by a team of experts (consisting of both academics and clinicians,

such as general practitioners, an orthopaedic surgeon, and physiotherapists) on LBP and are described in detail in a pilot study and recent RCT [27, 32]. Both e-learning interventions (EEI and TEI) were based on recent guidelines for the management of LBP and the previous pilot study [4, 8, 32]. While both e-learnings covered the necessary contents of the clinical guidelines (see Table 1) [1–4], different focusses on additional topics were given in both interventions.

The core principle differences was that the EEI concretely demonstrated how guideline recommendations could be applied in practice, using an interactive, pragmatic format with clinical videos, simulated scenarios, metaphors, and quizzes to support learning [27]. In contrast, the TEI presented the same guidelines in a more traditional, lecture-based and theoretical manner, without interactive or clinically applied elements [27].

A detailed comparison of content differences follows and is supported by Table 1. Firstly, while both interventions discussed the importance of assessing red flags to rule out specific LBP [33], in the EEI this was only supplemented with the levels of concern described by Finucane et al. [10]. In the TEI, different spinal pathologies that might explain LBP were discussed in depth (i.e. how to recognize them, underlying pathology, referral, etc.) [7, 10, 34–43]. Secondly, The EEI discussed in depth the importance of attitude and beliefs of both patien and HCPs and its influence on LBP [44–46]. More specifically, the EEI focused on how HCPs can reassure their patients, and how they can encourage patients to progressively increase physical activity, by emphasizing that it is safe to exercise [41, 47–49]. The TEI had a more general overview, providing additional insights on the pharmacological treatment [50, 51], an overview of interventions that are not recommended and invasive procedures [7]. Thirdly, pain education was delivered in the EEI with a special focus on how to communicate about pain to the patients by using metaphors (e.g. "the water cup metaphor"), illustrations and clinical examples [52, 53]. The TEI focused instead on delivering more fundamental neuroscience research on pain [54, 55].

Each intervention consisted of three modules (30 min each) and is described in Table 1. The EEI was based on an active learning strategy such as critical reflection and purposeful observations [56] and contained interactive modules with the inclusion of menus, videos, simulated clinical situations, metaphors, voice-overs and quizzes. Participants could control their pace within the modules (play, pause, going back to a specific chapter, etc.). In contrast, the TEI was based on a passive learning strategy (lectures) without any interaction or clinical examples. Participants could not control the pace of the modules and were only able to watch and pause the recorded video.

Population

Licensed physiotherapists in Belgium and France were invited through a range of networks, including national professional associations, local networks of university departments and hospitals, registered physiotherapy associations, etc.[27]. Physiotherapists not actively managing patients with LBP were excluded from the RCT [27]. This nested qualitative design used a purposive, criterion-based sampling strategy and included all Dutch-speaking physiotherapists who participated in the RCT and completed the open ended questions of the post-intervention assessment for thematic analysis [27].

Table 1 An overview of the content in the two e-learning interventions as described in the pilot study and RCT [27, 32]

Module 1: Triage and evaluation of LBP: main messages

- EEI: Diagnostic triage of a LBP patient: Suspicion of an underlying spinal pathology with an evolutive clinical example discussing its referral urgency; The importance to avoid medical imaging in non-specific LBP ; How to approach non-specific LBP in your management. How to evaluate psycho-social factors (BIPQ); Classify the risk of chronicity (SBST).
- TEI: Diagnostic triage of a LBP patient: Exploring clinical symptoms of various specific spinal pathology; Presentation of the specific timing on when to refer the patient; No medical imaging in non-specific LBP. How to approach non-specific LBP in your management; Classify the risk of chronicity (SBST).

Module 2: Management of LBP: main messages

- EEI: How to reassure and encourage physical activity (clinical tips), promoting self-management; How to communicate with a patient with acute & chronic LBP (patient-therapist video); Pharmacological management (short information on non-recommended medication).
- TEI: Theory of risk-stratification of chronicity, self-management, physical activity and multidisciplinary rehabilitation; Pharmacological management (extensive information on recommendations); Invasive management (infiltrations, denervations, etc.); not recommended interventions.

Module 3: Understanding the complexity of pain: main messages

- EEI: Understanding the pain experience from a patient-centered point of view; How to explain and reassure a patient about the pain experience (videos, metaphors, infographics, etc.).
- TEI: Understanding the theory concerning the neurophysiology of pain; Exploration of the different pain definitions, mechanisms, spinal modulation, and the challenge of chronic pain.

Content in both interventions where fundamentally based on clinical guidelines and the diagnostic triage of low back pain [1–4, 7, 11]. *RCT* Randomized Clinical Trial, *LBP* Low back pain, *BIPQ* Brief Illness Perception Questionnaire, *SBST* STarT Back Screening Tool, *EEI* Experimental e-learning intervention, *TEI* Traditional e-learning intervention

Data collection

Data collection took place between August 2021 and February 2022 through an online survey with open ended questions using the Qualtrics program (https://qualtrics.com). After giving their informed consent and completing the e-learning intervention of the prior RCT study, physiotherapists were invited to complete the post-assessment as part of the process evaluation and were asked about their experiences on the content of the e-learning interventions. Seven open questions (listed in Table 2) were developed based and inspired on extensive work of a similar study exploring e-learning interventions [57]. These open questions were employed in a pilot-study and were further refined according to the participants' experiences regarding the educational content of the e-learning intervention [32]. These open questions were used to interview the physiotherapists regarding their experiences, perceived usefulness to improve knowledge, shortcomings, and perception of clinical applicability of the e-learning interventions' content. Socio-demographic information such as age, gender, estimation of new LBP-patients per month, and work experiences were retrieved from the RCT study to estimate the generalizability of the study population.

Ethical considerations

The ethical commission of the Antwerp University Hospital approved the study on February 2021 (registration number 20/51/714) and written informed consent was obtained for all participants. The study was conducted in accordance with the General Data Protection Regulation (GDPR). Data was automatically collected via the online survey instrument Qualtrics program often used by researchers with a strong confidential policy.

Table 2 Overview of the open questions concerning the experience of physiotherapists with the interventions

1.	What are your general experiences on this online intervention?
2.	Has the online intervention helped you in your approach of cases. If "Yes": What helped?; If "No": What do you need?
3.	What was the most useful part of the intervention to improve your knowledge, why?
4.	What was the least useful part of the intervention to improve your knowledge and why?
5.	Did you notice shortcomings that are important in the management of non-specific LBP in this intervention? If so, what would be necessary to improve the content?
6.	Which part of the content of this online intervention do you think you will be able to apply in the daily clinical practice?
7.	Do you have suggestions to improve this online intervention? If "Yes": What suggestions do you have?

LBP Low back pain

Data analysis

An inductive thematic framework approach was employed for the analysis of the seven open questions using NVivo 1.7.1 to support the data analysis. Researcher triangulation, an established and robust method to ensure credibility in qualitative research, was employed instead of member checking [58]. The primary researcher (RV) is a physiotherapist, researcher, lecturer, and is a clinician specialized in LBP management. The second researcher (SA), is primary care social scientist and expert in qualitative research, specialising in implementation science in primary care for both acute and chronic conditions. SA had no prior involvement in the intervention development, ensuring analytical distance. To minimize potential bias, the analysis was conducted in collaboration with a multidisciplinary team of co-authors from diverse disciplinary backgrounds (i.e., general practitioner, orthopaedic surgeon, social scientist, physiotherapists) and profiles (i.e., lecturers, academics, clinicians).

Regular analytical discussions were held with this multidisciplinary composition of the analysis team to enhance the trustworthiness of our analysis. This reflexive approach was embedded within a collaborative team process, challenging assumptions and analytical decisions through thoughtful and systematic dialogue throughout the research process. This collaborative reflexivity ensured that individual biases and preconceptions were surfaced and examined collectively, strengthening the analytical rigor of our interpretations [59].

All participant responses were included in the analysis. As the full dataset was analysed, no formal saturation criteria were applied. In a first step, the primary researcher familiarized himself with the data and each question was coded separately for all participants. A repetitive pattern for each question surfaced after coding circa 30 participants and formed the basis of the initial coding framework. A process of researcher triangulation resulted in iterations and adaptations of the analysis framework. Continuing the inductive analysis with the initial framework, the coding was completed for the entire dataset. While reviewing the first completed framework it was noted that participants repeated their answers in multiple questions. To maintain a better perspective of the participant's experience with the intervention, it was decided to recode the entire dataset with all seven answered questions in relation to each other for each participant. After recoding the dataset, this second framework was rediscussed and minor adaptations in the coding process were added to ultimately produce the third version of the framework. After a final multidisciplinary team discussion and systematic dialogue, final adaptations were made. Overlapping (sub)themes were merged to provide a more coherent overview of the experiences of the participants leading to the final thematic framework. The

Table 3 Demographic results

	n (%)
Gender	
Female	177 (66%)
Male	92 (34%)
Estimation new LBP patients/month	
1–5	68 (25%)
5–10	95 (35%)
10–15	56 (21%)
15–20	20 (7%)
> 20	30 (11%)
Clinical occupation percentage	
100%	221 (82%)
75%	32 (12%)
50%	12 (4%)
25%	4 (1%)
Work setting (multiple answers allowed)	
Self-employed	76 (NA)
Self-employed (in a group with same profession)	136 (NA)
Multidisciplinary setting	39 (NA)
Medical house	11 (NA)
Hospital	56 (NA)
Disability sector	10 (NA)
	Median (IQR)
Age (years)	33 (20)
Work experience (years)	8 (21)

n Amount, *LBP* Low back pain, *IQR* Interquartile range, *NA* Not applicable

content within each theme was counted on frequency of occurrence to provide an overview on which experiences were predominantly present. When (sub)themes were merged, the initial answers were checked in the data set to prevent double coding.

Results

Descriptive data

Table 3 describes the Dutch speaking physiotherapists in Belgium who completed the e-learning intervention and finished the post-assessment as part of the process evaluation. In total, 269 physiotherapists (66% female; 34% male) completed the course of which 140 participated in the EEI and 129 were grouped in the TEI. The participants had a median age of 33 years, a median of 8 years work experience, and 60% reported to treat up to 10 new LBP patients a month, further details can be found in Table 3.

Four broad themes emerged from the inductive analysis: (1) "Practical application", (2) "Relevancy and adequacy of the intervention", (3) "Knowledge", and (4) "Confirmation of practice". Based on the experiences of the participants, these themes were further classified into either: "useful", "shortcoming", and "not useful". The interpretive analysis that follows will address these themes and offer insights into the experiences of the physiotherapists (see also Fig. 1).

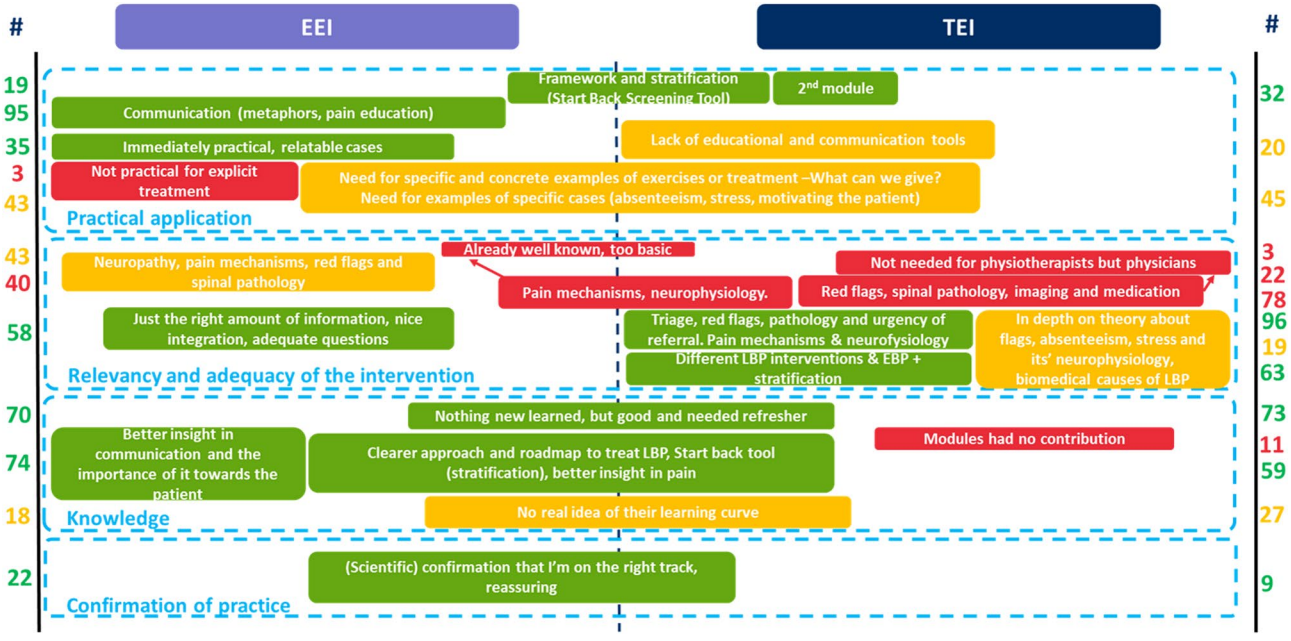

Fig. 1 Interpretative analysis of the four themes
#: number of unique references; EEI: experimental e-learning intervention; TEI: traditional e-learning intervention; 'Green boxes': experiences classified as useful; 'Yellow boxes': experiences classified as a shortcoming in the intervention; 'Red boxes': experiences classified as not useful

Interpretative analysis of the themes (Fig. 1)

Practical application

Physiotherapists in the EEI said that they considered the communication strategies (e.g., use of metaphors, 'tips and tricks', how to reassure, how to impart pain education, etc.) to be highly useful and practical to employ in practice. Instead, participants from the TEI regarded this topic as a shortcoming in the modules and stressed the need for educational and communication resources. Interestingly, physiotherapists in both e-learning interventions ($n = 88$) wanted more specific and concrete examples of exercise therapy (including examples of 'good exercise for patients with LBP', as this was found lacking in the interventions. Following, physiotherapists called for examples of different treatment modalities or specific cases.

Relevancy and adequacy of the intervention

Physiotherapists have a mixed opinion when being provided with educational content on red flags, spinal pathologies, and pain mechanisms. While 96 out of 129 physiotherapists in the TEI found the third module's content on red flags, spinal pathologies, pain mechanisms, and urgency of referral useful, other physiotherapists in both interventions expressed that the content regarding the pain mechanisms and neurophysiology was not relevant to their clinical practice. Participants in the EEI ($n = 40$) and a minority in the TEI ($n = 3$) specified the provided content in module 3 was too basic or well-known and did not offer new useful insights to their profession or was just "not relevant". Physiotherapists following the TEI ($n = 78$) mainly indicated the third module's content was overly theoretical, challenging, and lengthy to be effective. Surprisingly, 22 physiotherapists in the TEI explicitly stated that the information on red flags, spinal pathology, imaging, and medication was not relevant to their profession as they considered that these topics should be checked by the physicians. In contrast, some of the EEI physiotherapists ($n = 43$) argued that a more complete coverage on this topic would be useful since they believed the current e-learning intervention lacked in providing knowledge in this area.

Survey 74 (28 year old female, 6 years of work experience):

> *"The pain theory part was too technical, not patient specific nor friendly."*

Survey 96 (45 year old female, 22 years of work experience):

> *"Specific pathologies are filtered out by the physician and do not reach us. The content about other kinds of low back pain gave no added value".*

Survey 18 (22 year old male, 2 years of work experience):

> *"The content on specific spinal pathologies were useful as this cannot be refreshed enough, as we have an important role to the patient here."*

Knowledge

While many physiotherapists ($n = 143$) in both interventions mentioned that the modules did not provide a lot of new information, they commonly reported that the modules served as a very useful and necessary knowledge refresher. Alongside the adoption of clinical tools (e.g., SBST), which was experienced as very practical, a better understanding of cases at risk of developing chronic complaints and how to manage them were considered as an important part of the modules. A notable portion of participants in the EEI also stated that they had a better understanding of why and how to communicate with a patient. A considerable amount of participants in the TEI distinctly indicated to have improved their knowledge on red flags and spinal pathology. Interestingly, a small group of physiotherapists claimed that they do not have an idea of their learning curve because they were not given feedback on their answers related to the clinical cases in both e-learning interventions.

Confirmation of practice

A small number of physiotherapists in both e-learnings ($n = 31$) mentioned that by participating in the modules they were reassured about their current clinical practices and behaviours (i.e. in line with current clinical and scientific guidelines).

Discussion

This study focussed on the experiences of physiotherapists regarding the educational content of e-learning interventions aimed at improving their LBP management. Key-results from the interpretative analysis show that: (1) Physiotherapists in the EEI were very positive on the various communication strategies demonstrated in the intervention. This contrasts to the expressed need of physiotherapists in the TEI to receive more information on communication, as they felt it was lacking. (2) Eighty-eight physiotherapists still want concrete examples of "good exercises", although this is in contrast with all evidence favouring an individual approach based on needs and preferences. (3) Physiotherapists have a mixed opinion about the relevance to include content on red flags, spinal pathologies, and pain mechanisms in the e-learning interventions. (4) Although the provided content was not very new to a majority of physiotherapists, most of them found this refresher very useful.

Communication strategies in LBP management

Physiotherapists need to be able to reassure a patient with LBP, as described in the clinical guidelines and mentioned in the e-learnings [2, 3, 7]. But guidelines seldom specify how to communicate. Therefore, good communication skills and being able to have a genuine biopsychosocial approach to patients is important in LBP management. In this study, physiotherapists mentioned a lack of specific content concerning dealing with work absenteeism, stress and about reassuring and motivating the patient. They consider these skills could help them in improving their LBP-management. This aligns with previous qualitative research where physiotherapists indicated not having the skills or knowledge to adequately communicate or approach psychosocial factors in patients [19, 28–31]. In particular, physiotherapists in the TEI expressed a need for communication strategies on how to reassure their patients, how to provide pain education, and to address various cases with different psychosocial factors. In contrast, the EEI did provide information and examples on how to educate pain concepts and how to reassure a patient (e.g. by using metaphors, such as "the water cup metaphor" [52]). This approach was valued as very useful because it related to messages that could be directly applied in clinical practice. These positive observations are reflected in the outcome of the RCT, with the EEI demonstrating a higher impact than the TEI on attitudes, beliefs, and clinical-decision making in a biopsychosocial oriented, guideline-consistent manner [27]. Future educational interventions should be encouraged to invest on improving communication skills of physiotherapists and provide metaphors and analogies along with tips for practical implementation.

Personalised exercise prescription

After completing the intervention, many physiotherapists noted that the modules lacked examples of "good" exercises to prescribe. This is notable, as both interventions stressed that there is no convincing evidence that one type of exercise is superior to another when treating LBP [7, 60–63]. Indeed, recent evidence underscores the benefits of exercise and supports the inclusion of exercise prescription as a core component of patient care in general [7, 60–64]. However, this prescription must be tailored to the individual needs of each patient [64]. The apparent insecurity around exercise prescription in this study aligns with previous research, where physiotherapists identified limited knowledge, confidence, or training as barriers to delivering effective individualised exercises in a guideline-consistent manner [64–66]. These barriers may explain why many physiotherapists expressed a desire for a ready set of exercises to use in clinical practice. This observation is thought-provoking, as a key-message during the intervention was to enhance the awareness of physiotherapists that there are no "one-size fits all exercises" and thereby on the importance of giving the patients individually designed exercise programs they enjoy, aligned to their goals, rather than focusing just on fixed exercises examples [60, 67]. Such personalised approaches have been associated with improved therapy adherence, better clinical outcomes in addition to promoting regular physical activity [60, 67]. Future research and educational interventions should take into account physiotherapists' lack of confidence in prescribing individualised exercise therapy and aim to support the development of these skills, thereby enhancing the implementation of personalised care in clinical practice.

Diagnostic triage and the knowledge of red flags screening and spinal pathology

While all guidelines stress the importance of excluding a specific underlying reason for LBP as a first and important step, several studies revealed that many physiotherapists were not able to recognize these cases, with inadequate management as result [5, 68–70]. The results of the current study confirm there is a huge problem with the differentiation between specific and non-specific LBP in clinical practice. Participants not only expressed mixed opinions about the added value of red flag screening, spinal pathologies and pain mechanisms, but even explicitly mention this is not their job. A tailored approach could be beneficial for future educational interventions to sensibilize physiotherapists that more advanced knowledge of red flags screening and underlying pain mechanisms will help them to differentiate between specific and non-specific LBP. Moreover, direct access for physiotherapists is currently being developed in the country of recruitment and the ability to differentiate between non-specific LBP and specific pathology is crucial [71].

Knowledge refresher on LBP management

Several physiotherapists specifically reported that the e-learning interventions functioned as a valuable refresher or reaffirmation of their existing approaches to LBP management, and appreciated the content offering practical tools and biopsychosocial strategies. These perceptions are consistent with the results of the RCT. Importantly, both interventions were developed in accordance with current clinical guidelines that promote a biopsychosocial approach to LBP management [27]. While the theoretical underpinnings, rationale, and outcomes for this were elaborated in the RCT, this nested qualitative process-evaluation provides deeper insight into how that content was received and interpreted in practice.

Implications for practice

To facilitate further improvement on personalized care, future educational interventions should integrate

communication strategies in interventions for physiotherapists to implement in their patient education. It is still unclear for some physiotherapists that a "one-size-fits-all exercise" does not exist to manage LBP but should rather focus on individual designed exercises, fitted the patients' personal preferences and goals. It could be considered that future educational interventions need to devote a substantial amount of time when explaining or demonstrating this message. Furthermore, educational interventions should consider a tailored approach where participants are scored first on their knowledge of the importance on red flags and spinal pathologies with an opportunity to receive additional content on this topic before continuing with the educational intervention. Many physiotherapists appreciate a thorough refresher course providing them with the latest scientific updates, but a considerable proportion lose their interest when it is overly theoretical. Finally, the implementation of the SBST and the elaboration on its purpose, scoring, interpretation, and practical application was experienced as extremely useful for the majority of the physiotherapists taking part in this study.

Strengths and weaknesses

To the best of our knowledge, this study is one of the first to explore the experiences of physiotherapists on what content they find useful or not in an e-learning intervention to improve their LBP management. The large sample size with a representation of different ages and work experiences is certainly a strength of the study. However, the results of this study should be seen in the light of some methodological considerations. Firstly, despite the large convenience sample, recruitment bias cannot be excluded. Some risk of selection bias cannot be excluded. Although 88% of invited physiotherapists consented to participate at baseline, 33% of the Dutch-speaking participants dropped out before the post-intervention assessment. This level of dropout was anticipated given the nature of the online survey. Despite this, the final sample met the RCT's required sample size. Moreover, this nested qualitative study included a relatively large and diverse group of clinicians involved in LBP management, which helps mitigate selection bias and enhances the credibility of the findings. Nonetheless, it remains possible that those who remained in the study were more motivated, which may have influenced their responses.

Because of the GDPR, it was not possible to get access to the full mailing list of the members of the organisation to explore reasons for non-participating or dropping out of the RCT [27]. Since we awarded physiotherapists completing the full study with accreditation points, it is possible that some participants were only interested in gaining points. Secondly, because of the online nature of this qualitative study we were unable to ask additional questions to acquire a sufficient answer when needed, as some participants interpreted the questions differently or did not answer in a relevant way. As a consequence, it is possible that some relevant information towards the experience of the interventions was not acquired. Thirdly, the questions in this study were the last of multiple questionnaires included in the RCT [27]. One participant stated he was *'tired with answering questions'*, it is possible that more people answered out of politeness but half-heartedly. This should be taken into consideration that some experiences might be limited towards their completeness. However, considering the population size, the latter should not be substantial. Finally, this study did not include member checking with participants, which may limit the validation of interpretations. However, credibility was enhanced through researcher triangulation and by comparing findings with quantitative outcomes from the related RCT. While no formal reflexivity process was documented during analysis, the multidisciplinary research team brought varied clinical and research perspectives, helping to balance potential biases and enrich interpretation.

Conclusions

The findings from this qualitative study suggest that future educational interventions aiming to improve LBP management may benefit from including clear communication strategies, as these were highly valued by physiotherapists. The reported lack of confidence in prescribing individualised exercise therapy also highlights a potential area where additional support and training could be helpful. Furthermore, our results indicate that a tailored educational approach might be useful, given the differing views among physiotherapists on the relevance of spinal pathologies and red flags.

Abbreviations

LBP	Low back pain
HCPs	Health-care professionals
RCT	Randomized controlled trial
EEI	Experimental e-learning intervention
TEI	Traditional e-learning intervention
BIPQ	Brief Illness perception questionnaire
SBST	STarT Back Screening Tool
GDPR	General Data Protection Regulation

Supplementary Information

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Supplementary Material 1.

Authors' contributions

Conceptualization, S.A., N.R.; methodology, R.V., N.R., J.M., H.B., S.A.; software, R.V; validation, R.V., H.B., J.M., N.R, S.A.; formal analysis, R.V., S.A.; investigation, R.V., S.A.; resources, N.R, S.A.; data curation, R.V.; writing original draft preparation, R.V., S.A.; writing - review and editing, AF., C.D., H.B., J.M., N.R., S.A.;

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Data availability
The qualitative data is available on reasonable request from authors.

Declarations

Ethics approval and consent to participate
The ethical commission of the Antwerp University Hospital approved the study on February 08-2021 (registration number 20/51/714) and written informed consent was obtained for all participants.

Consent for publication
All authors have read and agreed to the published version of the manuscript. Informed consent was obtained from all participants involved in the study and agreed to participate in this study, including their consent for publication of anonymised data. In accordance with institutional requirements, any individual details, images, or other personal data have been anonymised to ensure confidentiality.

Competing interests
The authors declare no competing interests.

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