Evolution of teaching in short-term courses: A systematic review

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A B S T R A C T

Short-term courses are a useful tool for continuous training to update and deepen knowledge in various fields. In this article, we analyse the evolution of the teaching methods used in short-term courses through a systematic review conducted using the PRISMA methodology. The inclusion criteria for selecting articles were those that described the methodological structure of the teaching methods used in designing short-term courses. The exclusion criteria were courses longer than 90 days and unfinished documents. The search was conducted on April 9, 2022, using the SCOPUS database. The list of papers was reviewed and analysed three times by different researchers to ensure that they met the criteria. Articles approved by at least two researchers were selected. The results were systematically analysed based on criteria that allowed us to understand the learning methods used, such as the educational modality, content presentation, teaching methodology for teamwork and individual work, technological resources, and assessment methods. We selected 42 articles, and the results are presented in four parts: the learning experience, teaching methodology, technological resources, and assessment methods. One of the main findings is that short-term courses are primarily designed for experiential learning, and memory-related activities commonly used in traditional training are not typically included in short-term courses.

1. Introduction

Education is now seen as a continuous, dynamic process for updating, refining, and further training knowledge, skills, and attitudes [1]. According to Polla (2008) short-term courses are a tool for continuous training, aiming to incorporate relevant information for professional performance [1]. People from various backgrounds, including professionals, academics, and those interested in specific topics, participate in these courses to meet labour market requirements [1]. Formal education institutions have found that short-term courses can be innovative in knowledge acquisition [2], making education more flexible for lifelong learning [3].

The interest in short-term courses and their contribution to student learning is evident. Moreover, short-term courses are aligned with current challenges faced by higher education. For example, higher education is facing criticism of campus-centered program models, such as lengthy and inflexible programs, inadequate recognition of prior learning, and slow innovation in pedagogy [4]. Students prioritize their work and career outcomes, and employers call for public sector action to address talent and skills gaps. Governments demand greater responsiveness of higher education systems to labour market demands [4].

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Table 1
PRISMA 2020 checklist.

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Title
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Abstract
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	1. Introduction
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	1. Introduction
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	2.2. Inclusion and exclusion criteria 2.3. Selection and data collection process
Information sources	6	Specify all databases, registers, websites, organizations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	2.1. Searching strategy
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	2.1. Searching strategy
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	2.2. Inclusion and exclusion criteria 2.3. Selection and data collection process
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	2.3. Selection and data collection process
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	2.3. Selection and data collection process 2.4. Data items
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	2.3. Selection and data collection process 2.4. Data items
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	2.3. Selection and data collection process
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	2.3. Selection and data collection process
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	2.2. Inclusion and exclusion criteria 2.3. Selection and data collection process
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	2.1. Searching strategy
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	2.1. Searching strategy
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	2.3. Selection and data collection process
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	2.3. Selection and data collection process
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	2.3. Selection and data collection process
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	2.3. Selection and data collection process
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	2.3. Selection and data collection process
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Fig. 1
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	3. Results
Study characteristics	17	Cite each included study and present its characteristics.	Table 2. Papers selected for the research

(continued on next page)

Table 1 (*continued*)

Section and Topic	Item #	Checklist item	Location where item is reported
			3.1. General characteristics of short-term courses
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	3. Results
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/ credible interval), ideally using structured tables or plots.	3.1. General characteristics of short-term courses
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	3.2. Summary table of results
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	3.2. Summary table of results
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	3.2. Summary table of results
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	3.2. Summary table of results
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	3. Results
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	3.2. Summary table of results
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	4.1. Experiential Learning in short-term courses 4.2. Aspects related to teaching methodologies 4.3. Technological resources in short-term courses 4.4. Assessment of short-term courses
	23b	Discuss any limitations of the evidence included in the review.	Limitations
	23c	Discuss any limitations of the review processes used.	Limitations
	23d	Discuss implications of the results for practice, policy, and future research.	5. Conclusions
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	2.4. Data items
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	2. Method
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	2.4. Data items
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Funding information
Competing interests	26	Declare any competing interests of review authors.	Conflicts of Interest
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	2.4. Data items

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews [12].

Besides, short-term courses can provide solutions to these challenges. Jansen and Schuwer (2015) note that universities have a particular interest in offering short-term courses as they increase visibility and reputation, allow for experimentation with new pedagogies and technologies, generate additional revenue, reduce costs, and increase responsiveness to student and labor market demands [5].

Despite their benefits, short-term courses have also received criticism. For example [6], notes that such courses may limit students' ability to acquire transferable knowledge and skills. Furthermore, concerns have been raised about the impact of accelerated programs on the quality of learning outcomes and meeting labor market expectations [7]. Additionally [7], argues that micro-credentials can be viewed as a form of "learning innovation theater," and that institutions risk prioritizing profits over academic integrity by unbundling degrees.

The above highlights the need to further examine the teaching methods employed in short-term courses to determine which approaches lead to optimal learning outcomes. Therefore, this systematic review aims to answer the research question: How has the teaching methodology used in short-term courses evolved? Additionally, it should be noted that the definition of short-term courses varies, with some lasting only hours [8], while others may span days [9] or several weeks [10]. For the purposes of this article, courses lasting up to 90 days will be considered short-term courses [11].

2. Method

This systematic review follows the 2020 PRISMA statement, which aims to enhance the transparency and completeness of systematic reviews [12]. To achieve this goal, we employed the 27 criteria proposed by the statement, as detailed in Table 1. The question that guided this systematic review is: How has the teaching method used in short-term courses evolved?.

2.1. Searching strategy

Liu et al. (2019) argue that literature reviews are crucial for developing specific fields or areas of knowledge, as they enable condensing and reflecting on prior research experiences to set the foundations for knowledge development [13]. In this study, we conducted an exploration of the SCOPUS database, which was selected due to its trajectory and recognition within academic research fields, its interdisciplinary nature, and the fact that short-term courses have been used in many areas beyond education. SCOPUS has a database of over 34,100 titles from more than 5000 international publishers [14]. The search filters included: 1) theme, in which several synonyms for the phrase 'short-term courses' were used and they were crossed with the term learning, and 2) articles published in English. Thus, the following Boolean code was acquired:

TITLE-ABS-KEY (minicourses OR mini-courses OR "short courses" OR "short-term courses") AND TITLE-ABS-KEY (learning) AND (LIMIT-TO (LANGUAGE, "English")). The query was made on 9 April 2022 and the time range for the publication of the articles found was from 1965 to 2022.

A list of 810 articles was found. To prepare the data for synthesis and presentation, the articles were exported into a matrix that included details such as author names, year of publication, title, DOI, and abstract. This allowed for the creation of graphs and tables to aid in data analysis.
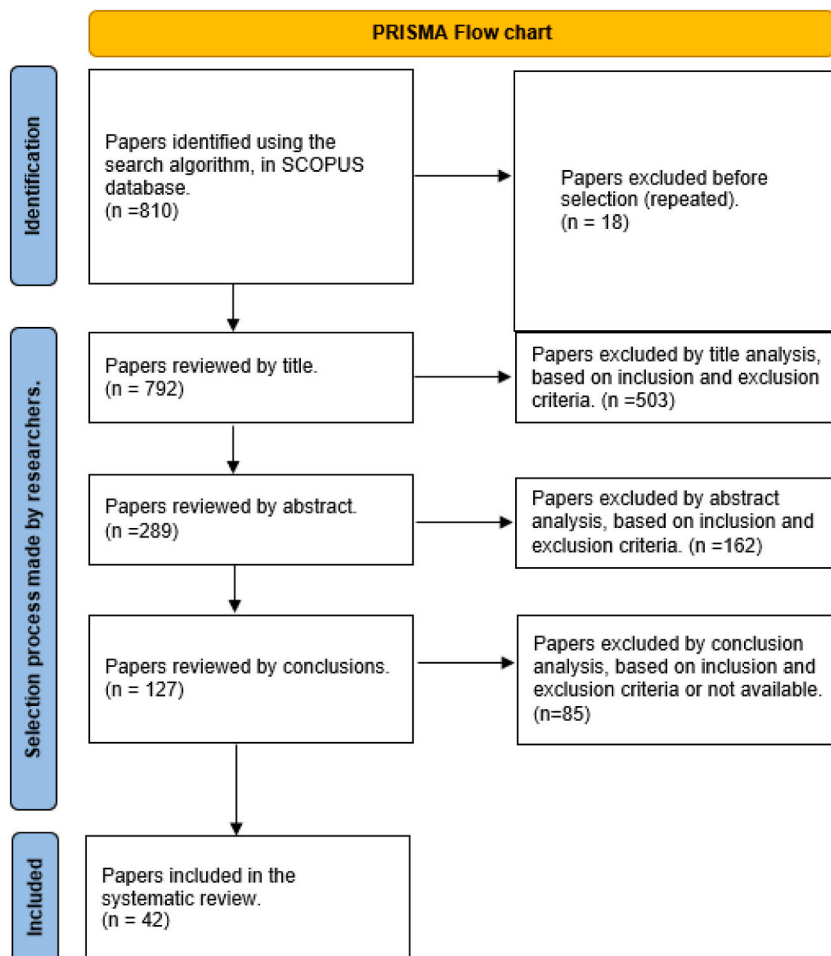

Fig. 1. PRISMA Flow chart.

Table 2

Papers selected for the research.

Author	#	Paper	Year
O'Keeffe, D.A., Brennan, S.R. & Doherty, E.M.	[9]	Resident Training for Successful Professional Interactions	2022
Ali, S., Hafeez, Y., Abbas, M.A., Aqib, M.& Nawaz, A.	[15]	Enabling remote learning system for virtual personalized preferences during COVID-19 pandemic	2021
Albright, H. J., Stephenson, C.R. & Schindler C.S.	[16]	Converting a Two-Week Chemistry Course for High School Students to a Virtual Format during COVID	2021
Atkinson, C.L.	[6]	Significant learning and public administration education: The impact of short-term courses	2021
Pokrovskaia N.N., Leontyeva, V.L., Ababkova M.Y., Cappelli L. & D'ascenzo, F.	[17]	Digital communication tools and knowledge creation processes for enriched intellectual outcome—experience of short-term E-learning courses during pandemic	2021
Arithra Abdullah, A., Nor J., Baladas J., Tg Hamzah T.M. A., Tuan Kamauzaman, T.H., Md Noh A.Y. & Rahman A.	[18]	E-learning in advanced cardiac life support: Outcome and attitude among healthcare professionals	2020
Judge, P.K., Buxton, J.A., Sheahan, T.C., Phetteplac, E.R., Kriebel, D.L., & Hamin Infield, E.M.	[19]	Teaching across disciplines: a case study of a project-based short course to teach holistic coastal adaptation design	2020
Jackson, B., Hauk S., Tsay J.J. & Ramirez, A.	[20]	Professional development for mathematics teacher education faculty: Need and design	2020
Hyder, A.	[21]	Teaching systems science to public health professionals	2020
Lewandowski, L.B., Schiffenbauer, A., Mican, J.A.M., Moses, S.J., Fallah, M.P., Plotz, P. & Katz J.D	[10]	Rheumatology capacity building: implementing a rheumatology curriculum for Liberian health-care providers in 2016	2020
Jacobson,S.K., Seavey, J., Goodman, J., Nichols, O.C., Williams, L.C., Márquez-García, M.& Barbosa O.	[22]	Integrating Entrepreneurship and Art to Improve Creative Problem Solving in Fisheries Education	2020
Demazière, C.	[23]	Using active learning in hybrid learning environments	2020
Jessani, N. S., Hendricks, L., Nicol, L., & Young, T.	[24]	University Curricula in Evidence-Informed Decision Making and Knowledge Translation: Integrating Best Practice, Innovation, and Experience for Effective Teaching and Learning	2019
Gomez-Cabrero, D., Marabita, F., Tarazona, S., Cano, I., Roca, J., Conesa, A., Sabatier, P.& Tegnér, J.	[25]	Guidelines for Developing Successful Short Advanced Courses in Systems Medicine and Systems Biology	2017
Koudelova, P., Kawasaki, A., Koike, T., Shibuo, Y., Kamoto, M. & Tokunaga, Y.	[26]	Design and implementation of a training course on big data use in water management	2017
Munir, A.R.& Prem, K.D.	[11]	Report on short course in educational methodology for university teachers in complementary and alternative medicine (CAM) disciplines – A pilot study conducted at Rajiv Gandhi University of Health Sciences, Karnataka, India	2016
Migliorini, P. & Lieblein, G.	[27]	Facilitating transformation and competence development in sustainable agriculture university education: An experiential and action oriented approach	2016
Yan, C.& He, C.	[28]	'Short courses shouldn't be short-lived!' Enhancing longer-term impact of short English as a foreign language INSET initiatives in China	2015
Pollack, K.M., Dannenberg, A.L., Botchwey, N.D., Stone, C.L. & Seto E.	[2]	Developing a model curriculum for a university course in health impact assessment in the USA	2015
Schröder-Bäck, P., Duncan, P., Sherlaw, W., Brall, C. & Czabanowska, K.	[8]	Teaching seven principles for public health ethics: Towards a curriculum for a short course on ethics in public health programmes	2014
Dreyer, J., Hannay J.& Lane, R.	[29]	Teaching the Management of Surgical Emergencies Through a Short Course to Surgical Residents in East/Central Africa Delivers Excellent Educational Outcomes	2014
Foster, K.& Laurent, R.	[30]	How we make good doctors into good teachers: A short course to support busy clinicians to improve their teaching skills	2013
Samadi, S.A., Mcconkey, R. & Kelly, G.	[31]	Enhancing parental well-being and coping through a family-centered short course for Iranian parents of children with an autism spectrum disorder	2013
Robinson, III W.P., Schanzer, A., Cutler, B.S., Baril D.T., Larkin A.C., Eslami M.H., Arous E.J., Messina L.M.	[32]	A randomised comparison of a 3-week and 6-week vascular surgery simulation course on junior surgical residents' performance of an end-to-side anastomosis	2012
Ashurst, E.J., Jones, R.B., Williamson, G.R., Emmens, T. & Perry, J.	[33]	Collaborative learning about e-health for mental health professionals and service users in a structured anonymous online short course: pilot study	2012
Williams, R., Limberis, L., Umphlett, R. & Yarley D.H.	[34]	Professional development-styled short courses for a highly effective bioprocess engineering laboratory experience	2012
Chakrabarti S., Hunsinger K.A	[35]	Developing a successful framework for online delivery of non-credit engineering short-courses to global aerospace professionals	2012
Marrero, M., EoodruffKaren, A. & SchusterGlen, S.	[36]	Live, Online Short-Courses: A Case Study of Innovative Teacher Professional Development	2010
Hazelton, P., Malone, M. & Gardner A.	[37]	A multicultural, multidisciplinary, short course to introduce recently graduated engineers to the global nature of professional practice	2008
Rathod, M.	[38]	A short course in understanding prints for auto manufacturing plants	2007
Lockyer, J., Ward, R., & Toews J.	[39]	Twelve tips for effective short course designused to enhance the learning experience and obtain the desired course outcomes	2005
Hubbard, C.J., Miller, J.S. & Olson, D.	[40]	A new way to teach an old topic: The cadaver-based anatomy short course for high school students	2005
Keleher, H., Round, R., Marshall, B.& Murphy, B.	[41]	Impact evaluation of a five-day Short Course in Health Promotion: workforce development in action	2005

Table 2 (*continued*)

Author	#	Paper	Year
Laughlin, K., Szogi, A., Burris, F., Mahler, R.L., Loeffelman, K., Steele, V. & Alderson, L.	[42]	Enhancing public understanding of water resources issues: A community-based short course for the Pacific Northwest	2004
42. Cone, J., Schmidt, K.J. Ezekoye, O.A. & Patil, T.	[43]	Beyond solution fixation: a short course on engineering and business concepts	2003
Macchi, V., Munari, P.F., Ninfo, V., Parenti, A. & De Caro, R.	[44]	A short course of dissection for second-year medical students at the School of Medicine of Padova	2003
Macgillivray, H.L.	[45]	Making statistics significant in a short course for graduates with widely-varying non-statistical backgrounds	2003
Fritsche, L., Greenhalgh, T., Falck-Ytter, Y., Neumayer, H.-H.,& Kunz R.	[46]	Do short courses in evidence based medicine improve knowledge and skills? Validation of Berlin questionnaire and before and after study of courses in evidence based medicine	2002
Nic Daéid, N.	[47]	The use of IT in teaching forensic science	2001
Samples, J. W., Costello, M. F., Conley, C. H., Lenox, T. A.& Ressler, S.J.	[48]	Teaching Teachers to Teach Engineering: A year later	1997
Conley, C.H., Samples, J.W. & Lenox T.A.	[49]	Teaching Teachers to Teach Engineering	1996
Johnson, E.V.	[50]	Foreign Language Mini-Courses: Still a Good Idea	1979

2.2. Inclusion and exclusion criteria

In regard to the inclusion criteria, papers were required to contain a description of the methodological structure of the teaching method used for designing the short-term course. As for the exclusion criteria, courses with a duration longer than 90 days and not-available documents were excluded.

2.3. Selection and data collection process

In addition to the aforementioned points, to mitigate the risk of bias from missing results, this study conducted a systematic bibliographic review without imposing a specific time range to capture changes in the design of short-term courses for educational training.

The results were systematized, presented, and synthesized based on specific criteria that shed light on the learning methods employed, as follows:

- Educational modality
- Content presentation
- Teaching methodology for teamwork
- Teaching methodology for individual work
- Technological resources
- Assessment method

These criteria were selected because they represent key components to be considered when designing and implementing a teaching method. To ensure a low risk of bias in the included studies, the list of articles was reviewed and analysed by three different researchers to ensure they met the established criteria. Articles that received approval from at least two researchers were selected for inclusion in the systematic review.

2.4. Data items

Table 2 presents a total of 42 articles, including journal articles, conference documents, and newspaper pieces that were reviewed and analysed to guide this research. The articles were published between 1979 and 2022 and are registered under the name "2023-04-16: Evolution of teaching in short-term courses: a systematic review" with registration number 646456 in the Rayyan platform.

3. Results

The steps outlined in the PRISMA [12] statement was followed in this study. Initially, out of a total of 810 articles, 18, 503, 162, and 85 were excluded due to repetition, inappropriate titles, irrelevant abstracts, and incomplete manuscripts, respectively. The un-available papers that appeared to meet the inclusion criteria were also excluded because it was not possible to obtain the complete manuscript.

As previously mentioned, the selection process was carried out by three different investigators who screened the articles based on their titles, abstracts, and conclusions. An article was only included if two investigators considered it to meet the inclusion and exclusion criteria. By comparing the papers selected by each investigator, a total of 42 articles were included in the review. Of these 42 articles, the majority (29) were selected by all three investigators, while the remaining articles were selected by two of them.

To control the risk of bias due to missing results, the study used two approaches. First, no time range was applied in the database search, allowing the identification of potential changes in the design of short-term courses for educational training. Second, the

institutional databases available through the researchers' universities were utilized to obtain the 42 articles included in the review. For those not found in the institutional databases, an extensive internet search was conducted, resulting in the exclusion of only 36 out of the total 810 articles. The two points mentioned in the previous paragraph also contribute to increasing the validity of the conclusions, as all the available documentary evidence in SCOPUS was considered. The results are presented in section 3.1, organized by publication country and area of knowledge. Additionally, a summary table of the results is provided in section 3.2.

3.1. General characteristics of short-term courses

Between 1979 and 2022, there has been a noticeable global interest in short-term courses aimed at providing high specialisation [23], professional training [9], disciplinary integration [22], academic motivation [21], and teachers' training [36]. In terms of publication country and knowledge areas, the United States has been the most productive, accounting for 52.4% of the selected articles, as shown in Fig. 2. Australia, the United Kingdom, and Italy have also made significant contributions (9.5%, 4.8%, and 4.8%, respectively). Interestingly, some courses have been designed for replication in other regions. For example [22], discusses a sustainable fishing field course at the Shoals Marine Laboratory conducted by Cornell and New Hampshire Universities, which was replicated in a short-duration course at Universidad Austral de Chile for postgraduate students of the Ecology and Natural Resources programme. Another example is [2], who conducted a study with international instructors to assess the impact of health, with the intention of replicating the experience in the United States within the educational structure of their respective countries.

Regarding the areas of knowledge, highest number of short-term courses is related to health, especially in medicine, as it can be seen in Fig. 3 [39]. Moreover, interesting development in the areas of education and those courses that integrate several disciplines are presented suggests that there is a tendency to break particular paradigms of the areas of knowledge and move towards a more comprehensive and cooperative understanding. Some of the interdisciplinary works are the following: [45], who integrates the knowledge on statistics with students from different professions such as Psychology, Architecture and Languages [42]; who articulate engineering and finance disciplines and [26] who combine big data with research in the field of geosciences in water management. In this sense, these are adapted to the definition by Ref. [19], in which the term interdisciplinarity is referred to as 'joint exploration of knowledge based on specific knowledge of the individual's discipline (…) furthermore, multidisciplinarity involves a sequential work with researchers that communicate with collaborators from other disciplines' (p. 342). Likewise, the great variety of courses related to fields such as Environment, Psychology and Agriculture that present a strong interest in creating and designing short-term courses is noteworthy. This fosters meaningful learning through innovative teaching according to the participants' needs so as to obtain timely and practical training [27].

3.2. Summary table of results

To better comprehend the teaching methods utilized in short-term courses, a matrix was constructed containing the relevant criteria, including educational modality, content presentation, teaching methodology for both teamwork and individual work, technological resources, and assessment method. The collected data were then analysed, and the outcomes were compiled on Table 3.

4. Discussion

The discussion is presented in four sections, which expand on those included in Table 3 of results: experiential Learning in short-term courses, aspects related to teaching methodologies, technological resources in short-term courses and assessment of short-term courses.

4.1. Experiential learning in short-term courses

Theories of experiential learning can be traced back to ancient Greek and Chinese philosophy, but since the 1960s, it has been recognized as a systematic approach to learning [27]. In this regard, Tyson and Low (1987) suggest that experiential learning emphasizes providing a firsthand experience rather than a theoretical understanding. This diverges significantly from traditional approaches to adult learning [6]. As mentioned earlier, there is a growing trend to incorporate experiential learning in short-term
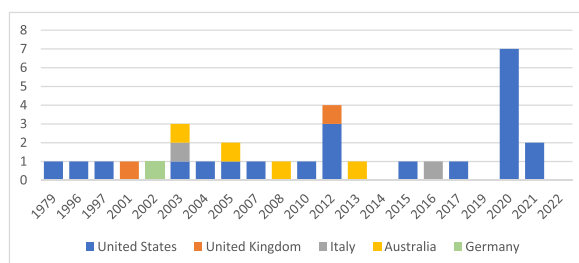

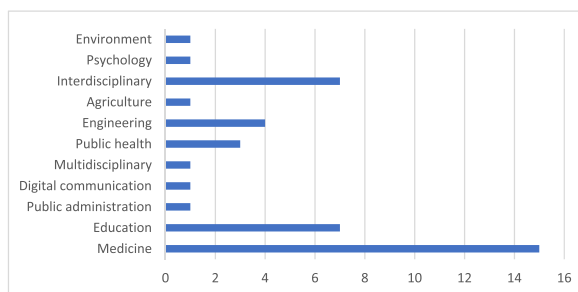**Fig. 2.** Papers by year and country of publication.

Fig. 3. Papers by area of knowledge.

courses. For instance Ref. [19], applied this approach in their research and found that experiential learning facilitated a holistic integration of thinking, perception, action, and communication. Similarly [24], note that sessions integrating discovery and reflection enable autonomous knowledge generation through experiential learning in short-term courses. Moreover [27], highlight the importance of identifying the impact of experiential learning in developing the necessary competencies and transforming the students' learning experience, providing opportunities for meaningful learning and the possibility of failure [6]. Fig. 4 displays the application of experiential learning in short-term courses for the past four decades. For instance, as early as four decades ago [48], incorporated various activities such as classroom demonstrations, laboratory experiments, and integration of technology into teaching, as they believed that learning by doing leads to a better retention of knowledge. However, in 2020, there is a significant spike in the application of experiential learning, possibly due to the need for additional training resources and facilitation of learning in response to the COVID-19 confinement situation.

4.2. Aspects related to teaching methodologies

Improving the quality of learning is a major concern when designing short-term courses. According to Ref. [36], traditional professional development methods can be outdated, inaccurate, and fragmented. To ensure better results in these learning processes, short-term courses have implemented innovative teaching strategies. In order to design an effective instructional program, it is necessary to conduct a thorough exploration to identify the course's objectives and peculiarities [20]. Therefore [36], suggest that conducting surveys and assessments is crucial to follow up on the administrative and academic aspects of short-term courses. Methodologically, it is important to note that short-term courses have been offered through various modalities such as face-to-face, distance, virtual, and hybrid. Hybrid courses, in particular, can be approached in different ways. For instance, some courses may include a mix of face-to-face and online content delivery [9,23]. In other cases, hybrid courses may involve remote synchronous interaction [15]. Additionally, some courses may combine various learning strategies to enhance topic comprehension [51]. During the period of time analysed in this study (1979–2022), Fig. 5 shows a clear predominance of face-to-face courses. However, since 2001, some innovative courses have been designed that integrate technology to achieve interactive, deep, and student-centered learning in areas such as forensic medicine [47]. From 1979 to 2014, face-to-face courses were clearly preferred. Nonetheless, in 2020, the year of the pandemic, there was significant progress in courses with different modalities, including face-to-face, due to the uncertainty surrounding long-term planning. It should be noted that some studies were conducted before the pandemic but published in 2020, such as [18,21] (see Fig. 6).

Methodologies in short-term courses also involve the way information is presented, which is referred to as the type of exposure. There are two options available: lecture class and conference type. Lecture class is a structured theoretical presentation that primarily involves verbal communication by the teacher [52]. On the other hand, conference type emphasizes active learning through practice. For example, teaching how to use rangefinders, which is a tool for measuring distances and elevations, falls under this category [19].

The current trend in short-term courses is to adopt conference type, which typically has shorter schedules deliberately designed to encourage discussions and provide meaningful learning opportunities among peers while improving communication skills [37]. However, older articles such as [44,49] still emphasize the importance of lecture classes that require trainers to establish more extensive contacts with students during the lesson.

To achieve the goals of short-term courses, a significant amount of time investment is required to design effective methodologies. The development of these courses often involves the collaboration of multidisciplinary groups, including individuals from administrative, logistic, academic, and inter-institutional areas. For instance, in a study presented by Ref. [42], various entities were brought together to define course themes and create a pilot program aimed at enhancing community understanding of water resources. Through this interdisciplinary and inter-institutional collaboration, teaching strategies for short-term courses can be accurately designed to achieve meaningful learning within the allotted time frame. It can be said that in this context, there is a pragmatic approach to teaching methods, as complete information can be delivered in relatively intense periods of time [51].

In this systematic review, it was found that the conference format was the most prevalent (27 out of 42 articles), while individual work combined with group activities was the most commonly used teaching method (24 out of 42 articles). However [21], suggests that when courses are heavily reliant on conferences, it can be challenging for students to maintain focus during lengthy sessions. Therefore, short-term courses tend to utilize methodologies that promote collaborative learning. Table 4 shows that case studies,

Table 3
Results summary.

	1979	1996	1997	2001	2002	2003	2004	2005	2007	2008	2010	2012	2013	2014	2015	2016	2017	2019	2020	2021	2022
EL			1			2	1	1		1		2	1	1		2	1	1	4	1	1
F2F	1	1	1		1	3		3	1	1		2	2	2		1	1	1	3		
E-Le											1	1			1				3	1	
D-Le															1						
B-Le				1			1					1			1			1	2	2	1
TW	4	2	5	1	1	5	3	6	1	4	1	7	3	7	3	5	5	2	17	4	2
IW		1			1	2		1	1	1	1	2	1	1	1	1	2	1	5	1	1
TR		1	1	1		2		2		1	1	4	1	1	2	1	2	1	6	3	1
LA			1	1	1	2		2	1	1	1	3	2	2		2	1	0	3	2	0
OS	1	1	1	1	0	2	1	2	0	0	1	3	1	1	2	1	2	1	6	2	1

EL: Experiential learning, F2F: Face to face, E-Le: E-learning, D-Le: Distance learning, B-Le: Blended learning, TW: Teamwork, IW: Individual Work, TR: Use of technological resources, LA: Learning assessment and OS: Opinion survey.
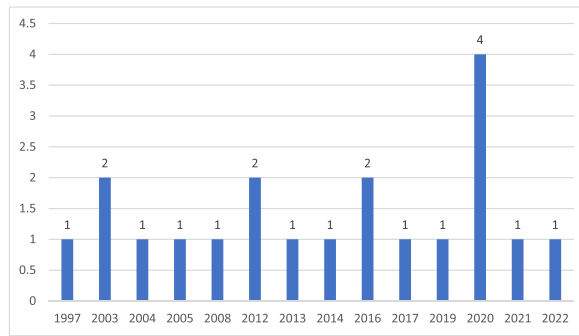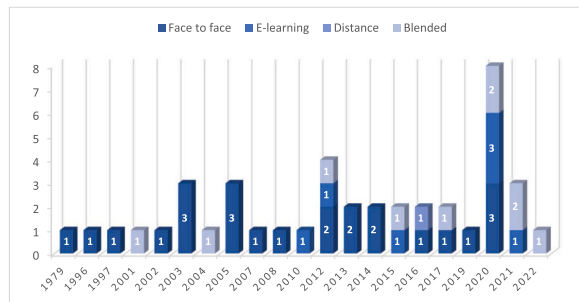
Fig. 4. Papers by year.

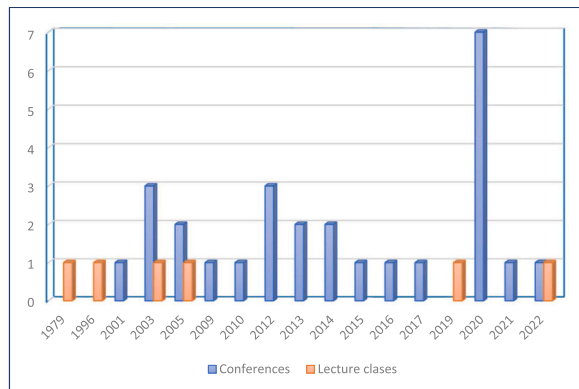**Fig. 5.** Papers by modality of study.

Fig. 6. Papers by study methodology.

workshops, debates, lab activities, and exhibitions were more frequently employed (15, 14, 12, and 8 occurrences, respectively, out of the 42 articles). The design of short-term courses emphasizes the importance of creating active learning spaces that ensure high-quality content and effective organization of the different teaching activities. For instance, in Ref. [50], a course was designed that combined activities such as role-playing, demonstrations, labs, and workshops to achieve dynamic learning and better retention, thereby emphasizing the difference from traditional training approaches. Similarly [37], used a combination of short conferences lasting 30 min or less, group discussions, and field outings to foster reflection and deeper learning. In addition [24], explains that in organizing teaching activities, strategies such as role-playing and case studies were necessary to challenge participants and help them step out of their comfort zones to achieve a deeper analysis of the real situations they may face.

Collaborative dynamics in courses can also create knowledge networks across different disciplines, enabling participants to share experiences regarding the application of the information learned in the courses [24]. These dynamics further promote the creation of social learning networks among participants during and after the courses, allowing for the integration of personal, social, and professional experiences into the learning process [53].

In designing short-term courses, there is a strong emphasis on individual work as these learning experiences promote active participation and enhance understanding of study topics. Individual activities have been included in short-term courses as seen in

Table 4
Relation of used didactic for group work in short-term courses of the selected articles throughout time.

Year	Roles	PS	E	CS	IBL	IPBL	DEB	FOR	DM	LAB	SEM	TR	WOR
2022				1									1
2021							1		1			1	1
2020		1		2	1	2	4		1	2		1	3
2019				1									1
2017	1			1		1	1						1
2016		1		1			1					1	1
2015		1								1			1
2014				1		1	1		2			2	
2013						1		1		1			
2012				1			1	1	1				1
2010				1									
2009				1			1	1				1	
2007				1									
2005				1	1	1	1		1	1			
2004		1								1			1
2003			1	2			1	1					
2002				1									
2001		1											
1997	1								1	1	1		1
1996								1					1
1979	1								1	1			1
Total	3	5	1	15	2	6	12	5	8	8	1	6	14

Abbreviation table 4.PS, Problem solving; E, Exemplification; CS, Case study; IBL, Inquiry based learning; IPBL, Issues/project-based learning; DEB, Debates; FOR, Forums; DM, Demonstration; LAB, Lab; SEM, Seminars; TR, Trips, Outings; WOR, Workshops.
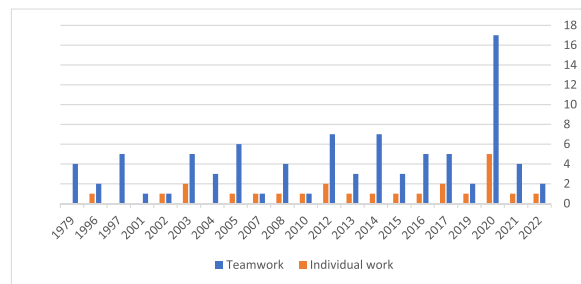

Fig. 7. Papers for individual or group study.

Fig. 7, as specific thinking strategies are applied to improve originality, flexibility, and fluency in creative thinking [22]. Reflective individual creation also provides a space for individual analysis after theoretical presentations [44], enabling participants to face complex situations within a specific area of knowledge [27].

Fig. 7 also shows the implementation of individual work in contrast to group work. There is a concern regarding the integration of these two learning modes [26]. state the importance of maintaining a balance between individual and group work to provide adequate opportunities for participants to acquire the planned skills and knowledge. Additionally [37], emphasize the importance of creating a space for individual analysis after the development of several group activities to identify the internalization of learning. Collaboration and individual work have always been linked to short-term courses, but group learning is generally favored to foster active learning with high levels of retention.
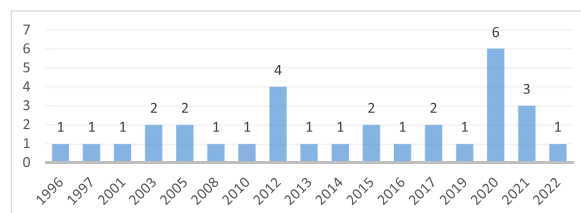

Fig. 8. Papers in which the use of technological resources is mentioned.

4.3. Technological resources in short-term courses

Undoubtedly, technology has had a significant impact on the development of teaching and learning processes, including short-term courses. In particular [49], highlights the potential of technology to enhance short-term courses, as evidenced by a redesign of a course that incorporated information technology such as email in 1996, resulting in better outcomes through the integration of content, learning models, and technology [48].

Furthermore [47], argues that traditional teaching methods tend to favor abstract and reflective thinking, and thus, the use of technology should foster and facilitate learning for all types of thinkers by providing a more active and supportive learning environment. To this end, interactive technologies and online assessment with the use of the World Wide Web were utilized in the structure of the short-term course.

Fig. 8 shows the application of technological resources, which date back to 1996, with peaks during the years 2012 and 2020. Interestingly, all reviewed articles published in 2012 are related to the field of medicine, which may be due to the need for updates through various technologies to accommodate working activities [32,33,35,54]. In 2020, the pandemic necessitated the use of various technology resources to facilitate content understanding. Additionally, higher education institutions that had previously relied on face-to-face courses had to resort to technology to restructure their online courses [16].

4.4. Assessment of short-term courses

The nature of short-term courses, where specific content is taught in a limited amount of time, highlights the importance of evaluating not only the level of learning achieved but also the opinions of those who have taken the course with regard to the academic organization and logistics. Surveys, questionnaires, and evaluations are commonly used to gather feedback on these aspects, as seen in Fig. 9. In older courses, surveys have been conducted to assess the reactions of participants and to improve course design [48–50]. In fields such as medicine, where learning outcomes must be guaranteed, assessments are designed for different stages of the course, including testing prior knowledge and comparing it to acquired knowledge, as seen in courses by Refs. [11,39,40]. Additionally [32], conducted a 16-week assessment after testing the level of information retention. Effective assessment can be carried out continuously throughout the course [29], but it is important to first evaluate prior knowledge, as well as levels of emotion and enthusiasm for the activities. Surveys have also been used to gather feedback from teachers and assess the effectiveness and efficiency of the course [44].

5. Conclusions

The guiding question of this systematic review was to investigate the evolution of teaching methods in short-term courses. In the following conclusions, we will address this question from various perspectives, including learning environments or modalities, the use of technological resources and social networking platforms, collaborative learning, and factors to consider when designing short-term courses. The use of innovative teaching strategies and techniques in short-term courses has been a constant trend. Since the 1970s, various teaching techniques have been incorporated in a coherent, articulated, and effective manner to achieve experiential and active learning, tailored to the specific areas of knowledge [50]. This active learning approach engages participants and enhances their ability to retain information over the long term, which contributes to the success of the teaching and learning experience [38]. Learning environments have evolved over time, with face-to-face instruction traditionally being the dominant format. However, e-learning and blended learning have been incorporated into short-term courses well before they became commonplace in more formal educational settings. Currently, the blended modality has been the subject of several studies, which have identified both benefits and limitations. These experiences can be used to inform future designs of short-term courses [38]. Short-term courses have incorporated various technological resources such as augmented and virtual reality to create simulations of real-life situations, enabling more immersive and meaningful experiences [15]. However, the use of technology can also pose challenges, such as connectivity issues or lack of experience in utilizing technological tools [35].

As short-term courses aim to facilitate experiential learning, activities focused on memory retention, commonly employed in traditional training, are typically not emphasized. Rather, these courses generate new spaces for practical application, thereby enhancing the relevance of the training in the working environment [6]. This approach also encourages participants to reconsider their relationship with work activities and their colleagues [41]. S The use of social media is widely regarded as a valuable tool for the development of short-term courses. This is due to the fact that social media platforms allow for interaction and collaboration among participants, which can facilitate the construction of knowledge through workshops, videos, messages, and audio formats, both synchronously and asynchronously. Additionally, the use of social media can help to connect learners from different contexts and communities, which can help to reduce social isolation and improve the overall learning experience [31]. Interdisciplinary or multidisciplinary short-term courses seem to be preferred, as they offer opportunities to integrate knowledge from various fields through collaborative learning, without requiring participants to take specific courses in each discipline [25,39]. This systematic review highlights the importance of considering the following factors in the design of short-term courses:

1. Prioritize e-learning or blended learning as these modalities require greater autonomy, which is also necessary in short-term courses.
2. Develop courses that can attract people from different disciplines, as this promotes collaboration and community building.
3. Emphasize collaborative work in short-term courses and provide opportunities for students to interact and evaluate each other. The creation and maintenance of a community outside the learning environment is also vital for the success of short-term courses.
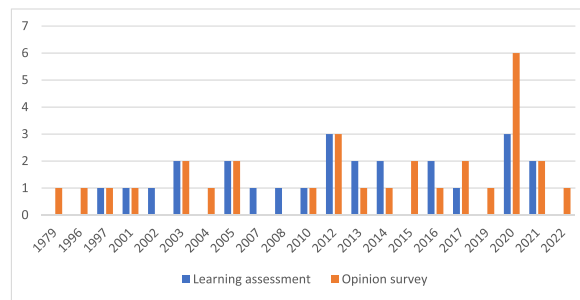
Fig. 9. Types of assessment in short-term courses.

4. Give priority to participant opinion surveys over learning assessment to evaluate the success of short-term courses. This highlights the need for further exploration into evaluation methods for these courses.

The findings of this systematic review are particularly relevant to educators, as they provide guidelines for the effective design of short courses. They are also valuable to companies or organizations that offer short-term courses, as they describe the successes and shortcomings of the teaching methods employed in such courses. Moreover, academic managers at all levels of education who wish to integrate short-term courses into their curricula can benefit from these insights.

6. Limitations

Out of the 810 articles initially identified, 36 had to be excluded from the review as their full text was not available online.
Due to the lack of consensus on the terminology used to describe short-term courses, it is possible that some relevant synonyms were not included in the search strategy outlined in section 2.1 of this systematic review.

Author contribution statement

All authors listed have significantly contributed to the development and the writing of this article.

Data availability statement

Data included in article/supp. material/referenced in article.

Additional information

Supplementary content related to this article has been publish online at [URL].

Declaration of competing interest

The authors declare no conflict of interest

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e16933.

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