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Development of higher-order thinking in health profession education: A comprehensive toolkit for medical educators

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Abstract:

BACKGROUND: Higher-order thinking (HOT) is widely recognized as an essential objective of health profession education (HPE). Based on Lipman's three-dimensional model of thinking, we investigated strategies for the development of HOT including critical thinking (CT), creative thinking, and caring thinking in HPE in three consecutive studies. Fostering students' CT is regarded as an outcome of HPE. However, there is the limited level of consensus on educational interventions for CT development. In view of some of the controversies surrounding the development of CT skills and dispositions in HPE, the aim of this study was to determine educational interventions affecting CT development in HPE.

MATERIALS AND METHOD: This study employed the best-fit framework synthesis design. The frameworks recommended by Abrami *et al.* were used as a basis for the synthesis. The *priori themes* were extracted from the selected best-fit frameworks. Then, Google Scholar, PubMed, SID, and ProQuest databases were searched for the literature related to the development of CT skills and dispositions in HPE students. Derived data from the HPE literature were coded against the *priori themes*, extracted from the best-fit frameworks. Interpretation and restructuring of the new themes derived from HPE literature, and the preexisting *priori themes* resulted in the final framework of the interventions affecting CT development in HPE students.

RESULTS: The themes extracted from the HPE studies (including reflection, discussion, simulation, role-playing, questioning, and explicit expression of CT goals in curriculum) were similar to the *a priori themes* derived from the studies by Abrami *et al.* The new themes of experiential learning, art-based learning, argument mapping, concept mapping, and creating appropriate educational atmosphere were obtained by constant comparison of the data among the studies.

CONCLUSION: The comprehensive framework of CT development methods provides a toolkit for medical educators. According to the results of the current study, the mixed approach, where CT is taught as an independent track, along with the discipline-specific CT development, seems to be more effective, compared to the immersion approach. Creating learning moments in the context of practice through experiential learning is noteworthy in the development of CT skills and dispositions. Further research is needed to evaluate the efficacy of the newly developed strategies, such as art-based learning and concept mapping.

Keywords:

Critical thinking (CT), medical education, thinking skills

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Introduction

Achievement of higher-order thinking (HOT) by students is one of the most important goals of educational

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systems.^[1] It is also crucial to pay attention to HOT in the health profession education (HPE), which is engaged with addressing indeterminate situations involving patients. As the graduates of HPE are exposed to a wide range of complex challenges, uncertainties, and complicated clinical situations that have not been experienced during their education, one of the essential goals of the HPE should be fostering self-directed learners equipped with HOT; accordingly, they can present appropriate decision-making, judgment, and problem-solving capabilities when facing complicated, unknown circumstances.^[2]

The current series of studies draws on the work of Lipman, who represented three-dimensional model of thinking.^[3] Despite the disconnected, fragmented approach to HOT education that categorizes HOT under discontinuous dimensions of critical thinking (CT) and/or creative thinking,^[4-6] Lipman's model connected the various dimensions of thinking (critical, creative, caring) into a whole. In this way, HOT is not equal to CT shouldered with the responsibility to upgrade the education. Instead, a balance between the critical, creative, and caring aspects of thinking is expected.^[3] Accordingly, adopted from Lipman's three-dimensional model of thinking, HOT education in HPE is assessed in three dimensions, namely critical, creative, caring thinking, in this series of studies.

Considering the importance of viewing the HOT based on its fundamental three dimensions, this series of studies conceived to investigate the methods of development of the three dimensions of HOT (including critical, creative, caring thinking) in HPE students. The present study differs from previous investigations that have failed to specify the development of the three fundamental dimensions of HOT.^[2,7,8] In majority of the related studies, HOT development has been limited to the education of CT to the students, whereas the development of the other dimensions of HOT has not been considered. In few studies, education of creative thinking to students has been taken into account, while the necessity of development of caring thinking has been neglected.^[9,10] On the other hand, scholars have emphasized the importance of applying multiple methods for the development of HOT, due to different learning styles, contextual variations, and the complex nature of HOT education.^[11] This issue has not been considered in most of the studies, which have focused on a specific single method to develop HOT.^[7-10] In order to address this knowledge gap, the present study aimed to conduct a comprehensive investigation of various methods of HOT development in HPE students, in each dimension of critical, creative, and caring thinking. Accordingly, the current study scrutinized a series comprising three consecutive studies of HOT

development interventions in the HPE by the critical, creative, and caring thinking offers multiple methods of HOT development that provide comprehensive toolkit for medical educators, In the first part of this series, the methods for the development of CT have been investigated.

Critical thinking

CT, a key component of competence across domains, underlies health professionals' abilities and performance.^[12-14] Its deficit leads to cognitive biases, prejudices, misjudgments, and intolerances that contribute to diagnostic and therapeutic errors.^[15-17] In addition, CT is increasingly important in an era when biomedical science is progressing exponentially and knowledge acquisition alone is insufficient for practitioners to function in complex clinical environments. Accordingly, CT must be taught and explicitly assessed.^[3,11,18,19]

Several studies have described different educational methods for CT development. Ennis expressed four educational approaches including general, infusion, immersion, and combination of the general with either infusion, or immersion.^[20] Behar-Horenstein and Niu comprehensively reviewed empirical studies on teaching CT and showed that explicit methods of teaching CT have been more effective than immersion method alone, where CT is regarded as a by-product of instruction. Moreover, long-term educational courses have been more effective than short-term courses. Overall, these researchers highlighted the limitations of empirical and quantitative studies, and drawing the attention of researchers to the importance of qualitative studies.^[21]

Despite the consensus of experts on the importance of CT as an educational ideal, some programs have failed to achieve significant success in CT development.^[22] In one of the most comprehensive programs to develop CT across Europe, known as CRITHINKEDU, several challenges were reported to impede the expansion of CT in learners.^[23] The unsatisfactory development of CT among HPE students is also worth mentioning. Poor CT skills in Iranian Medical students, as well as in-efficiency of the educational process in medical schools in improving the level of students' CT dispositions, urging experts to consider revisions in the educational curricula.^[24-26] In this regard, Norris believes that the purpose of some educational interventions aiming to improve CT skills is limited to identifying and correcting reasoning errors and lack of paying attention to the general spirit of CT^[27] ("that critical spirit").^[28,29] This notion is also evident in studies in the field of HPE, where the development of CT dispositions has been neglected^[30-33] or immersed in the development of CT skills.^[34,35] Furthermore, multiple conceptions of CT among educators, derived

from paradigmatic and disciplinary views to CT^[36,37] that provide conceptual richness and productivity of CT,^[38] necessitates the need to clarify educators' perspective toward CT.^[39] In addition, even where some instruction in these areas has provided, teacher preparation to develop CT in students is insufficient.^[3] In this regard, it is important to confront that most educators do not apply a rich variety of instructional methods in CT development.^[11] Accordingly, it seems essential to equip educators with a toolkit that employs a wide range of CT development interventions, in order to address these challenges.

The limited number of studies investigated the educational methods of CT skills and dispositions in HPE students and carried out as a systematic review or meta-analysis, either few studies have been included^[32,35] or these reviews have drawn no specific conclusions.^[40,41] On the other hand, comprehensive review of different interventions that fulfill multiple conceptions of CT has not been aimed in the most of studies related to CT development in HPE students. Considering disparity and inconclusiveness of evidence regarding interventions to develop CT skills and dispositions in HPE students, there is a need to conduct a comprehensive study to explore the interventional approaches and developmental methods in this field. Therefore, this study aimed to provide a comprehensive framework for CT development methods (according to its separate skills and dispositions) in HPE students.

Materials and Methods

Study design and setting

This study used the best-fit framework synthesis method presented by Carroll and Booth.^[42] Adapted from framework analysis used in primary research, framework synthesis is a systematic review employed in qualitative and mixed-method studies. The best-fit framework synthesis, a pragmatic, flexible, and time-saving strategy for health policy-making studies is based on the organization and synthesis of data within a *a priori* framework from a related area, to which new data are incorporated and themes are derived from the data.^[43] In this way, existing data and new evidence are both organized and presented within a structured and inclusive framework. Using an underpinning external structure facilitates evaluation of effectiveness, feasibility, and acceptance of achievements in a discipline, in comparison with initiatives led by others.^[44] Regarding sparse and inconsistent data on CT development methods in the field of HPE, framework synthesis method was employed as the method of choice in current study. Moreover, considering the preexisting comprehensive frameworks of CT interventions, regardless of specific discipline, which

can be employed as a best-fit framework, the best-fit approach to framework synthesis was used in this study. In consideration of the complexities of the educational interventions used for CT development in HPE, quantitative and qualitative studies were included in the synthesis process to enrich data interpretation, according to Brunton's new approach.^[45]

The steps used to conduct this study are as follows [Figure 1]:

Being Familiar with Relevant Literature and Selection of the Best-Fit Framework

During comprehensive literature review, the research team encountered two highly cited studies conducted by Abrami *et al.* (2008 and 2015), who explored educational interventions for CT development at the transdisciplinary level and scrutinized their effectiveness. The frameworks proposed in the aforementioned studies closely matched objectives of the present study; therefore, they were selected as the best-fit frameworks of choice.

Extraction of Priori Themes from the Best-Fit Framework

The priori themes were extracted from the frameworks proposed by Abrami *et al.*, which provided the *a priori* framework of themes, against which to code the data extracted from the included studies. A *a priori* framework including the priori themes was classified into five general themes, along with their relevant subthemes [Table 1].

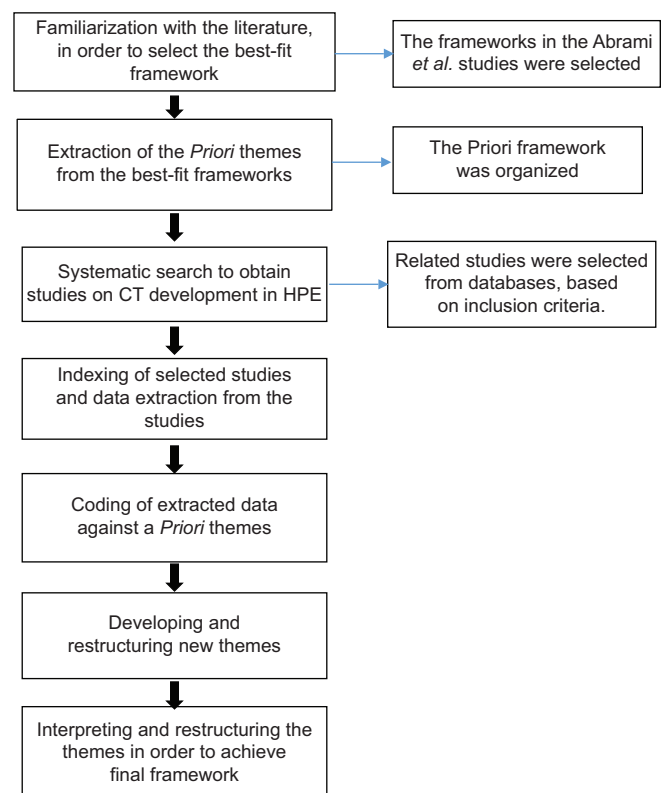


Figure 1: Diagram of the steps of the best-fit framework synthesis

Systematic Search to Obtain Studies on CT Development in HPE

A systematic search to identify relevant studies was performed by the researcher (NG). The search combined terms describing the agent of interest (CT, skills, dispositions, development/instruction/education), together with the medical subject heading "Health Profession Education." Google Scholar, ProQuest, SID, and PubMed databases were used to identify published materials between 2000 and 2022. To be included in the review, the criteria were as follows:

- Studies in either Persian or English
- Quantitative and qualitative studies on CT educational approaches and methods in HPE.

Duplicated studies, studies focusing on topics other than CT educational methods, and studies failing to fulfill the inclusion criteria were excluded from this study. The Joanna Briggs Institute (JBI) checklist was used to check quality of the obtained articles, and studies obtaining high validity according to this checklist were selected.

Given the problems with identifying relevant literature through systematic searching of electronic databases alone,^[46] the reference list of included studies was manually checked for additional literature. Disagreement on included studies resolved through retrieval of full text paper to make a final decision by research team.

Considering the CT dispositions as the only component that is in common between different disciplines, a study in non-health fields was also included in this step.^[47]

Indexing of Selected Studies and Data Extraction

The indexed data extracted from the studies, regarding CT developmental methods in HPE, are summarized in Table 2.

Coding of Extracted Data against a Priori Themes

The data extracted from HPE studies were coded against a priori themes obtained from the best-fit framework presented by Abrami *et al.* Two of the researchers (SY, ZK) verified or challenged the coding process performed by (NG). The researchers then reached a consensus on whether a priori themes are supported by the data.

Developing and Restructuring New Themes

Where the data obtained from included studies did not fit into the preexisting themes, new themes were developed using secondary thematic analysis.

Interpreting and Restructuring the Themes in order to Achieve Final Framework

The relationship between the preexisting themes and the new themes was scrutinized by the authors. The final framework of methods of CT development in HPE was

Table 1: A Priori Framework extracted from two studies of Abrami *et al.* (2008, 2015)

A Priori Themes	Subthemes
Combined Educational Approach ^[18]	
Individualized Studies ^[48]	-Reading, watching, listening to teacher's explanations -Reflecting on new information -Solving abstract problems on their own
Dialogue ^[48]	-Question asking -Discussion -Debate/Socratic dialogue
Authentic/Anchored Instruction ^[48]	-Applied problem-solving -Case studies -Simulations -Playing games -Role-play
Mentoring ^[48]	-One-on-one teacher-student interaction -Peer-led dyads -Internship

Table 2: Educational interventions to develop CT skills and dispositions

Extracted Data from HPE Studies	
Educational interventions to develop CT skills	-Expression of CT objectives in the curriculum ^[52,60] -Questioning ^[57,58] -Reflection ^[33,49,50] -Discussion ^[51-53] -Simulation ^[30,40,54-56] -Role-play ^[39] -PBL-based education ^[31,35,61,62] -Concept map ^[32,35,49,63-65] -Workshops ^[39] -Experiential learning ^[50,59,60] -Inter-cultural experiences ^[39] -Role of teacher/Mentor/Facilitator/Preceptorship ^[34,51,52,68] -Art-based pedagogy ^[39]
Educational interventions to develop CT dispositions	-Experience of being in an educational atmosphere ^[47] -Reflection ^[50] -Role of teacher ^[34] .Creating space for discussing and expressing ideas ^[67-69] . Student support and encouragement ^[34,69] . Role model ^[34] -Experiential learning ^[34,50] -The role of context and cultural values ^[39,69]

created through iterative interpretation and restructuring of the themes by the authors.

Ethical considerations

Considering the method of the present study, which is based on the obtaining and integration of data from the published literature, that are accessible from the scientific databases, ethical considerations were not applicable.

Results

A Priori Framework: *A Priori* framework including *a priori* themes and subthemes extracted from the studies of Abrami *et al.* is shown in Table 1. Based on the results of Abrami *et al.* studies, the combination approach to CT education, that is, general CT education along with infusion/immersion, had the largest effect size on CT development.^[19] Furthermore, among CT educational interventions, the methods of dialogue and authentic/anchored instruction attained the greatest effect size for the development of generic and specific CT skills and dispositions. Mentoring was shown to play an essential role in CT development, just along with the two noted methods.^[48]

Extracted data from HPE studies: The data extracted from HPE studies regarding educational interventions to develop CT skills and dispositions are shown in Table 2.

Final framework of CT development: Following data coding against the *A Priori* themes, and restructuring the *A Priori* framework, the final framework was organized into three separate categories: CT developmental approach; interventions to develop CT skills; interventions to develop CT dispositions [Table 3].

Similar themes: The data regarding explicitly defining learning objectives of CT development in the

curriculum,^[45-47] matched preexisting theme of “combined educational approach”; therefore, this preexisting theme was kept unchanged. Clear expression of objectives of CT education in the curriculum was included as a subtheme.

The data regarding CT developmental interventions including reflection,^[33,49,50] discussion,^[34,51-53] simulation,^[30,40,54-56] role-playing,^[39] questioning^[57,58] were in accordance with preexisting themes. In this way, these data were mapped unmodified in the preexisting themes. Given that the word “discussion” has been widely used in HPE studies, it was merged into the *priori* theme “dialogue.”

- **New themes:** The new themes extracted from HPE studies were organized in the *A Priori* framework as follows:
- Regarding CT dispositions, which are not explicitly addressed in the *a priori* framework, two main themes and related subthemes were formed using secondary thematic analysis.
- Considering the individualized aspect of “concept mapping”, this intervention was mapped under the *priori* theme of “individualized studies.
- The positive impact of “experiential learning” on the development of CT skills and dispositions has been emphasized in some of the HPE studies.^[50,59,60] Considering close proximity of new theme of “experiential learning” to the *priori* theme

Table 3: The final framework of approach and interventions to develop CT in HPE

Approach and interventions to develop CT in HPE	Themes	Subthemes
Developmental approach	Combined Educational Approach	Clear expression of CT objectives in curriculum
Interventions to develop CT skills	Individualized studies	-Reading, watching, listening to teacher’s explanations
		-Reflecting on new information
	Dialogue and Discussion	- Solving abstract problems on their own
		-Concept mapping
		-Argument mapping
Experiential/Authentic/Anchored learning	Mentoring	-Question asking
		-Debate/Socratic dialogue
		-Applied problem-solving/PBL
		-Case studies
		-Simulations
		-Playing games
		- Role-play
Interventions to develop CT dispositions	Art-based pedagogy Experiential learning Creating appropriate environment by teacher/mentor	-Inter-cultural experiences
		-One-on-one teacher-student Interaction
		-Role model
		-Peer-led dyads
		-Internship
		-Inter-cultural experiences
		-Being in educational environment
		-Student support and encouragement to reflection, discussion, questioning, expressing idea
		-Role model

of “authentic/anchored instruction,” these two themes merged as “experiential/authentic/anchored learning” within the final framework. The word “instruction” was replaced with “learning,” due to the active role of student in the latter. It is noteworthy that some studies have focused on the role of experiential learning in the development of CT dispositions.^[34,50] Therefore, experiential learning was considered as a new theme for development of CT dispositions, as well.

- The theme of problem-based learning (PBL), highlighted as a CT development method in some of the HPE studies,^[31,35,61,62] was closely related to the applied problem-solving (a subtheme under the *Priori* theme of authentic/anchored instruction in the *Priori* framework extracted from the Abrami *et al.*'s study), [Table 1]. In both of these methods, learning takes place following solving a problem by students. Therefore, in the final framework, the theme “(PBL)” was merged to the *Priori* subtheme “applied problem-solving,” due to their conceptual proximity [Table 3].
- Role-modeling, as an educational intervention to develop CT skills, was classified as the subthemes of main theme “mentoring.” Considering its effect on the development of CT dispositions, role-modeling was categorized as a subtheme, under the main theme of “creating appropriate environment by teacher/mentor.”
- “Art-based pedagogy,” regarded as a new main theme under a new category, added to the *a priori* framework.
- Considering “workshop” as a platform through which training methods can be presented, this concept is not *per se* educational method. Therefore, it was not included in the final framework of CT development.

Discussion

For the best knowledge of the authors, this series of studies is the first review to take a systematic approach in exploring the methods to develop the three dimensions of HOT in HPE students.

In the first part of this comprehensive study, we conducted best-fit framework synthesis to systematically synthesize CT developmental methods in HPE students, by CT skills and dispositions, separately. Considering sparse evidence on CT development methods in HPE students, the best-fit framework synthesis method that presents findings in a highly structured and comprehensive framework provides a suitable context for achieving the main objective of this study. The meta-disciplinary frameworks of CT development, proposed by Abrami *et al.*, employed as scaffolds to which the discipline-specific data from HPE studies

were mapped. In this regard, the frameworks refined, developed, and extrapolated to HPE context.

Based on the results of the present study, explicit mentioning of goals of CT education in the curriculum and necessity of general education of CT through training courses is noteworthy. This is in accordance with the study of Abrami *et al.*, who emphasized clear and explicit notion of CT goals in curriculum through combined approach of CT development.^[19] On the other hand, the role of experiential learning in the development of CT indicates importance of CT development in the context of each discipline, through developing CT tailored to the actual context, unique content, and requirements of each discipline. It is noteworthy that the immersion approach, in which there is no clear mention of the goals of CT development, seems to be the least effective method. Nevertheless, the results of a comprehensive study by Puig *et al.* indicated that the immersion method was the most common approach used to teach CT to students across Europe.^[23] This finding might justify fruitlessness of numerous CT educational programs. Therefore, it is necessary for teachers and designers of educational programs to incorporate the immersion method with the generic method of developing CT.

Although most of the results obtained in present study are in line with comprehensive studies of Abrami *et al.*, there are some disagreements in this regard. According to the results of the study of Abrami *et al.*, the largest effect size of CT development methods was related to authentic/anchored instruction and dialogue-oriented methods.^[48] On the other hand, the results of some HPE studies have shown no significant difference between PBL, a sub-type of authentic education method, and traditional teaching (i.e., lecturing).^[35,61,62] It seems that small sample size and short duration of intervention could have affected the aforementioned observations. This finding is in line with the report of Behar-Horenstein *et al.* who stated that an intervention shorter than four months could not considerably improve the development of CT skills.^[21] Nevertheless, it should not be ignored that direct teaching of CT in the form of lectures can be somewhat effective in developing CT skills in learners, which can be another reason for lack of a significant difference between the two mentioned groups. It seems that effectiveness of PBL in developing CT skills depends on a variety of factors, such as teachers' attitudes toward CT, environment of PBL implementation, and students' prior readiness, as noted by Lee *et al.*^[35]

In spite of the results of Abrami *et al.* study who indicated high effect size for dialogue-based methods of CT development,^[48] Lee, in her study of the effect of online collaborative discussion, compared to individualized study, on CT development, did not show any significant

difference between the two methods.^[53] Also, students' satisfaction with improving CT, before and after implementation of the online discussion method had no significant difference, according to Hvorecky and Korenova^[51] At first glance, it seems that virtual nature of the two aforementioned methods is the reason for achieved results, although positive impact of face-to-face encounters in discussion-based methods should not be neglected; however, there are multiple factors in this regard. Creating an appropriate environment for questioning and expressing ideas,^[34] active engagement of students in the discussion,^[52] and presence of the teacher as a facilitator,^[51] are among the factors that affect impact of discussion on CT development. Therefore, it seems that if the discussion-based methods implemented properly, CT development is expected.

Art-based methods, as new methods of developing CT provide possibility of attracting interest of students with different learning styles, introverts, and nonnative individuals who are not fluent in dominant language of the academic environment, to express their ideas in non-lingual ways. Since this concept is in its prime in the field, instructors should be familiarized with the art-based strategies of CT development and their effectiveness.^[39]

Concept mapping, another new theme extracted from the HPE studies, has been mentioned as a method having positive impact on the development of CT skills and dispositions in some studies,^[35,63-65] whereas having no significant effect on CT development in other studies.^[32,49] Controversial results regarding role of concept mapping in CT development, along with lack of mentioning it in comprehensive meta-analysis of Abrami *et al.*, necessitate further investigations.

Regarding importance of dispositions in nurturing a strong critical thinker, as Paul notes, creating a strong sense of CT,^[66] the current study addressed interventions to develop CT dispositions under a distinct category. Based on the results of this study, experiential learning which provides students with unique opportunities in real context plays an essential role in the development and establishment of CT dispositions. Encountering and interacting with real situations and gaining experience from them, becoming familiar with different cultures, obtaining cross-cultural experiences, and reflection on one's own and others' experiences contribute indispensable roles to the development of CT dispositions.^[32,36,47,67-69] In addition, providing a suitable environment for expressing opinions and questioning is the other important issue in nurturing CT dispositions.^[32,64] Huber questions the durability of CT dispositions taught upon leaving school.^[47] In response to this challenge, it should be said that the establishment

of a "critical spirit" in students, as noted by Facione and Siegel,^[28,29] is highly effective in developing CT skills, which subsequently increases the stability of critical dispositions in the individual, rendering forgetting or abandoning them impossible or at least difficult.

Study strengths and limitations

In this series of studies, comprehensive investigation of the methods of developing HOT in HPE that addresses three dimensions of HOT led to a broad range of interventions which provides a toolkit for educators. In addition, the best-fit framework synthesis, selected as the method of choice in the current study, allowed a transdisciplinary view to the CT development strategies, while providing discipline-related data regarding educational interventions to develop CT skills and dispositions.

Regarding limitations of the present study, heterogeneity of the design, interventions, and duration of interventions in different literature, led to draw broad, general conclusions.

Conclusions

In conclusion, the comprehensive CT developmental framework achieved in this study provides HPE educators with a toolkit of CT developmental methods, in order to address the diverse conceptions of CT, different learning styles, and various educational contexts. Further studies to evaluate the effectiveness of novel CT development interventions are recommended. In addition, the authors of this study emphasize the importance of conducting a comprehensive meta-analysis study to explore the effect size of the methods employed to CT development in HPE. Accordingly, HPE educators can select more efficient methods from the toolkit, in order to best commitment of resources and maximization of educational gains. Also, the effective manner of application of an instructional method should be emphasized in future research.

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Conflicts of interest

There are no conflicts of interest.

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