

A Unified Theoretical Framework of Learning Theories to Inform and Guide Public Health Continuing Medical Education Research and Practice

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Abstract Continuing medical education (CME) emerged at the start of the 20th century as a means of maintaining clinical competence among health care practitioners. However, evidence indicates that CME is often poorly developed and inappropriately used. Consequently, there has been increasing interest in the literature in evaluating wider contexts at play in CME development and delivery. In this article, the authors present a unified theoretical framework, grounded in learning theories, to explore the role of contextual factors in public health CME for health care practitioners. Discussion with pedagogical experts together with a narrative review of learning theories within medical and social science literature informed the framework's development. The need to consider sociocultural theories of learning within medical education restricted suitable theories to those that recognized contexts beyond the individual learner; adopted a systems approach to evaluate interactions between contexts and learner; and considered learning as more than mere acquisition of knowledge. Through a process of rigorous critical analysis, two theoretical models emerged as contextually appropriate: Biggs principle of constructive alignment and Bronfenbrenner bioecological model of human development. Biggs principle offers theoretical clarity surrounding interactive factors that encourage lifelong learning, whereas the Bronfenbrenner model expands on these factor's roles across multiple system levels. The authors explore how unification into a single framework complements each model while elaborating on its fundamental and practical applications. The unified theoretical framework presented in this article addresses the limitations of isolated frameworks and allows for the exploration of the applicability of wider learning theories in CME research.

Keywords: continuing medical education, learning theory, theoretical framework, constructive alignment, bioecological model

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The advent of continuing medical education (CME) in the early part of the 20th century was a turning point in the recognition of the importance of lifelong education among health care professionals (HCPs).¹ Thirty-nine systematic reviews since 1977 reveal that CME is effective in increasing

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HCP's knowledge, changing HCP's behavior, and to a lesser extent, improving patient outcomes.² However, there is ongoing concern that CME continues to be poorly developed: ineffective formats (eg, didactic lectures and conferences) continue to dominate,² with more than 80% of accredited CME activities not targeting higher levels of learning as defined by Bloom taxonomy (cognitive (Table 1), affective, and psychomotor domain).³

CME selection is predominantly driven by the expectation that HCPs are able to accurately self-assess and determine their own learning needs.⁴ Evidence suggests, however, that HCPs are unable to accurately self-assess their skill deficit⁴ and often tend to overestimate their abilities.⁵ As a result, HCPs are more inclined to select familiar CME topics in which they are already competent, potentially ignoring other areas of important and contemporary medical knowledge.⁶

This concern about quality,³ format,² and self-selection of CME⁶ is aggravated further by the rapidly changing field of medical knowledge: it is estimated that the extent of medical knowledge covered in medical school doubles every 73 days.⁷ The focus of this increased knowledge has moved toward matters relating to public health (PH) and quality patient care,⁸ driven by the global recognition of changing population dynamics and health care needs.⁹ In addition, the push for universal health care,¹⁰ and the benefit of preventive primary care in the community,¹¹ requires that HCPs keep apprised of developments and knowledge within the realm of PH. Currently, only 50% of

TABLE 1.
Revised Bloom Taxonomy—Cognitive Domain Levels, Definitions, and Descriptive Verbs*



<u>HIGHER ORDER LEARNING SKILLS</u>		
<u>LEVEL</u>	<u>DEFINITION</u>	<u>VERBS</u>
Create	Combining elements to produce new coherent whole	Produce, construct, develop
Evaluate	Make judgements based on criteria to justify a decision	Argue, support, critique
Analyse	Deconstruct material into constituent parts and draw connections	Differentiate, organise, compare
Apply	Apply material in new situations	Apply, demonstrate, perform
Understand	Understand meaning of material	Describe, explain, interpret
Remember	Remember previously learned material	Define, list, state
<u>LOWER ORDER LEARNING SKILLS</u>		

* Adapted from Krathwohl, DR (2002) 'A Revision of Bloom's Taxonomy: An Overview', *Theory into Practice*, 41(4), pp212-218

patients receive the appropriate level of preventive care.¹² Increasing this to 90% could save an additional two million lives a year with cost savings.¹³ Because of the broad multiprofessional, multidisciplinary, and multiagency nature of PH, CME that cuts across clinical domains and is specific to the PH needs of a population is required.¹⁴ Because HCPs are considered an integral component of the PH workforce, a unique responsibility exists to ensure they are equipped with the necessary knowledge and skills "to provide relevant health promotion and disease prevention services in the health care setting."¹⁵ (pg. 17)

These issues necessitate the optimization of PH CME. As has been mentioned, CME is effective when offered and used correctly; however, this is not always the case. Understanding what role context may play in CME effectiveness has been identified as a research priority.² Indeed, within medical education, context continues to elude definition¹⁶; as a result, there is increasing interest to define¹⁷ and identify¹⁸ context in CME-related fields. Bates and Ellaway¹⁶ examined 62 articles that addressed context in some way and developed a definition for context in medical education:

“Context is a dynamic and ever-changing system that emerges from underlying patterns of patients, locations, practice, education and society, and from the unpredictable interactions between these patterns.” (p. 814)

This definition serves as the basis for the authors’ understanding of context in CME.

It is the appreciation of CME’s potential in equipping HCPs to address population needs, combined with an understanding of its current limitations regarding methods and context of delivery, that has led to an investigation into what role context plays in PH CME. As part of this investigation, the research team has objectified a theoretical framework to inform the research project. The use of such a framework offers a theoretically grounded explanation for results¹⁹ and moves the field of medical education research forward in a fashion that allows theory to be tested, challenged, and developed further.²⁰ This article presents an innovative and progressive unified theoretical framework that ensued from a critical analysis of learning theory as it relates to PH CME. This unified framework addresses shortcomings of other approaches considered by the research team and offers the potential for new theoretical and methodological insights into understanding CME context within health care systems.

Identifying a Framework

Ringsted et al²¹ argue that the first step in medical education research should be situating the problem within a theoretical or conceptual framework. The deficit of such frameworks within medical education research literature has been noted as a factor in publication rejection in two-thirds of articles submitted, whereas only half of all published medical education research literature makes explicit use of a theoretical framework.²² This hampers educational scholarship and limits applicability and generalizability of findings.

As Hodges and Kuper²³ (p. 26) have pointed out, “there are hundreds of theories” in use today across various disciplines. Within the realm of medical education research, these theories have tended to focus on the individual, as opposed to the sociocultural context in which HCPs function and learn.²⁴ Although focusing on the individual has proved a useful approach to medical education following the recommendations of the Flexner report (1910), the changing face of health care, and our evolving understanding of how students learn, necessitates a different approach in how we advance medical education to meet the needs of a rapidly progressing global society in the 21st century.²⁵ HCPs do not function in isolation; they are part of wider health care systems that stretch from clinical teams, in their immediate environment, to national health policies determining the type and standard of care that HCPs practice, which in turn are influenced by international health agendas and emerging concerns, such as SARS-CoV-2. Sociocultural theories of learning offer opportunities to examine how learning occurs across these systems “at the level of the environment in which medicine is learned and practiced.”²³ (p. 31) Indeed, isolating HCPs from this system complexity during training is unlikely to foster interprofessional abilities that are shown to improve patient outcomes.²⁶

Systems thinking is becoming increasingly popular within the field of PH^{27,28} and has proved useful in modeling impacts of educational interventions on opioid abuse.²⁹ Indeed, a funda-

mental tenet of systems thinking is understanding how new knowledge is created, managed, disseminated, and integrated across systems to improve population outcomes.³⁰ Similarly, social learning theories assume a systems perspective by recognizing that knowledge is created through social interaction within complex systems.³¹ These commonalities offer fruitful ground for using sociocultural theories of learning to investigate PH CME.

With this in mind, the authors set out to establish a suitable theoretical framework to inform and ground their research. A search of online journal databases within the medical and social science fields was performed using terms “*medical education*,” “*learning theory*,” and associated synonyms. This was supplemented by informal group discussions with pedagogical experts in the field of medical education and higher education teaching and learning. Review articles identified through these processes^{23,25,32,33} were used as a springboard to evaluate relevant contemporary theories; from there, snowballing of suitable references took place. In addition, select academic text was consulted to provide deeper clarity on identified theories.

The following three criteria were used in identifying a suitable theory to inform the framework’s development:

1. In addition to the individual learner, the theory needs to be cognizant of the wider contextual factors involved in learning.
2. The theory needs to entail a systems understanding of the interactions between learner and wider contextual factors.
3. Any theory that will inform CME needs to move beyond the notion of learning as mere acquisition of knowledge.

In addition, practical application of any theory selected had to be feasible within the time and resource constraints of the research project. After an initial evaluation of identified theories, 10 theories were subsequently examined in detail to evaluate their suitability based on the prespecified criteria and relevance to the research (Table 2). None of the 10 theories individually was deemed sufficient for the purpose of exploring context in PH CME. Several were considered to be too overtly focused on the individual (Pathman awareness-to-adherence model, Kolb experiential learning cycle, Mezirow transformative learning, and Gardner theory of multiple intelligences) while Rogers diffusion of innovations theory was deemed more appropriate for making large-scale changes. Furthermore, the nebulous nature of Hallqvist “social space” in biographical learning and the challenge in identifying a PH “master” in Lave and Wenger communities of practice precluded the use of these two theories. Finally, the complexity inherent in applying Engström expansive learning theory at the level of activity systems was considered too time and resource intensive.

Two theoretical perspectives, however, did emerge that avoided these challenges and, on critical assessment, could be combined to deepen understanding of the issue of context while complementing individual shortfalls of each perspective in isolation. These were Biggs principle of constructive alignment³⁴ and Bronfenbrenner³⁵ bioecological model of human development. Biggs principle offers theoretical clarity around the learning process as experienced by individual learners within the learning environment, whereas Bronfenbrenner model expands on this by describing how learning is influenced through interactions with various systems.

TABLE 2.**List of 10 Theories Evaluated to Inform Theoretical Framework for Public Health CME**

Theory	Author	Description	Rationale for Exclusion/Inclusion
Awareness-to-adherence	Pathman et al ⁵²	Postulates that physicians go through four cognitive and behavioral steps when complying with guidelines: 1. Awareness—physicians need to be aware of guidelines existence. 2. Agreement—physicians need to agree with the guidelines. 3. Adoption—physicians need to decide to follow it in practice. 4. Adherence—physicians need to follow it at appropriate times	Pathman model is focused on the individual and relates to clinical guidelines specifically, which is only one component of CME. It did not fulfill criteria 2, namely a systems understanding of interactions, and was thus excluded.
Bioecological model of human development	Bronfenbrenner ^{35,43,53}	A theory of how human development occurs through progressively more complex interactions between an individual and their environments. Bronfenbrenner identified four system levels (and later a fifth) across which interactions occur: 1. Microsystem. 2. Mesosystem. 3. Exosystem. 4. Macrosystem. 5. Chronosystem	While fulfilling all three criteria for inclusion, Bronfenbrenner model on its own was considered insufficient as a framework because of its lack of clarity around learning at the level of the individual.
Biographical learning	Alheit ^{54,55}	Biographical learning leads to viewing one's life in a new way based on reflexive reorganizing of experiences, which can lead to new ways of "doing." Central to this is the notion that learning occurs in social space, as it is "impossible to create meaning in one's life history without including the social world" ^{54(p.502)} . According to Alheit, this social world is both influencing, and influenced by, biographical learning in the individual.	Alheit concept of biographical learning fulfills all three criteria for inclusion. However, Bronfenbrenner model was believed to provide better definition, and thus operationalization, of the concept around "social space."
Constructive alignment	Biggs ^{34,37}	A combination of constructivism and alignment (a curriculum development principle aligning outcomes with teaching processes). The theory proposes developing "deep" learners capable of functioning knowledge by using their past experiences (constructivism) while aligning intended outcomes with teaching processes. It recognizes interactions between student and teacher factors (presage), the learning process (process) and the outcome (product).	Biggs constructive alignment fulfills all three criteria. However, it is limited by the extent of wider contextual factors that it examines (criteria 1) as it is focused on higher education. Thus, on its own, it was considered insufficient.
Diffusion of innovations theory	Rogers ^{56,57}	Rogers classical diffusion of innovations theory saw adoption of an innovation as the result of diffusion among members of a social group. Rate of adoption is dependent on several characteristics as perceived by individuals. Individuals adopt at different rates (innovativeness) with constant proportions of each adopter group across diverse social systems. Using "early adopters" to communicate innovation messages increases diffusion rate.	Rogers classical theory has evolved to acknowledge the iterative, bidirectional nature of communication between change agents and adopters, and takes into account the social context in which adopters function. However, Rogers' theory addresses major changes in thinking. Given that many changes are more modest in nature, such as knowledge updates, the authors excluded Rogers theory as it cannot address all changes.
Experiential learning	Kolb, D ^{53,58,59}	Kolb theory of experiential learning posits that individuals learn best when engaging with, and subsequently processing, first-hand experiences. The theory views learning as a four-stage cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation. Kolb acknowledged that individual learners would have preference for certain stages, but for truly effective learning to occur, learners need to progress through all stages.	Although Kolb theory recognizes that learning occurs through experiences, which by default entail societal constructs, the theory itself does not examine these constructs, and instead, is focused on the individual learner. This precludes the use of this theory based on criteria 1.
Expansive learning	Engström, Y ^{24,60}	The third iteration of activity theory proposed by Engström sees learning as a dynamic process of knowledge production (as opposed to mere reproduction) that occurs through the interaction of at least two activity systems. An activity system consists of interactions between the following 5 components: the subject, the object, mediating artifacts, rules, community, and division of labor. The theory resides on five principles that acknowledge the complex, multicomponent, time-dependent, activity transforming nature of the theory.	Engström theory fulfilled all 3 criteria, as the unit of analysis is a system that consists of individuals and their interactions with wider social constructs (criteria 1 and 2). Furthermore, the theory resides on a principle of transformation, ie, more than mere acquisition of knowledge (criteria 3). However, implementation of this theory was considered too time and resource intensive to be feasible.

(Continued)

TABLE 2.**List of 10 Theories Evaluated to Inform Theoretical Framework for Public Health CME (Continued)**

Theory	Author	Description	Rationale for Exclusion/Inclusion
Situated learning and communities of practice	Lave and Wenger ^{53,59,61}	Lave and Wenger view learning as occurring through participation in communities, whereby learners enter these “communities of practice” as peripheral novices and over time gain mastery in the skill set of the community. Learning thereby becomes a part of social practice, informed and influenced by the context in which it is situated, as opposed to the structure of pedagogy being the source of learning. This “learning through social practice” in turn changes the individual. The theory arose through research of apprenticeships.	Lave and Wenger situated learning and its concept of communities of practice fulfill the criteria for inclusion. However, the changes occurring in health care delivery (“situation”) and the lack of a defined PH “master” in certain health care situations precluded its use for this research.
Transformative learning	Mezirow, J ^{59,62}	Unlike informative learning, which brings about changes in what we know, transformative learning is a theory that attempts to change how we know. ⁶³ That is, it is a process whereby problematic frames of reference are transformed to be more inclusive and reflective through challenging of old paradigms. These old paradigms, or “habits of mind,” are how one categorizes experiences, beliefs, people, and events.	A major criticism of Mezirow theory of transformative learning is the “decontextualized” nature of transformative learning. Given that the aim of the framework is to allow examination of contextual factors, this theory was excluded based on criteria 1.
Theory of multiple intelligences	Gardner, H ^{64,65}	Gardner theory of multiple intelligences (MI) posits that individuals possess 8 distinct intelligences, as opposed to the singular intelligence concept (IQ) that predominate Western psychology. These intelligences are distinct measurable phenomenon. Identifying which MI individuals “excel” in enables educators to align teaching to individuals’ strengths. Unlike skills that can be acquired through various routes in society, MI is considered a biopsychological potential that all humans possess by virtue of their humanity.	Gardner theory is predominantly focused on the neurobiological basis of learning, and thus does not address the context beyond the individual. Therefore, it was excluded based on criteria 1.

CME, continuing medical education.

Biggs Principle of Constructive Alignment

Biggs principle of constructive alignment lies within the school of constructivist learning theory, that is, learning occurs through construction of knowledge based on personal experiences and social interactions.³⁴ Biggs builds on this through the curricular concept of alignment, whereby alignment of outcomes, teaching/learning activities, and task assessment confers additional educational benefits.³⁴ Biggs’ intended outcome of applying this theory in higher education was to develop “deep” self-directed learners who leave tertiary education not only with declarative knowledge but also with functioning knowledge needed to put learning into practice in a professional context. Evidence suggests that applying Biggs principle of constructive alignment in higher education does indeed result in a “deep” situational learning approach, regardless of individuals’ preferred learning styles.³⁶ This is particularly relevant to HCPs, who must constantly update their knowledge and skills throughout their professional career through self-directed learning.

There is an inherent systems nature evident in Biggs principle. His initial 3P model (Presage-Process-Product)³⁷ clearly expresses this through its recognition of how changes in one component can impact the other. Indeed, Biggs describes education as consisting of several nested “interacting ecosystems.”³⁷ (p. 74) It is this interactive systems nature that offers promise for CME, aiming to develop functioning knowledge by considering alignment across learning activities and institute levels.

Although Biggs recognizes various levels inherent in tertiary education that could align (program, college, and university), applying this principle to settings outside of tertiary education is complicated. Particularly within CME, there are numerous

factors and stakeholders that play important roles in its development and delivery.³⁸ Freeth and Reeves³⁹ adapted Biggs 3P model in an attempt to identify these wider influences on learning opportunities within interprofessional workplaces. Their adaptation has proven effective as an analytical tool for synthesizing results in systematic reviews of interprofessional education.^{40,41} However, Biggs model does not allow the exploration of the effect of context on learning across systems because it aggregates them into a single presage factor. As previously mentioned, understanding how knowledge is created across systems is a fundamental aspect of both systems thinking within PH and social learning theories. It is on this point that Bronfenbrenner bioecological model of human development³⁵ offers opportunity for greater understanding of how knowledge is created across systems within Biggs model.

Bronfenbrenner Bioecological Model of Human Development

Bronfenbrenner³⁵ viewed learning as arising from increasingly complex interactions between individuals and the systems in which they operate and live and the associated interactions between these systems. From this, Bronfenbrenner defined four initial levels that make up educational environment’s ecological structure, namely the microsystem, mesosystem, exosystem, and macrosystem (Table 3). These level definitions offer concrete descriptions of key stakeholders within each system based on their degree of interaction with the individual. Such a reading of Bronfenbrenner’s work allows for the possible expansion of components of Biggs model to provide further granularity of contextual factors that influence learning within and across systems. Applying Bronfenbrenner model addresses the potential shortcoming of using Biggs theory in isolation.

Criticism of the use of Bronfenbrenner model revolves around the lack of acknowledging or using subsequent iterations of the model due to the success of its initial four system-level ecological framework.⁴² Rosa and Tudge⁴³ point out that this initial model underwent a further two iterations. The second iteration focused on the role of the individual in their own development. The third and final iteration, referred to as the Process-Person-Context-Time (PPCT) model, highlighted the importance Bronfenbrenner placed on complex interactions between the individual and their immediate surroundings (proximal processes of development), and the influence of time, both longitudinal and historical, on that development. As a result, the fifth system, termed *chronosystem* by Bronfenbrenner,⁴³ was added to the model. It posits that development is shaped across the life course and through historical time past, present, and future. This is highly relevant in CME because the changing face of health care requires changes in the way HCPs maintain competency and develop professionally.⁴⁴

There is a large component of complementarity and compatibility between the two models described above. Both view the process of learning as an integral component of the outcome, although the models approach this from opposite ends: Biggs starts with the outcome, and then aligns the learning process to this outcome, whereas Bronfenbrenner observes how the learning process leads to the outcome (development). Both place the individual at the heart of the theory: Biggs talks about level 3 teaching, where the focus is on “what the student does and how that relates to teaching”³⁴ (p. 20); the importance of the individual to Bronfenbrenner was so great that the second iteration of their work focused wholly on the role of the individual in their own development.⁴³ Finally, although Biggs does not explicitly address time in their own model to the same extent as Bronfenbrenner chronosystem, it does point out that learning is not “a one-off process but a continuing action learning cycle”.³⁴ (p. 281) This implies a concept of time in motion, although apart from its influence on evaluation, is not a major component of Biggs principle.

Although both models complement each other, it would seem Bronfenbrenner model offers more depth regarding exploring wider contextual variables. However, for the purpose of examining contextual factors in PH CME, there were several shortcomings with Bronfenbrenner model that precluded its sole use. First, the underlying focus of Bronfenbrenner model was child development. Although it stated that development occurs in a similar fashion throughout life, the “progressively more complex reciprocal interaction”⁴³ (p. 252) that occurs over a professional career is likely to be far more complex than those

examined in children. In addition, the environments, and the objects and persons within those environments, are also likely to be vastly different between children and professionals.

Second, the direction of enquiry within Bronfenbrenner model, namely how process affects outcome, is already well studied within the field of CME.² What is now of interest is how to improve these processes, and thus population outcomes, by evaluating interacting contextual factors that play a role. Beginning with the end in mind has been proposed as a means of achieving this with CME.^{45,46} Thus, Biggs principle of constructive alignment that starts with the intended outcome is a more suitable application of learning theory on this point.

A Unified Theoretical Framework of Learning

Figure 1 presents a fusion of these two models to create a unique unified theoretical framework of learning. This framework will inform the authors' current study and has the potential to serve as a theoretical foundation for any future study exploring professional learning.

The original representation of Biggs 3P model has been expanded to include interactions across multiple ecological systems over all three domains (Presage-Process-Product). This countenances examination of potential contextual factors that play a role in CME at multiple levels beyond the student–teacher interaction as proposed within Biggs original model. In addition, the inclusion of Bronfenbrenner model offers explicit definitions to aid in the identification of critical stakeholders within each system (Table 3). Titles were assigned to each level to represent the key characteristics of each as defined by Bronfenbrenner. At the microsystem level is the *individual* and the settings in which they engage on a regular basis. At the mesosystem level are the *intermediaries*, those organizations that bring the microsystems together. In Bronfenbrenner initial model, this was displayed as a simple layer around the microsystem. The authors are in agreement with Rosa and Tudge⁴³ that this does not adequately represent the richness of interactions that can arise at this level, and therefore, the framework expands it to include all components of Biggs model. Below the mesosystem in the diagram is the exosystem, termed *influencers*, those “social structures”³⁵ that are not directly involved with the microsystem, but nevertheless exert influence (both positive and negative) on the individual. Finally, the macrosystem is termed *ideologies*, as it encapsulates those organizations whose ideologies shape the overall culture in which all systems function.

From a theoretical perspective, elaboration of a blended framework that combines these two models increases the

TABLE 3.
Definitions of Each System Level Within Bronfenbrenner Ecological Model

System Level	Definition*
Microsystem	The setting containing the individual, defined as a place in which the individual engages in particular activities within a particular role.
Mesosystem	The interrelations between the microsystem settings of the individual, ie, “system of microsystems”
Exosystem	A system of social structures in which the individual does not reside, but is nonetheless influenced and impinged on by activities within this system.
Macrosystem	The overarching institutions that determine the culture and subculture of the society of which the lower systems (micro, meso, and exo) are concrete manifestations.
Chronosystem	The historical period through which the individual lives, and whose developmental life course is shaped by conditions and events occurring during this historical period

*Adapted from Bronfenbrenner³⁵ and Rosa and Tudge.⁴³

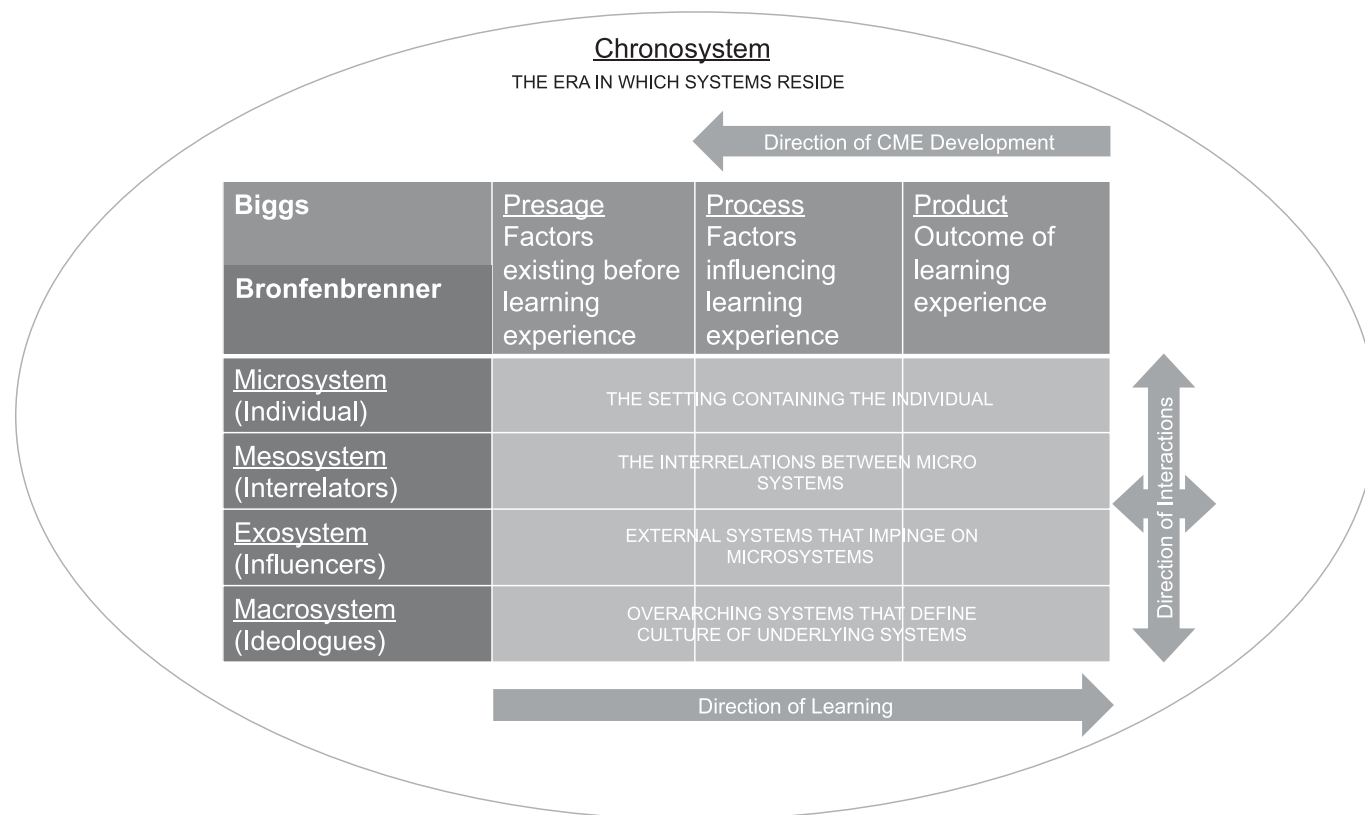


FIGURE 1. A unified theoretical framework of learning for public health continuing medical education.

depth and richness of understanding of interactions that occur across and between systems. These interactions are indicated by the cross-arrow directions to the right of the framework. From a practical application perspective, it offers clear definitions and theoretical processes to guide research enquiry. The additional detail also permits applying Biggs theory of alignment to investigate whether the intent of each system is aligned within and across the systems. Curricular alignment *within* higher education, represented by the horizontal arrow, has been shown to encourage ‘deep’ self-directed learning³⁶; the same outcome might be expected when alignment occurs *across* systems, represented by the vertical arrow.

The arrow at the diagram’s top indicating direction of CME development, from outcome to process, is in keeping with Biggs’ theoretical perspective.³⁴ This also aligns with current practical thinking regarding CME development (“start with the end in mind”⁴⁶ (p. 6)). Although CME development originates with the outcome, the direction of learning, represented by the arrow below the diagram, naturally occurs from left to right over time—presage factors of the individual and the systems they reside in influence the process of learning and knowledge dissemination within these systems. This is supported by the theoretical perspectives of both models as described above. The practical implication of this longitudinal time implies learning is a continuous, ongoing process. To be effective, CME cannot be developed as a single interaction at a point in time. Indeed, empirical evidence supports the notion that

multiple-exposure CME is more effective than single-exposure activities.²

Finally, Bronfenbrenner’s conceptualization of time is represented by the encapsulating chronosystem in which processes and systems of learning reside. This acknowledges that an individual’s learning is shaped by changes arising in the historical era through which they live and develop,⁴³ and requires researchers to be cognizant of similar changes in medical education over the past decades.⁴⁷ These changes will occur more frequently as technology continues to impact health care education⁴⁸ and practice.⁴⁹ Thus, several generations of various pedagogical learning strategies will be present among HCPs undertaking any CME activity.⁵⁰ Failure to acknowledge the impact of these learning eras on the individual’s preferred learning process may limit the effectiveness and potential impact of CME.

CONCLUSION

The authors have advanced this novel unified theoretical framework to evolve understanding into the role of contextual factors in PH CME. The models applied in this framework complement each other and provide opportunity to explore the phenomenon of professional learning in CME with greater clarity than either model on its own. The unified theoretical framework that has emerged from this analysis offers a structured, theory based approach for use in CME research. This unified theoretical framework will form the a priori framework for a “best fit” framework synthesis of the literature⁵¹ to develop a conceptual

framework of contextual factors that play a role in PH CME. The evolution of this unified theoretical framework created from theories with a proven evidence base not only enhances the reliability of findings using the future conceptual framework but also progresses scholarship within medical education research.

Lessons for Practice

- To move CME scholarship forward, CME research should be situated within theoretical frameworks.
- Ecological and systems-based learning theories offer the opportunity to explore how knowledge is created within interacting systems.
- Combining complementary theories has the potential to enrich the understanding of the research issue at hand.

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