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# Theories and Models in Health Sciences Education – a Literature Review

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# Theories and Models in Health Sciences Education – a Literature Review

**Abstract**
Working within a scholarship of teaching and learning (SoTL) perspective requires a rigorous approach based on conceptual frameworks in order to build on previous developments. Nevertheless, in health sciences education, the development, implementation, and evaluation of many educational innovations are carried out without an underlying conceptual framework, partly due to a lack of knowledge about any such applicable framework. The objective of this research was to catalogue conceptual frameworks mentioned in recently published health sciences education articles and to classify them according to their use in various SoTL contexts. A literature review in health sciences education from the January, 2011 to March, 2016 period was carried out using the Pubmed, CINAHL, Embase, ERIC, and PsychINFO databases and based on the following terms: (a) theories and models; (b) education; and (c) health professionals. The titles and abstracts of articles were reviewed for purposes of including research articles, innovation reports, and synthesis articles using or discussing theories or models. Data extraction followed the SoTL classification contexts provided by Simpson et al. (2007). A total of 471 articles were selected, retrieving 324 conceptual theories and models, classified according to Simpson's classification in one or more categories: Teaching (*n*=294), Curriculum development (*n*=182), Mentoring (*n*=12), Leadership/administration (*n*=16), and Learner assessment (*n*=78). In conclusion, this literature review identified conceptual theories and models mentioned in articles published in health sciences education from 2011 to 2016. This repertory highlights the importance of conceptual frameworks in health science education. It should encourage faculty members to work from a SoTL perspective by making it easier to identify conceptual frameworks pertaining to the educational innovations they are addressing.

Le travail accompli dans la perspective de l'Avancement des connaissances en enseignement et en apprentissage (ACEA) exige une approche rigoureuse basée sur des cadres conceptuels afin de baser les activités sur les développements précédents. Toutefois, dans l'enseignement des sciences de la santé, le développement, la mise en oeuvre et l'évaluation de nombreuses innovations en matière d'enseignement sont menées en l'absence d'un cadre conceptuel sous-jacent, en partie dû au fait que l'on ignore l'existence de tels cadres applicables. L'objectif de cette recherche était de cataloguer les cadres conceptuels mentionnés dans des articles récemment publiés sur l'enseignement des sciences de la santé et de les classifier selon leur usage dans divers contextes d'ACEA. Un examen des articles portant sur l'enseignement des sciences de la santé publiés entre janvier 2011 et mars 2016 a été mené à l'aide des bases de données Pubmed, CINAHL, Embase, ERIC et PsychINFO. Cet examen était basé sur les termes suivants : (a) théories et modèles; (b) éducation; (c) professionnels de la santé. Les titres et les résumés des articles ont été examinés dans le but d'inclure les articles de recherche, les rapports novateurs et les articles de synthèse dans lesquels les théories et les modèles étaient discutés. L'extraction des données a suivi les contextes de classification de l'ACEA fournis par Simpson et al (2007). Un total de 471 articles ont été choisis, parmi lesquels 324 théories et modèles conceptuels ont été prélevés et classés selon la classification de Simpson dans une ou plusieurs catégories : enseignement (*n* = 294), développement des programmes de cours (*n* = 182), mentorat (*n* = 12), leadership/administration (*n* = 16) et évaluation des apprenants (*n* = 78). En conclusion, les publications examinées ont permis d'identifier les théories et les modèles conceptuels mentionnés dans les articles publiés dans le domaine de l'enseignement des sciences de la santé de 2011 à 2016. Ce répertoire met en valeur l'importance de cadres conceptuels en enseignement des sciences de la santé. Il devrait encourager les enseignants à travailler selon une perspective d'ACEA en facilitant l'identification des cadres conceptuels relatifs aux innovations éducationnelles auxquelles ils répondent.

**Keywords**
conceptual framework, health sciences education, theory, model, scholarship of teaching and learning; cadre conceptuel, enseignement des sciences de la santé, théorie, modèle, avancement des connaissances en enseignement et en apprentissage

**Cover Page Footnote**
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Health sciences education is evolving quickly around the world, thus producing many educational innovations. Scholarship of Teaching and Learning (SoTL) encourages the development and evaluation of such innovations through systematic and peer-reviewed approaches, from which results can be publicly disseminated and built upon (Simmons & Marquis, 2017) so as to improve student learning and enhance educational quality. Educational innovations can lead to SoTL in various contexts, as defined by Simpson et al. (2007), namely teaching, curriculum development, mentoring, academic leadership, and learner assessment. Adopting this approach is increasingly encouraged by experts in the field but doing so involves a rigorous application with appropriate frameworks to structure the development, implementation, and/or evaluation of such educational innovations essential to the pursuit of SoTL activities.

In an analysis of the quality of experimental studies in medical education, Cook, Beckman, and Bordage (2007) found that in 55% of studies, the use of conceptual frameworks was not explicitly mentioned. It has however been shown that the use of such frameworks helps enrich the repertoire of educational interventions in clinical teaching (Cote & Bordage, 2012; Cote, Gromaire, & Bordage, 2015).

Conceptual models are a set of interrelated concepts that symbolically represent and convey a mental image of a phenomenon (Fawcett & Alligood, 2005); they are considered less abstract and more explicit and specific than philosophies but more abstract and less explicit and specific than theories (Fawcett, 2005). A theory is "a set of interrelated constructs (concepts, definitions, and propositions) that present a systematic view of phenomena by specifying relations among variables, with the purpose of explaining and predicting phenomena" (Kerlinger,1986, p. 9)

Conceptual frameworks can be defined in many ways. Bordage (2009) has suggested a broad view, where "conceptual frameworks represent ways of thinking about a problem or a study, or ways of representing how complex things work. They can come from theories, models, or best practices" (p. 313). In Bordage's view, theories are well-organized principles and propositions that have been confirmed by observations or experiments; models are derived from theories, observations, or sets of concepts; and evidence-based best practices are derived from outcome and effectiveness studies. Best practices are generally known and applied in health sciences education, particularly because they are often included in faculty accreditation standards. For Ravitch and Riggan (2017), a conceptual framework is "an argument (i.e. a series of sequenced, logical propositions, the purpose of which is to ground the study and convince readers of the study's importance and rigor) about why the topic one wishes to study matters, and why the means proposed to study it are appropriate and rigorous" (p. 5). They link conceptual frameworks to the phases of the research process, which also apply to SoTL approaches: conceptualisation of the project, question and design, data collection, data analysis, and presenting/explaining the findings.

Terminology around theories, models, and frameworks is also often used interchangeably when referring to similar concepts. For example, the Kirkpatrick framework (Kirkpatrick, 1994), commonly applied in program evaluation articles, is sometimes identified as a model (Piryani et al., 2013); an approach (Erlich & Shaughnessy, 2014); a scale (Nestel, Groom, Eikeland-Husebø, & O'Donnell, 2011); or a hierarchy (Hauer, Carney, Chang, & Satterfield, 2012).

However, theories and models pertaining to health sciences education can come not only from education but also from the health sciences (e.g., nursing) or related disciplines (e.g., administration). They need to be carefully examined and applied in other disciplines such as health sciences education (Cianciolo, Eva, & Colliver, 2013), for example in curriculum development and implementation (Hodges & Kuper, 2012), and program evaluation (Dauphinee, 2015) to name only two potential areas of interest. The literature generally groups conceptual frameworks by discipline, such as theories in nursing (Masters, 2011), or field of activity, such as theories of learning through simulation (Chauvin, 2015). This approach complicates general understanding of the whole set of

theories and models likely to be applied to health sciences education. Some review articles on learning theories used in health sciences education (Mann, 2011; Torre, Daley, Sebastian, & Elnicki, 2006) provide a general idea of common conceptual perspectives that may be useful in health sciences education, but they do not identify a range of conceptual frameworks used to guide SoTL in health sciences.

It is often difficult for health sciences faculty members who received little or no educational training to use these frameworks since they know little or nothing about them. While developing a graduate course on SoTL for a health sciences education program, we faced the challenge of mapping current and relevant frameworks to guide our students in their scholarly work. We therefore adopted a SoTL approach in this literature review, aiming to catalogue theories and models mentioned in health sciences education articles and to classify them according to their use in various SoTL contexts.

## Method

### Sources and Search Strategies

The Pubmed (Medline), CINAHL, Embase, ERIC, and PsychINFO databases were searched for the January 2011 to March 2016 period for articles in English and French. The research strategy was based on the terms (a) conceptual framework (theories and models), (b) education, and (c) health professionals and was adapted using indexing terms and free-text searches depending on the different databases examined. The complete search strategy is presented in Appendix A.

### Selection Criteria for Articles

The titles and summaries of articles in health sciences education were reviewed to include research articles, innovation reports, and synthesis articles using or enumerating theories or models. Articles were excluded if the framework was absent or not explicitly mentioned (even if it could be inferred), or if it was not applied to health sciences education. Furthermore, methodological theories or approaches (e.g., grounded theory), simulation models (e.g., artificial arm for venipunctures), and use of the term "model" to describe curriculum structure (e.g., horizontal vs. vertical internship models) were excluded because they did not correspond to Bordage's definition as described earlier.

### Data Extraction

Data extraction included the following items: author, publication year, title, journal, type of article (review, research, other), discipline, theory or model. Data extraction also included the context of SoTL according to Simpson et al. (2007):

- Teaching: learning strategies used on a daily basis, both in clinical (supervision) and non-clinical teaching;
- Curriculum development: identification of needs and objectives; choice of teaching strategies and their implementation; program evaluation;
- Mentoring: coaching and guidance;
- Leadership and/or administration: academic management of departments and university programs;

- Learner assessment: development, validation, and administration of assessment in classrooms or workplaces.

Three authors extracted data for each selected abstract, and all authors reached consensus through triangulation of the extracted data.

### Data Synthesis

Calculations were carried out according to descriptive statistics on the number of articles per discipline; the number of frameworks identified; the number of articles citing each of these frameworks; and the SoTL contexts in which they were used. The provisional list of frameworks was reviewed by the team of authors and organized according to their original discipline. The final list of frameworks was drawn up based on exchanges and a consensus among team members.

## Results

### Characteristics of Articles

At the end of the review process, 471 articles were selected, retrieving a total of 324 distinct theories and models. The disciplines most frequently represented were medicine and nursing. A total of 30 articles focused on more than a single discipline (Table 1). Supplemental digital files provided an overview of the retrieved frameworks, classified under Educational (Appendix B); Health disciplines (Appendix C); or Other disciplines (Appendix D). A total of 11 frameworks remained unclassified because we were unable to retrieve their original references.

Table 1
*Number of Articles and Distinct Frameworks for Each SoTL Context*

| | Teaching | Curriculum Development | Mentoring | Leadership | Learner Assessment | Other |
|---|---|---|---|---|---|---|
| | | | Articles (*n*) | | | |
| Medicine | 79 | 71 | 5 | 6 | 24 | 12 |
| Nursing | 69 | 100 | 6 | 10 | 14 | 5 |
| Pharmacy | 3 | 7 | 0 | 0 | 2 | 1 |
| Rehabilitation | 8 | 10 | 0 | 1 | 2 | 0 |
| Dentistry | 3 | 4 | 0 | 0 | 2 | 0 |
| Other | 6 | 9 | 2 | 0 | 1 | 0 |
| Interprofessional | 7 | 19 | 0 | 1 | 3 | 0 |
| N/S | 1 | 5 | 0 | 0 | 3 | 0 |
| | | | Number of distinct retrieved frameworks (*n*) | | | |
| Medicine | 63 | 79 | 5 | 6 | 31 | 22 |
| Nursing | 69 | 91 | 4 | 17 | 15 | 7 |
| Pharmacy | 6 | 8 | 0 | 0 | 2 | 4 |
| Rehabilitation | 7 | 14 | 0 | 2 | 2 | 0 |
| Dentistry | 3 | 6 | 0 | 0 | 2 | 0 |
| Other | 10 | 11 | 2 | 0 | 2 | 0 |
| Interprofessional | 16 | 28 | 0 | 2 | 3 | 0 |
| N/S | 1 | 11 | 0 | 0 | 6 | 0 |

In medicine, the most commonly retrieved framework categories included cognitivist, humanist, and constructivist frameworks (education frameworks); psychology and social sciences frameworks (disciplinary frameworks); and measurement and evaluation frameworks (other disciplines frameworks) (Figure 1). Nursing articles more commonly cited humanist and constructivist frameworks (education frameworks); social sciences frameworks (health disciplines frameworks); and scientific frameworks (other disciplines) (Figure 2). Other health disciplines made a greater use of cognitivist frameworks as well as measurement and evaluation frameworks (Figure 3).

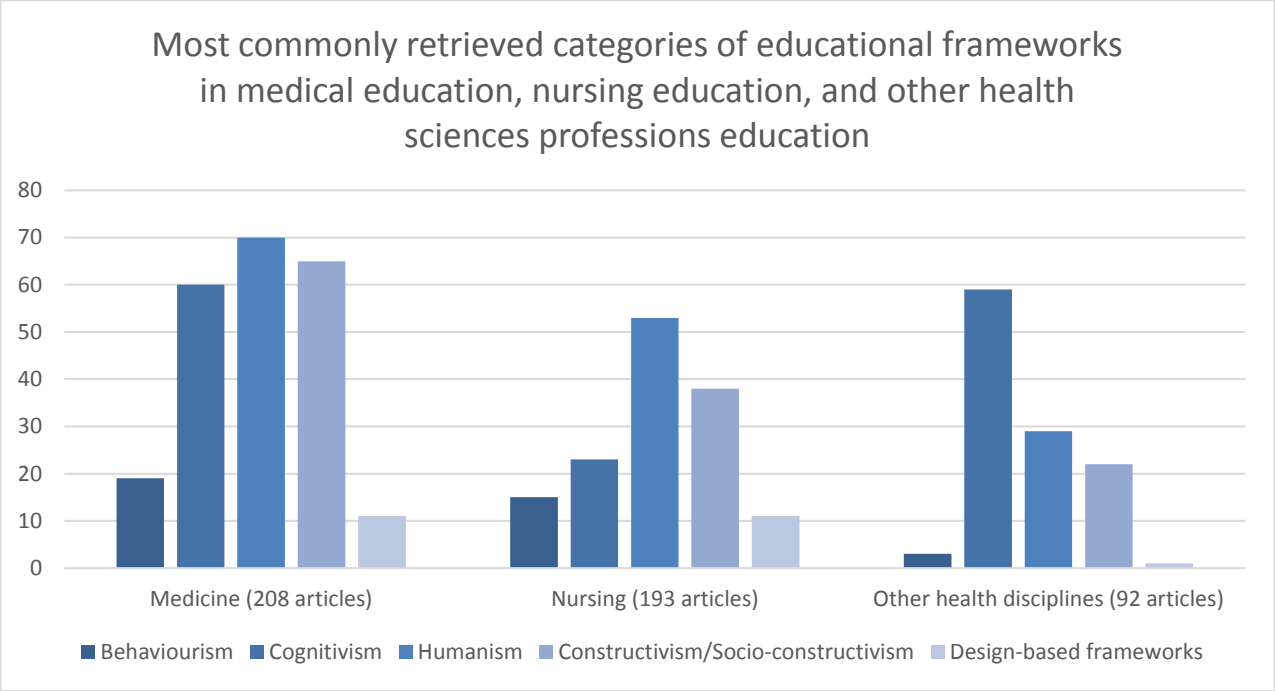



*Figure 1*. Educational frameworks.

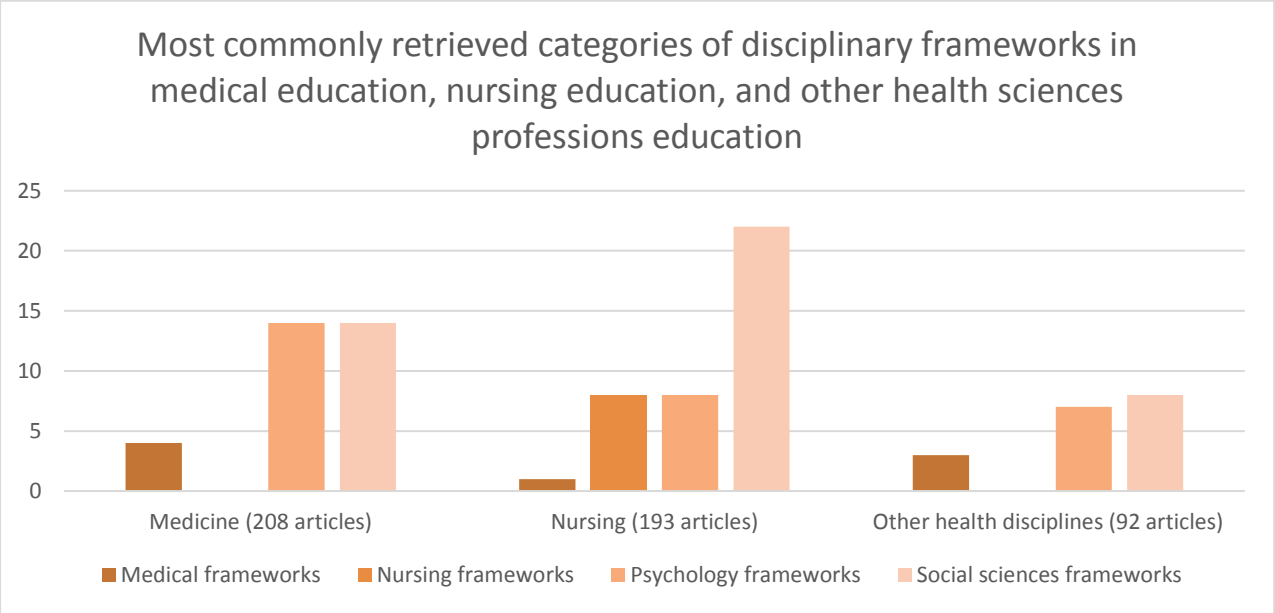



*Figure 2.* Health sciences disciplinary frameworks.

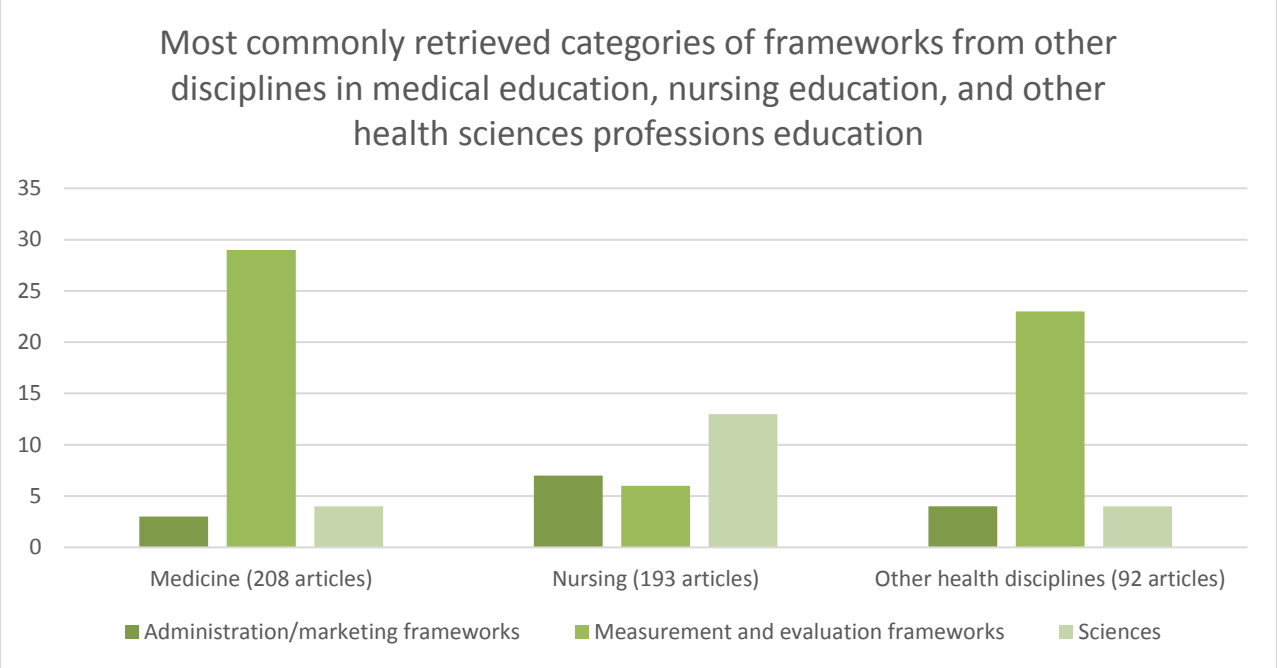
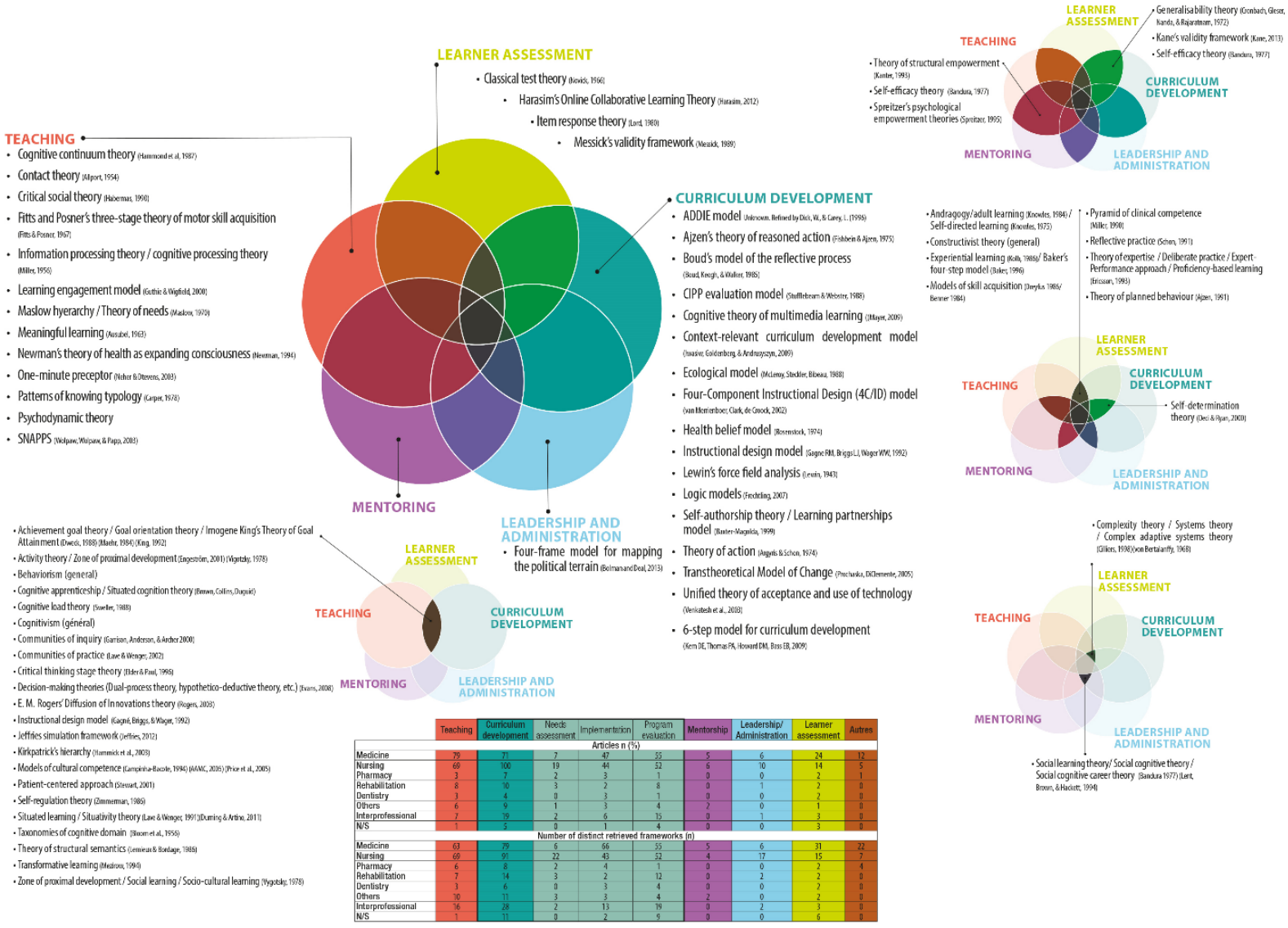



*Figure 3.* Frameworks from other disciplines.

## Types of Educational Scholarship

Depending on each article's SoTL context, the retrieved theories and models could appear under one or more categories. Figure 4 illustrates the frameworks retrieved at least twice in the literature review.




| | Teaching | Curriculum development | Needs assessment | Implementation | Program evaluation | Mentorship | Leadership/ Administration | Learner assessment | Autres |
|---|---|---|---|---|---|---|---|---|---|
| Articles n (%) | | | | | | | | | |
| Medicine | 79 | 71 | 7 | 47 | 55 | 5 | 6 | 24 | 12 |
| Nursing | 69 | 100 | 19 | 44 | 52 | 6 | 10 | 14 | 5 |
| Pharmacy | 3 | 7 | 2 | 3 | 1 | 0 | 0 | 2 | 1 |
| Rehabilitation | 8 | 10 | 3 | 2 | 8 | 0 | 1 | 2 | 0 |
| Dentistry | 3 | 4 | 0 | 3 | 1 | 0 | 0 | 2 | 0 |
| Others | 6 | 9 | 1 | 3 | 4 | 2 | 0 | 1 | 0 |
| Interprofessional | 7 | 19 | 2 | 6 | 15 | 0 | 1 | 3 | 0 |
| N/S | 1 | 5 | 0 | 1 | 4 | 0 | 0 | 3 | 0 |
| Number of distinct retrieved frameworks (n) | | | | | | | | | |
| Medicine | 63 | 79 | 6 | 66 | 55 | 5 | 6 | 31 | 22 |
| Nursing | 69 | 91 | 22 | 43 | 52 | 4 | 17 | 15 | 7 |
| Pharmacy | 6 | 8 | 2 | 4 | 1 | 0 | 0 | 2 | 4 |
| Rehabilitation | 7 | 14 | 3 | 2 | 12 | 0 | 2 | 2 | 0 |
| Dentistry | 3 | 6 | 0 | 3 | 4 | 0 | 0 | 2 | 0 |
| Others | 10 | 11 | 3 | 3 | 4 | 2 | 0 | 2 | 0 |
| Interprofessional | 16 | 28 | 2 | 13 | 19 | 0 | 2 | 3 | 0 |
| N/S | 1 | 11 | 0 | 2 | 9 | 0 | 0 | 6 | 0 |

*Figure 4.* Classification of frameworks according to Simpson's contexts of SoTL (retrieved at least twice from health sciences education SoTL 2011-2016).

**Teaching.** Many frameworks are used to orient approaches to in-class teaching (e.g., courses, workshops, simulations); daily clinical teaching (e.g., clinical supervision); or self-directed learning (e.g., virtual patients, online modules). The most commonly retrieved frameworks were mainly from the field of education (*n*=49).

For example, behaviorist frameworks such as mastery learning (Bloom, 1968) (*n*=3) provide a basis for repetition and feedback. Social-cognitive theories (Bandura, 1977a) (*n*=4) are also helpful in understanding human behaviour and its influencing factors.

Cognitivist theories such as the dual-process theory (Evans, 2008) (*n*=8) assist in teaching clinical reasoning, as do some supervision models [e.g., One-minute preceptor (Neher, Gordon, Meyer, & Stevens, 1992) (*n*=2)] which encourage thinking-aloud about the reasoning process. Other cognitivist frameworks such as meaningful learning (Ausubel, 1963) (*n*=6) or cognitive load theory (Sweller, 1988) (*n*=7) facilitate learning, particularly when simultaneous integration of multiple contents is required.

Humanist theory, including adult learning (Knowles, 1975) (*n*=20); experiential learning (Kolb, 1984) (*n*=19); transformative learning (Mezirow, 1990) (*n*=6); self-regulation theory (Zimmerman, 1986) (*n*=6); and self-determination theory (Ryan & Deci, 2000) (*n*=4), promote learner-oriented teaching. Some teaching/supervision models also promote reflective practice (Schon, 1991) (*n*=5) and active learning, such as the SNAPPS (Wolpaw, Wolpaw, & Papp, 2003) (*n*=3).

Socio-constructivist frameworks encompass the developmental approach to learning, as seen with the pyramid of clinical competence (Miller, 1990) (*n*=6) or the models of skills acquisition (Benner, 1984; Dreyfus & Dreyfus, 1986) (*n*=7). Other frameworks from this paradigm include situated learning (Lave & Wenger, 1991) (*n*=9) and communities of practice (Lave & Wenger, 2002) (*n*=6).

Besides these educational frameworks, some disciplinary frameworks help to structure course content, for example Peplau's interpersonal relations theory from nursing (Peplau, 1992); the Maslow hierarchy of needs from psychology (Maslow, 1970); theories of empowerment (Kanter, 1993; Spreitzer, 1995) (*n*=3); and complexity/systems theory (Bertalanffy, 1968; Cilliers, 1998) (*n*=7).

**Curriculum development.** The SoTL context that yielded the largest number of frameworks is curriculum development (47% of articles, *n*=220), where articles addressed one or more of the following steps: on needs assessments (*n*=29); choice of teaching strategies and their implementation (*n*=104); and program evaluation (*n*=121). Examples of design-based (or instructional systems design) frameworks commonly used for curriculum development include

- 6-step model for curriculum development (Kern, Thomas, & Hughes, 2009)
- ADDIE model (Branson et al., 1975)
- Four-component instructional design (4C/ID) model (Merriënboer, 1997)
- Context-relevant curriculum development model (CrCD) (Iwasiw, Goldenberg, & Andrusyszyn, 2009)
- Jeffries simulation framework (Jeffries & Rogers, 2012)

The frameworks used in the initial steps of curriculum development, explicitly for needs assessment and determination of learning objectives, also commonly involved humanist frameworks, particularly taxonomies (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956; Krathwohl, 2002); theories focused on self-determination (Ryan & Deci, 2000); transformative learning (Mezirow, 1990); adult learning (Knowles, 1975); and goal achievement (King, 1992).

Among the 121 distinct frameworks used in a program evaluation strategy, three were specifically developed for this purpose: Kirkpatrick's hierarchy (Kirkpatrick, 1994); the CIPP model (Sufflebeam, 2003); and logic models (Knowlton, 2013) (*n*=3). All the other frameworks have been used to structure program evaluation works (i.e., design the research question, organize data collection, guide data analysis, or explain and contextualize results). The frameworks most commonly used in this manner include experiential learning (Kolb, 1984) (*n*=9), transformative learning (Mezirow, 1990) (*n*=6), and adult learning (Knowles, 1975) (*n*=6).

**Mentoring.** The SoTL context of mentoring learners or faculty was found in only 13 articles. Social learning theory (Bandura, 1977b) (*n*=3) and theories of empowerment (*n*=2) were the most commonly cited. Frameworks about goals/motivation (King, 1992; Vroom, 1964), life cycle (Erikson, 1968) (*n*=1), transitions (Schlossberg, 1981, 1984) (*n*=1), and organizational socialization (Bauer & Erdogan, 2011) were also cited.

**Leadership and/or administration.** Frameworks used in academic leadership were borrowed from the field of administration more commonly than the other SoTL contexts, e.g. the four-frame model for mapping the political terrain (*n*=2) and theories of empowerment (Benner, 1984; Kanter, 1993) (*n*=1). Social learning theories (Bandura, 1977b) (*n*=2); complexity theory (*n*=2); and self-determination theory (*n*=2) were also retrieved for this SoTL context.

**Learner assessment.** Student evaluation was the subject of 11% of the selected articles. The retrieved frameworks often guided psychometric validation works, such as Messick's validity framework (Messick, 1989) (*n*=4) or Kane's validity framework (Kane, 2013) (*n*=5). The pyramid of clinical competence (Miller, 1990) (*n*=8) and models of skill acquisition (Benner, 1984; Dreyfus & Dreyfus, 1986; Fitts & Posner, 1967) (*n*=5) were also commonly cited.

## Discussion

This work provides an overview of various theories and models recently mentioned in health sciences education articles and identifies the main frameworks for each of the five SoTL contexts as defined by Simpson et al. (2007).

Previous literature on learning theories in health sciences education (Aliakbari, Parvin, Heidari, & Haghani, 2015; Lavoie et al., 2018; Mann, 2011; Torre et al., 2006) mostly presented theories and models from the field of education. This review highlights several other disciplinary frameworks underlying various SoTL initiatives. For example, health sciences theories and models (nursing, psychology, social sciences, etc.) can help to structure the presentation of teaching content [e.g., models of cultural competence in Aponte (2012)]; health belief model in Blom, Wolters, Hoor-Suykerbuyk, Paassen, and Oyen (2011); or format [e.g., Ajzen's theory of reasoned action in Hardell (2011) or Carper's patterns of knowing typology in McGovern, Lapum, Clune, and Martin (2013)]. Learner assessment is often supported by theories or models in measurement and evaluation [e.g., Messick's validity framework in Baker, Ledford, Fogg, Way, and Park (2015) or Kane's validity framework in Wijnen-Meijer et al. (2013)]. Some science and technology models were retrieved for curriculum design and program evaluation (e.g., Hoover, Wong, & Azzam, 2012). Lastly, some theories from administration guided SoTL works around mentoring and leadership/administration, such as empowerment theories in Wiens, Babenko-Mould, and Iwasiw (2014). This review therefore enhances understanding of how to use theories and models from other disciplines in health education scholarship.

Besides learning about and understanding the use of theories and models in health sciences education, it is important to know how to use them. For example, "having a variety of frameworks in mind when giving feedback to residents can help preceptors gain a deeper understanding of underlying factors and provide a broader range of possible responses and interventions" (Cote &

Bordage, 2012). The general overview provided by this review will therefore foster awareness of different frameworks used in heath sciences education scholarship.

During this review, we encountered various methodological challenges. We encountered a variety of usages of "theory" and "model," including their synonyms. In fact, several frameworks retrieved in the literature as "theories" did not meet the definition established for this literature review (Bordage's broad view) because they were not predictive (e.g., adult learning theory). The same difficulty was encountered for models, since this term was also used to describe educational approaches (e.g., competency-based model); teaching strategies (e.g., one-minute preceptor model); and curriculum organizing (e.g., horizontal model, spiral model). Moreover, several synonyms used in a variable manner from one article to another to name different frameworks made the selection of articles very complex. For example, "transformative learning theory" was sometimes called "pedagogy of transformative learning" or simply "transformative learning." The Kirkpatrick framework was sometimes identified as a model (Piryani et al., 2013) and at others as a hierarchy (Hauer et al., 2012). Lastly, certain concepts referred to more comprehensive frameworks, for example the concepts of "hypothetico-deductive vs. intuitive/pattern recognition decision-making," referring to dual-process theory, or the concept of "deliberate practice," evoking Ericsson's expertise theory (Ericsson, Krampe, & Tesch-Romer, 1993). Ambiguity, and even original authors' errors in designating the different frameworks used, made selecting articles for this literature review even more complex. Some relevant frameworks may therefore not have been selected given the difficulty in deciding whether they met the definition set out above.

This literature review has certain limitations. First, given the magnitude of the literature in health sciences education, this review focused on articles spanning a period of five years, thus making it possible to identify the frameworks recently in use. As such, certain very relevant frameworks applied in the literature of previous years may have been omitted. In addition, many articles using frameworks that did not meet our definition of theory or model had to be excluded despite their potential relevance. The selection process (title and abstract screening) may have excluded articles which did not report their framework in the abstract; however, this methodology is in line with Cochrane Collaboration Group recommendations. Furthermore, each abstract was reviewed by three authors to ensure consensus around framework extraction. Thirdly, it may have been useful if, in addition to enumerating current frameworks used in health education scholarship, this review assessed the quality or relevance of the retrieved frameworks. However, this would require a different design as a second phase of the project. Lastly, some frameworks used more frequently than others could point to specific disciplinary biases. Similarly, theories and models that have not yet been used in health sciences education and therefore not identified by this research strategy may in fact be useful for SoTL projects in health sciences education. Despite such limitations, this review is the first to explore how theories and models are used in health sciences education scholarship.

In conclusion, this literature review made it possible to create a structured repertory of theories and models recently used in health sciences education. The repertory was used locally to develop a graduate level training module on reference frameworks in health sciences education in order to guide student learning. The repertory will also help guide faculty members with less experience in education by giving them examples of frequently used frameworks for various types of SoTL projects. Finally, this review emphasizes that clinical teachers and educators should choose and clearly present theories or models that are appropriate for the type of educational scholarship they are conducting.

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# Appendix A
# Search Strategy

| Pubmed |
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| "Models, Theoretical"[Majr] OR theor*[Title/Abstract] OR model*[Title/Abstract] OR conceptual*[Title/Abstract] OR framework*[Title/Abstract]<br><br>AND<br><br>"Education, Professional/instrumentation"[Mesh] OR "Education, Professional/methods"[Mesh] OR "Education, Professional/organization and administration"[Mesh] OR "Education, Professional/standards"[Mesh] OR "Education, Professional/trends"[Mesh]<br><br>AND<br><br>"Health Occupations/education"[Mesh] OR doctor*[Title/Abstract] OR physician*[Title/Abstract] OR nurs*[Title/Abstract] OR pharmac*[Title/Abstract] OR occupational therap*[Title/Abstract] OR physical therap*[Title/Abstract] OR physiotherap*[Title/Abstract] OR dentist*[Title/Abstract] OR medical personnel[Title/Abstract] or medical provider*[Title/Abstract] OR medical professional*[Title/Abstract] OR allied health*[Title/Abstract] OR non physician clinician*[Title/Abstract] OR audiolog*[Title/Abstract] OR speech-language patholog*[Title/Abstract] OR rehabilitation [Title/Abstract] OR dieteti*[Title/Abstract] OR optometr*[Title/Abstract] OR podiatr*[Title/Abstract] OR psycholog*[Title/Abstract] OR chiropract*[Title/Abstract] OR public health professional*[Title/Abstract] OR midwi*[Title/Abstract] OR acupunct*[Title/Abstract] OR osteopath*[Title/Abstract] OR physician assistant*[Title/Abstract]<br>OR doctor assistant*[Title/Abstract] OR doctor's assistant*[Title/Abstract]<br><br>NOT<br><br>Editorial[pt] OR Letter[pt] OR Case Reports[pt] OR Comment[pt] |

| CINAHL |
| --- |
| MH "Theory+" OR TI theor* OR TI model* OR TI conceptual* OR TI framework* OR AB theor* OR AB model* OR AB conceptual* OR AB framework*<br><br>AND<br><br>MH "Education+"<br><br>AND<br><br>MH ("Health Occupations+/ED") OR TI doctor* OR TI physician* OR TI nurs* OR TI pharmac* OR TI occupational therap* OR TI physical therap* OR TI physiotherap* OR TI dentist* OR TI medical personnel or TI medical provider* OR TI medical professional* OR TI allied health* OR TI non physician clinician* OR TI audiolog* OR TI speech-language patholog* OR TI rehabilitation OR TI dieteti* OR TI optometr* OR TI podiatr* OR TI psycholog* OR TI chiropract* OR TI public health professional* OR TI midwi* OR TI acupunct* OR TI osteopath* OR TI physician assistant* OR TI doctor assistant* OR TI doctor's assistant* OR AB doctor* OR AB physician* OR AB nurs* OR AB pharmac* OR AB occupational therap* OR AB physical therap* OR AB physiotherap* OR AB |

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| dentist* OR AB medical personnel or AB medical provider* OR AB medical professional* OR AB allied health* OR AB non physician clinician* OR AB audiolog* OR AB speech-language patholog* OR AB rehabilitation OR AB dieteti* OR AB optometr* OR AB podiatr* OR AB psycholog* OR AB chiropract* OR AB public health professional* OR AB midwi* OR AB acupunct* OR AB osteopath* OR AB physician assistant* OR AB doctor assistant* OR AB doctor's assistant* |

| **ERIC (1913 à 2015)** |
|---|
| Theories OR Models OR TI theor* OR TI model* OR TI conceptual* OR TI framework* OR AB theor* OR AB model* OR AB conceptual* OR AB framework* |
| AND |
| Medical education OR Health education |
| AND |
| Health occupations OR Health personnel OR OR TI doctor* OR TI physician* OR TI nurs* OR TI pharmac* OR TI occupational therap* OR TI physical therap* OR TI physiotherap* OR TI dentist* OR TI medical personnel or TI medical provider* OR TI medical professional* OR TI allied health* OR TI non physician clinician* OR TI audiolog* OR TI speech-language patholog* OR TI rehabilitation OR TI dieteti* OR TI optometr* OR TI podiatr* OR TI psycholog* OR TI chiropract* OR TI public health professional* OR TI midwi* OR TI acupunct* OR TI osteopath* OR TI physician assistant* OR TI doctor assistant* OR TI doctor's assistant* OR AB doctor* OR AB physician* OR AB nurs* OR AB pharmac* OR AB occupational therap* OR AB physical therap* OR AB physiotherap* OR AB dentist* OR AB medical personnel or AB medical provider* OR AB medical professional* OR AB allied health* OR AB non physician clinician* OR AB audiolog* OR AB speech-language patholog* OR AB rehabilitation OR AB dieteti* OR AB optometr* OR AB podiatr* OR AB psycholog* OR AB chiropract* OR AB public health professional* OR AB midwi* OR AB acupunct* OR AB osteopath* OR AB physician assistant* OR AB doctor assistant* OR AB doctor's assistant* |

| **PsychINFO** |
|---|
| OR (Index Terms:("Theories") OR Index Terms:(" Models ")) OR (Title:(theor* OR model* OR conceptual* OR framework*) OR Abstract:(theor* OR model* OR conceptual* OR framework*)) |
| AND |
| Index Terms:("Curriculum") OR Index Terms:("Education") OR Index Terms:("Educational Administration") OR Index Terms:("Educational Diagnosis") OR Index Terms:("Educational Measurement") OR Index Terms:("Educational Objectives") OR Index Terms:("Educational Programs") OR Index Terms:("Educational Quality") OR Index Terms:("Health Personnel") OR Index Terms:("Higher Education") OR Index Terms:("Nursing Education") OR Index Terms:("Teaching") OR Index Terms:("Teaching Methods") OR Index Terms:("Theories of Education") |
| AND |
| Index Terms:("Health Personnel") OR Title:(doctor* OR physician* OR nurs* OR pharmac* OR occupational therap* OR physical therap* OR physiotherap* OR dentist* OR medical personnel or medical provider* OR medical professional* OR allied health* OR non physician clinician* OR |

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| audiolog* OR speech-language patholog* OR rehabilitation OR dieteti* OR optometr* OR podiatr* OR psycholog* OR chiropract* OR public health professional* OR midwi* OR acupunct* OR osteopath* OR physician assistant* OR doctor assistant* OR doctor's assistant*) OR Abstract:(doctor* OR physician* OR nurs* OR pharmac* OR occupational therap* OR physical therap* OR physiotherap* OR dentist* OR medical personnel or medical provider* OR medical professional* OR allied health* OR non physician clinician* OR audiolog* OR speech-language patholog* OR rehabilitation OR dieteti* OR optometr* OR podiatr* OR psycholog* OR chiropract* OR public health professional* OR midwi* OR acupunct* OR osteopath* OR physician assistant* OR doctor assistant* OR doctor's assistant*) |

# Appendix B
## Theories and Models from the Field of Education Used in Health Sciences Education

| | Articles Using the Framework (N) | | | | | | | | | | | Context of Scholarship of Teaching and Learning for Each Framework (N) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Theories/models | Medicine | Nursing | Pharmacy | Rehabilitation | Dentistry | Public health | Health education specialists | Osteopathy | Others | Interprofessional | N/S | Teaching | Curriculum development | Needs assessment / Objectives | Implementation | Program evaluation | Mentoring | Leadership | Learner assessment | Other |
| **Behaviourism** | | | | | | | | | | | | | | | | | | | | |
| Behaviourism (general) | 5 | 3 | 0 | 0 | 0 | ? | ? | ? | 0 | 0 | 0 | 5 | 3 | 0 | 3 | 0 | 0 | 0 | 1 | 1 |
| Mastery learning (Bloom, 1968) | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 1 | 4 | 3 | 0 | 0 | 1 | 0 |
| Self-efficacy theory (Bandura, 1977a) | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 1 | 2 | 0 | 1 | 2 | 0 |
| Social learning theory/Social cognitive theory (Bandura, 1977b) | 4 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 4 | 5 | 0 | 3 | 3 | 3 | 2 | 1 | 0 |

| **Cognitivism** | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cognitivism (general) | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 6 | 2 | 0 | 3 | 0 | 0 | 0 | 1 | 0 |
| 5E learning cycle model (Jun, Lee, Park, Chang, & Kim, 2013) | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Cognitive continuum theory (Hammond, Hamm, Grassia, & Pearson, 1987) | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cognitive load theory (Sweller, 1988) | 9 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 7 | 6 | 0 | 4 | 4 | 0 | 0 | 0 | 1 |
| Cognitive theory of multimedia learning (Yue, Kim, Ogawa, Stark, & Kim, 2013) | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | **2** | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Dual-process theory (James, 1950); pattern-recognition/Aunt Minnie ([Anonymous], 1987; Barondess, 1986; Sackett, Haynes, & Tugwell, 1985) | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 8 | 6 | 0 | 0 | 2 | 0 | 0 | 1 | 0 |
| Information processing theory (Durning & Artino, 2011) / cognitive processing theory (Calhoun, 2012) | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Instructional design model (Gagne, Briggs, & Wager, 1992) | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 |
| Meaningful learning (Ausubel, 1963) | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Model of the reflective process (Boud, Keogh, & Walker, 1987) | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | **2** | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| One-minute preceptor (Neher et al., 1992) | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Taxonomies of cognitive domain (Bloom et al., 1956) | 3 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 3 | 3 | 4 | 3 | 0 | 0 | 1 | 0 |
| Theory of expertise and deliberate practice (Ericsson et al., 1993) / Expert-Performance approach (Ericsson, 2015) / Proficiency-based learning (Thinggaard et al., 2016) | 13 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 2 | 0 | 2 | 1 | 0 | 0 | 2 | 2 |
| Theory of structural semantics (Bordage & Lemieux, 1986) | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Humanism** | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Humanism (general) | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Achievement goal theory / goal orientation theory, Imogene King's Theory of Goal Attainment (I. King, 1992) | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 1 | 1 | 0 | 1 | 0 | 0 | 1 |
| Andragogy/adult learning (Knowles, 1975)/ self-directed learning (Knowles, 1975) | 21 | 14 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 20 | 13 | 1 | 11 | 6 | 0 | 0 | 2 | 3 |
| Expectancy theory (of motivation) (Vroom, 1964) | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| Experiential learning (Kolb, 1984), Baker's four-step model (C. Baker, 1996) | 14 | 13 | 0 | 1 | 2 | 0 | 0 | 0 | 1 | 2 | 1 | 19 | 14 | 0 | 9 | 9 | 0 | 0 | 2 | 0 |
| Grow's model of self-directed learning (Grow, 1991) | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| Learner-centered approach (C. R. Rogers, 1969), Weimer's dimensions of student-centred teaching (Weimer, 2002) | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Learning engagement model (Guthrie & Wigfield, 2000) | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reflective practice, reflective thinking (Boud et al., 1987; Kolb, 1984; Mezirow, 1991; Moon, 2004; Schön, 1983) | 4 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 5 | 2 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| RESPOND: Reflection in the Education and Socialization of Practitioners: Novice Development (Ng, 2011) | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Self-authorship theory (Kegan, 1995; Magolda, 2001) | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Self-determination theory (Ryan & Deci, 2000) | 7 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 4 | 5 | 4 | 1 | 2 | 0 | 2 | 1 | 3 |
| Self-regulation theory (Zimmerman, 1986) | 8 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 6 | 3 | 0 | 1 | 4 | 1 | 0 | 0 | 0 |
| Service learning (Bailey, Carpenter, & Harrington, 2002) | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| SNAPPS (Wolpaw et al., 2003) | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Test-enhanced learning (TEL) / model of the pre-assessment learning effects of consequential assessment (F. Cilliers, Schuwirth, & Vleuten, 2012) | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| Transformative learning (Mezirow, 1990) | 5 | 11 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 6 | 9 | 3 | 3 | 6 | 1 | 0 | 0 | 0 |

| **Constructivism / Socio-constructivism** | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Constructivist theory (general) | 6 | 12 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 12 | 10 | 1 | 6 | 5 | 0 | 0 | 2 | 0 |
| Cognitive apprenticeship (Collins, 2005) / Situated cognition theory (Brown, Collins, & Duguid, 1999) | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| Communities of inquiry (Garrison, Anderson, & Archer, 2000) | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Communities of practice (Lave & Wenger, 2002) | 8 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 6 | 3 | 0 | 2 | 4 | 0 | 0 | 0 | 1 |
| Connectivism (Siemens, 2005) | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Contemporary workplace learning theory (Billett, 2002) and models of workplace learning (Symes & McIntyre, 2000) | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Critical thinking stage theory (Elder & Richard, 1996) | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Fife Interprofessional Clinical Skills Model (O'Carroll, Braid, Ker, & Jackson, 2012) | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Models of skill acquisition (Benner, 1984; Dreyfus & Dreyfus, 1986; Fitts & Posner, 1967) | 4 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 2 | 0 | 2 | 1 | 0 | 0 | 4 | 0 |
| Online Collaborative Learning Theory (Harasim, 2012) | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| Pyramid of clinical competence (Miller, 1990) | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 6 | 7 | 1 | 1 | 1 | 0 | 0 | 8 | 0 |
| Situated learning / Situativity theory (Lave & Wenger, 1991) (situativity theory includes situated cognition, situated learning, ecological psychology, and distributed cognition according to Durning and Artino (2011)) | 8 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 9 | 6 | 1 | 4 | 1 | 0 | 0 | 1 | 1 |
| Three-stage theory of motor skill acquisition (Fitts & Posner, 1967) | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Zone of proximal development / Social learning / Socio-cultural (Vygotsky, 1978) | 13 | 2 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 10 | 7 | 0 | 3 | 3 | 0 | 0 | 1 | 3 |
| **Design-based frameworks** | | | | | | | | | | | | | | | | | | | | |
| 6-step model for curriculum development (Kern et al., 2009) | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 5 | 3 | 0 | 0 | 0 | 0 |
| ADDIE model (Dick, Carey, & Carey, 2005) | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 3 | 2 | 0 | 0 | 1 | 0 |
| Context-relevant curriculum development model (CrCD) (Iwasiw et al., 2009) | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **2** | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Four-Component Instructional Design (4C/ID) (van Merrienboer, Clark, & de Croock, 2002) | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 3 | 1 | 0 | 0 | 0 | 0 |
| Jeffries simulation framework (Jeffries, 2005) | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 0 | 2 | 3 | 0 | 0 | 0 | 0 |

# Appendix C
## Theories and Models from Health Disciplines Used in Health Sciences Education

| | Articles Using the Framework (N) | | | | | | | | | | | Context of Scholarship of Teaching and Learning for Each Framework (N) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Theories/models | Medicine | Nursing | Pharmacy | Rehabilitation | Dentistry | Public health | Health education | Osteopathy | Others | Interprofessional | N/S | Teaching | Curriculum development | Needs assessment / Objectives | Implementation | Program evaluation | Mentoring | Leadership | Learner assessment | Other |
| **Medicine** | | | | | | | | | | | | | | | | | | | | |
| Patient-centered approach (Stewart, 1995) | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| International classification of function, disability, and health (World Health Organization, 2001) | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Four Habits Model (Stein, Frankel, & Krupat, 2005) | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| **Nursing** | | | | | | | | | | | | | | | | | | | | |
| Patterns of knowing typology (Carper, 1978) | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Interpersonal relations theory (Peplau, 1952) | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Theory of health as expanding consciousness (Newman, 1994) | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Occupational therapy** | | | | | | | | | | | | | | | | | | | | |
| European conceptual framework for occupational therapy | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Psychology** | | | | | | | | | | | | | | | | | | | | |
| Theory of planned behaviour (Ajzen, 1991) | 5 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 2 | 0 | 2 | 2 | 0 | 0 | 2 | 0 |
| Theory of reasoned action (Ajzen, 2011) | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 |
| Health belief model (Rosenstock, 1974) | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 |
| Transtheoretical Model of Change (Prochaska & DiClemente, 1984) | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 |
| Contact theory (Allport, 1954) | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Team Effectiveness Conceptual Model (Kozlowski & Ilgen, 2006) | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Hierarchy/theory of needs (A. H. Maslow, 1970) | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Psychodynamic theory | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Social sciences** | | | | | | | | | | | | | | | | | | | |
| Model of cultural competence (Campinha-Bacote, 2002), Tool for Assessing Cultural Competence Training (TACCT) model ( Association of American Medical Colleges, 2005), Theoretical frameworks of cultural competency training (Price et al., 2005) | 3 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 6 | 0 | 3 | 3 | 0 | 1 | 0 | 0 |
| Activity theory (Engeström, 1987) | 8 | 5 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 7 | 5 | 1 | 2 | 2 | 0 | 0 | 1 | 1 |
| Diffusion of Innovations theory (E. Rogers, 2003) | 1 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 1 | 5 | 3 | 0 | 0 | 0 | 0 |
| Theoretical framework of practice theory (Bourdieu, 1977) | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Critical theories (Archer, Bhaskar, Collier, Lawson, & Norrie, 1998; Habermas, 2002) | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Actor-Network theory (Latour, 1997) | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **Health – other** | | | | | | | | | | | | | | | | | | | |
| Interprofessional alliance model (Lancken & Levenhagen, 2014) | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

# Appendix D
## Theories and Models from Other Disciplines Used in Health Sciences Education

| | Articles Using the Framework (N) | | | | | | | | | | | Context of Scholarship of Teaching and Learning for Each Framework (N) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Theories/models | Medicine | Nursing | Pharmacy | Rehabilitation | Dentistry | Public health | Health education | Osteopathy | Others | Interprofessional | N/S | Teaching | Curriculum | Needs assessment / Objectives | Implementation | Program evaluation | Mentoring | Leadership | Learner assessment | Other |
| **Administration/marketing** | | | | | | | | | | | | | | | | | | | | |
| Challenge model (Mansour, Vriesendorp, & Ellis, 2005) | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Four-frame model for mapping the political terrain, framework of functions (Bolman & Deal, 1991) | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| Structural theory (reference not mentioned) | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Theory of action (Argyris & Schon, 1974) | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Theory of structural empowerment (Kanter, 1993), Spreitzer's psychological empowerment theories (Spreitzer, 1995), personal and organizational empowerment (Kanter, 1993) | 1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 2 | 1 | 1 | 0 |
| **Arts** | | | | | | | | | | | | | | | | | | | | |
| Aesthetic theories (Baruch, 2013; Dewey, 1980; Heidegger, 1971) | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Measurement and evaluation** | | | | | | | | | | | | | | | | | | | | |
| CIPP (Sufflebeam, 2003) | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 3 | 0 | 0 | 6 | 0 | 0 | 0 | 0 |
| Domains of evaluation (Hakkennes & Green, 2006) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Force field analysis (Lewin, 1943) | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Kane's validity framework (Kane, 2013) | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 3 | 0 | 1 | 2 | 0 | 0 | 5 | 0 |
| Kirkpatrick's hierarchy (Kirkpatrick, 1994) | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 5 | 0 | 1 | 10 | 0 | 0 | 1 | 0 |
| Logic models (Frechtling, 2007) | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 2 | 1 | 0 | 3 | 0 | 0 | 0 | 0 |
| Messick's validity framework (Messick, 1989) | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 4 | 0 |
| Psychometric theories (classical test theory (Novick, 1966), generalisability theory (Cronbach, Gleser, Nanda, & Rajaratnam, 1972), item response theory (Lord, 1980) | 8 | 3 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 10 | 0 |

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| **Sciences** | | | | | | | | | | | | | | | | | | | | |
| Complexity theory / Systems theory / Complex adaptive systems theory (P. Cilliers, 1998) | 3 | 8 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 7 | 3 | 0 | 1 | 2 | 0 | 2 | 2 | 0 |
| Ecological frameworks (Dahlgren & Whitehead, 1991; Krieger, 2003; McLeroy, Bibeau, Steckler, & Glanz, 1988) | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 0 |
| Theory of fuzzy sets (Zadeh, 1965) | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Theory on Systems Perspective (Csikszentmihalyi, 1996) | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unified theory of acceptance and use of technology (Venkatesh, Morris, Davis, & Davis, 2003) | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 1 | 0 |
| **Research frameworks** | | | | | | | | | | | | | | | | | | | | |
| Description-Justification-Clarification framework (Schmidt, 2005) | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Research compass model (Ringsted, Hodges, & Scherpbier, 2011) | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |