Providing the meta-model of development of competency using the meta-ethnography approach: Part 2. Synthesis of the available competency development models

Shahram Yazdani, MD[1]; Somayeh Akbari Farmad, PhD[1*]

[1] School of Medical Education Sciences, Shahid Beheshti University of Medical Sciences, Tehran, Iran

Abstract

Background and Purpose: Considering the importance and necessity of competency-based education at a global level and with respect to globalization and the requirement of minimum competencies in medical fields, medical education communities and organizations worldwide have tried to determine the competencies, present frameworks and education models to respond to be sure of the ability of all graduates. In the literature, we observed numerous competency development models that refer to the same issues with different terminologies. It seems that evaluation and synthesis of all these models can finally result in designing a comprehensive meta-model for competency development.

Methods: Meta-ethnography is a useful method for synthesis of qualitative research that is used to develop models that interpret the results in several studies. Considering that the aim of this study is to ultimately provide a competency development meta-model, in the previous section of the study, the literature review was conducted to achieve competency development models. Models obtained through the search were studied in details, and the key concepts of the models and overarching concepts were extracted in this section, models' concepts were reciprocally translated and the available competency development models were synthesized.

Results: A presentation of the competency development meta-model and providing a redefinition of the Dreyfus brothers model.

Conclusions: Given the importance of competency-based education at a global level and the need to review curricula and competency-based curriculum design, it is required to provide competency development as well as meta-model to be the basis for curriculum development. As there are a variety of competency development models available, in this study, it was tried to develop the curriculum using them.

Keywords: Meta-ethnography, Competency development, Meta-model, Qualitative synthesis

Journal of Medical Education Summer 2016; 15(3):157-70

Introduction

The literature review of the past decades reflects a definite global movement to competency-based education and assessment of outcomes. This type of education is so much important that organizations, such as ACGME and Royal College of physician and surgeon of Canada, are ready to introduce the competency-based education as an accreditation standard in the near future with Can MEDS 2015 project (1).

Our country was also not exceptional on the movement towards competency-based education and the need to revise the competency-based curriculum design is strongly felt. This issue is so important that it has been reflected in the section 13 of "general health policies" that has recently been focused by the supreme leader of the Islamic Republic.

Given the importance of competency-based education and the need to revise the curriculum based on it, a question arises here: "Is there a comprehensive model that can be

∗**Corresponding author:** Somayeh Akbari Farmad, PhD; School of Medical Education Sciences, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
Email: Akbarifs1@mums.ac.ir

drawn for the development of competency for designing a new curriculum?"

Considering the clarification of importance and necessity of competency-based education at a global level and considering the globalization and requirement of minimum competencies in medical fields, medical education communities and organizations worldwide have tried to determine the competencies, present frameworks and education models to respond to the way we can be sure of the ability of all graduates.

Considering the literature, we observed numerous competency development models that refer to the same issues with different terminologies. It seems that evaluation and synthesis of all these models can finally result in designing a comprehensive meta-model for competency development.

Methods

Meta-ethnography is a useful method for the synthesis of qualitative research that is used to develop models that interpret the results in several studies. This method provides an alternative to aggregate synthesis methods, which includes induction and interpretation. Like many of synthesis, translation of studies encourages researchers to understand and convey ideas, concepts, and metaphors in different studies and this reciprocal translation aspect distinguishes meta-ethnography from traditional methods. Since the reciprocal translation allows comparisons between different studies, they must show the relationships between concepts. This recipro-cal translation can be a literal and word-by-word translation, or idiomatic, which main-tains the original text's meaning. Meta-ethnography has a special emphasis on preserving original meaning. Data interpreta-tion and synthesis in preliminary studies are considered as data and are translated in several studies (2-4).

Seven steps of meta-ethnography study (Noblit and Hare)

1. getting started
2. Deciding what is relevant to the initial interest
3. Reading the studies
4. Determining how the studies are related
5. Translating studies into one another
6. Synthesizing translations
7. Expressing the synthesis

Considering that the aim of this study is to ultimately provide a meta-model of competency development in the previous section of the study, the literature review was conducted to achieve competency develop-ment models. Models, obtained by the search, were studied in details; first, the models described by provider(s) were studied, then, each of the models was studied. A re-search was conducted to access available critical texts about each model and at this stage a detailed study was also conducted and criticisms were included in the study as criticism of others. In later stages, the researchers provided their own criticism to the model; in the second part of the study, researchers collected key concepts of each model in a table to determine the overarching concepts based on them; ultimately, based on the reciprocal translation, analytical models of criticism to competency development models were reciprocal translated and genericized and then line of argument synthesize between genericized models were conducted and competency development meta-model was provided.

Results

Step 4) Determine how models are related to each other: To determine how studies are related to each other, Noblit and Hare have proposed that a list of themes and metaphors should be created and it should be determined how they are related to each other (in fact, the reducing themes relevant to the category, which provides the basis for reciprocal translation) (2).

Simultaneous to assessing models (The Dreyfus brothers model (5), Cheetham & Chivers model (6),Yielder model (7), Dall,

Table 1. The key concepts of the analyzed models

Dreyfus(D) (1980)	**Collins (C) (2007)**	**Kinchin & Cabot (KC) (2010)**
Developmental stages(D)	Ladder (C)	Competing Chains (KC)
Novice(D)	Interactive Ability (C)	Nets (KC)
Competent(D)	Reflective Ability (C)	Competency (KC)
Proficient(D)	Ubiquitous tacit Knowledge (C)	Understanding (KC)
Expert(D)	Specialist tacit Knowledge (C)	Transition (KC)
Master(D)	Beer-mat Knowledge (C)	Purposeful oscillation(KC)
Skill level(D)	Popular Understanding (C)	Combination and creating (KC)
Mental function(D)	Primary Source Knowledge (C)	Competing and selection(KC)
Analytical(D)	Interactional Expertise (C)	Embedding (KC)
Intuitive(D)	Contributory Expertise (C)	
Recollection(D)		
Rule, Guideline, Maxim, Aspect (D)	Enculturation (C)	
Holistic and Intuitional Decision (D)		
Skill acquisition(D)		
Holistic and Intuitional Recognition(D)		
Situational(D)		
Garrett (Ga) et al. (2009)	**Dall, Alba & Sandberg (DS) (2006)**	**Yielder (Y) (2004)**
Dimension(Ga)	Embodied understanding of practice(DS)	Professional practice (Y)
Socio-technical perspective (Ga)	Skill progression (DS)	Cognitive processes (Y)
Subject matter(Ga)	Development trajectories (DS)	Knowledge based (Y)
Situational context(Ga)		Internal integrative processes (Y)
Interface tools(Ga)		Interpersonal relationship (Y)
Expert identification (Ga)		
Communication skill (Ga)		
Grenier & Kehrhahn (GK) (2008)	**Cheetham & Chiver (CH) (1996)**	
Contextual factors (GK)	Meta-competenc(CH)	
State (GK)	Trans-competency (CH)	
Dependence (GK)	Super-meta (CH)	
Independence (GK)	Functional competency (CH)	
Transcendence (GK)	Personal / behavioral competency (CH)	
Dynamic nature of expertise (GK)	Knowledge/cognitive competency (CH)	
Territory of expertise(GK)	Values/ethical competency(CH)	
Constituency(GK)	Professional competency(CH)	

Content(GK)	Context(CH)
Environment(GK)	Environment(CH)
Changes(GK)	

Alba & Sandberg's model (8), Collins &Evans model (9), Kinchin & Cabot model (10), Kehrhahn & Grenier model (11), and Garrett model (12), and extraction of first, second and third order construct, the models were carefully studied and key terms and concepts have been prepared for each model and it was tried to provide the necessary explanation regarding each of these concepts. In the next step, overarching concepts were specified based on the key concepts to provide a basis for reciprocal translation. In the following, the key concepts of models were derived at the same time of studying them are presented in table 1.

Step 5) translating studies into one another: In this stage, the concepts extracted in the previous step were compared with each other. In fact, concepts of models were compared with each other, such that concepts of the first model with the second model and then the result of the synthesis of these two models were compared with the third model and so on.

In this step, models were compared and it was sought to adapt the concept of a model with the concepts of the other model to ensure that a key and generic concept contain similar key concepts; in summary, at this stage, generic concepts were extracted from key concepts of models, translated, and models were genericized based on these concepts.

Extracting the Overarching concepts

Genericizing the analytic models based on overarching concepts and line of argument synthesis of models:

Genericizing the analytic models in this step was based on overarching concepts so that these baseline models are provided for synthesis and competency development model.

Step 6) Synthesis of translations: In the same way, a primary study might move from descriptive to explanatory analysis, a meta-ethnography can proceed from reciprocal translation to a higher order interpretation, which distils the translations into more than the parts alone imply – a "line of argument" synthesis. The method that different people have achieved at synthesized translation varies. There appears to be a general acceptance that the synthesis process, not unlike analysis in primary in qualitative research, "cannot be reduced to mechanistic tasks" and may, in practice, be difficult to replicate. In this step, analytical models, which were translated based on generic concepts and, in fact, genericizing has been processed according to these concepts, have been discussed, merged, and used for the line of argument synthesis and thus the compe-tency development meta-model was provided. Before presenting the final competency development meta-model, it is necessary to mention the relationship between competency and meta-competency and different types of possible cases of the relationship between these two concepts and explain the module considered by researchers and accepted as a mind frame, and the model is presented based on that framework.

Discussion

The original pre-assumption of model, the relationship between competency and meta-competency: For the relationship between competency and meta-competency, 4 models can be considered, as follows:

Model No.1: In this model, promotion and development of function levels require compe-tency development. In this model, meta-competency is included as subclass of such competency, like the one ACGME and Winterton provided.

Model No.2: In this model, promotion and development of function levels require simultaneous development of competencies and meta-competency; this model was our pre-assumption in the relationship between

Table 2. Overarching concepts

Concept	Overarching concept	
Developmental stages(D) Development trajectories(DS) Skill level(D) Ladder(C) States(GK)(Dependence, Independence, Transcendence)	Performance Level (Incompetent, Novice, Advanced Beginner, Competent, Proficient, Expert, Master)	
Knowledge based(Y) Subject matter (Ga) Knowledge/cognitive competence(CH)	Acquisition of Codified Knowledge (Background Basic, Background Clinical, Foreground)	
Competing Chains (KC) Nets(KC) Chains(KC) Recurrent meaningful component pattern (D)	Structure of Codified Knowledge (Reduced, Dispersed, Causal, Elaborated Causal, Scheme, Script)	
Embodied understanding of practice(DS) Understanding (KC) Competing Chains (KC) Nets(KC)	Understanding	
Competence(KC) Chains(KC)	Competence	
Competence[1](DS)	competency	
Analytical principles(rule, guideline, maxim)(D)	Rule based mode	Dominant mode of reasoning
Analytical decision (D) Decomposed recognition(D)	Analytical mode	
intuitional decision (D) Holistic recognition(D)	intuitional mode	
Beer mat knowledge Popular Understanding Primary Source Knowledge	Ubiquitous T.K.	Acquisition of Tacit Knowledge
Interactional Expertise (C) Enculturation (C)	Social T.K.	
Contributory Expertise (C)	Technical T.K.	
Interpersonal relationship(Y) Communication skill (Ga) Interactive Ability (C) Personal or behavioral competence (CH) Values/ethical competence (CH) Trans- competency (CH) Expert identification (Ga)	Enabling competency	
Functional competence (CH)	Technical competency	
-	Reasoning Method(Guessing, Simple Heuristics, Hypothetical	

	Deductive, Scheme Inductive, Pattern Recognition)[2]
-	Development of enabling competencies[3] -
Situational context (Ga) Environment (GK) Contextual factors (GK) Context free feature, context dependent, whole situations (D) Situational & non-situational recollection (D) Change (GK) Socio-technical perspective (Ga) Constituency (GK) Content (GK) Territory of expertise (GK)	Experience (Routine Simple, Routine Complex, Non-routine Complex)
Meta- competency(CH) Reflection (Y) (CH) Self-development (Y) Information flow path expertise(Ga) Trans- competency (CH) Interface tools(Ga)	Meta-competencies
Professional practice (Y) Purposeful oscillation between knowledge structure(KC) highly developed and integrated nets of understanding(KC) accommodation of competing chains of understanding and the selection of appropriate chains to suit particular contexts(KC) smoothness of transition between the two knowledge structure(KC) Skill acquisition(D) Skill progression (DS) Professional competence(CH) availability of multiple representations of knowledge(KC)	expertise
Mental function(D) Cognitive processes(Y)	Acquisition and reorganization of Codified Knowledge/Acquisition of Tacit Knowledge/ development of Reasoning Method
Self-perception(CH)[4]	-

[3]It has to be mentioned that competence concept in Alba and Sandberg's model means the competency, which has been mistakenly used.

[4]As none of the models has directly mentioned the reasoning methods, we provided the required information in our model in this section based on Harasim model.

[5]Presentation of development steps of this competence was based on ACGME milestones.

[6]This concept has been considered in professional identity and is not included in competence development model.

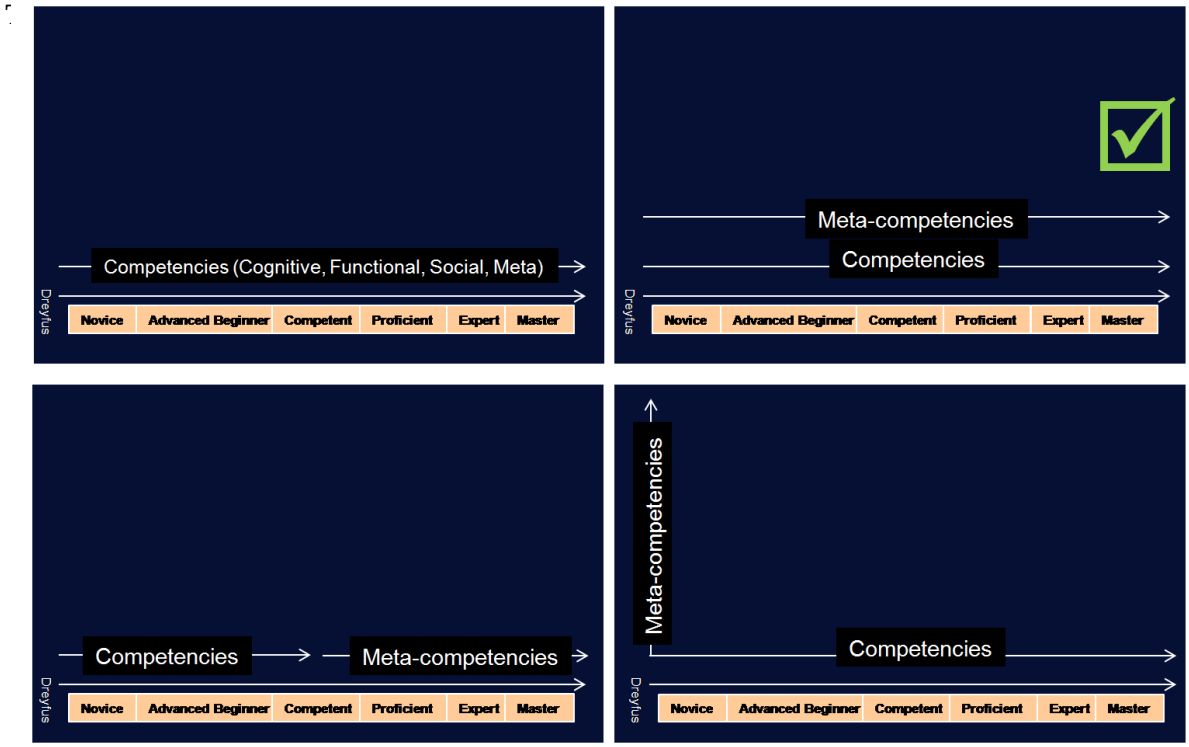


Figure 1. The various types of association between competency and meta-competency.

competency and meta-competency, upon which we also established our model that development of competencies and meta-competencies are performed parallel with each other at the same time.

❖ **Model No. 3:** In this model, the promotion and development of function levels (practice) require the development of competencies and after completion of competency development, it requires meta-competency development to achieve higher functional levels of competency development. In this model, development of competencies and meta-competency are considered consecutively.

❖ **Model No.4:** In this model, the highest level of performance (practice) is achieved through development of competency; developments of meta-competency also develop meta-function (meta-practice). As observed in the model, competencies and meta-competencies are displayed as two-dimensional.

Conclusion

Step 7) Describe the meta-model resulting from synthesis: This step includes the publication of the results that may be provided in the form of a meta-model or comprehensive meta-theory. In this step, we will describe and clarify the competency development meta-model.

To describe the meta-model, it must be stated that we first describe the meta-model horizontally aiming to express the changes that occur during the competency development process in the development levels, and then describe the meta-model vertically and try to describe this meta-model as cuts in line with each of the functional levels aiming to clarify each of the stages in Dreyfus model and in the end, we also offer a combination of these two dimensions in a tabular format.

Description of the horizontal dimension of competency development meta-model

❖ **Functional levels:** This level includes incompetent, novice, advanced beginner, competent, proficient, expert, and master that begins with formal education starting, in accordance with the incompetent level, then the individual tries to gain authentic experience and this step is in accordance with the novice level,

and the individual proceeds with the competency development step-by-step after gaining experience and immersion at different levels by participating in community of experience, as he has achieved competent step at the time of graduation. Further development in function levels are carried out after graduation with deliberated practice and access to issues, like meta-competency.

❖ **Acquisition of Codified Knowledge:** During the process of competency development, acquisition of codified knowledge is initially as obtaining background knowledge that includes a variety of basic, mechanism, and applied knowledge, respectively, and the individual goes for foreground knowledge after acquisition of background knowledge.

❖ **The structure of codified knowledge:** During the competency development process, the codified knowledge also develops in terms of structure and organization. This structure is initially as reduced knowledge; an individual with this structure has little knowledge. In the structure of dispersed knowledge, knowledge is adequate, but superficial and dispersed. In the structure of causal knowledge, the structure of knowledge is slightly more organized and is slightly more merged because of perception of causal relations and forms as linear chains. In the structure of elaborated causal knowledge, the structure forms like this to familiarize simultaneous with knowledge mechanism and finally, in the structure of the scheme and script, the knowledge is like scheme and script network (the simplified, highly relevant, and sequential structure) that is specialized for experts.

❖ **Acquisition of tacit knowledge:** During the process of competency development, tacit knowledge is initially as ubiquitous that this kind of knowledge is obtained by all members of society in the socialization period during training and tacit knowledge that is not specialized, then

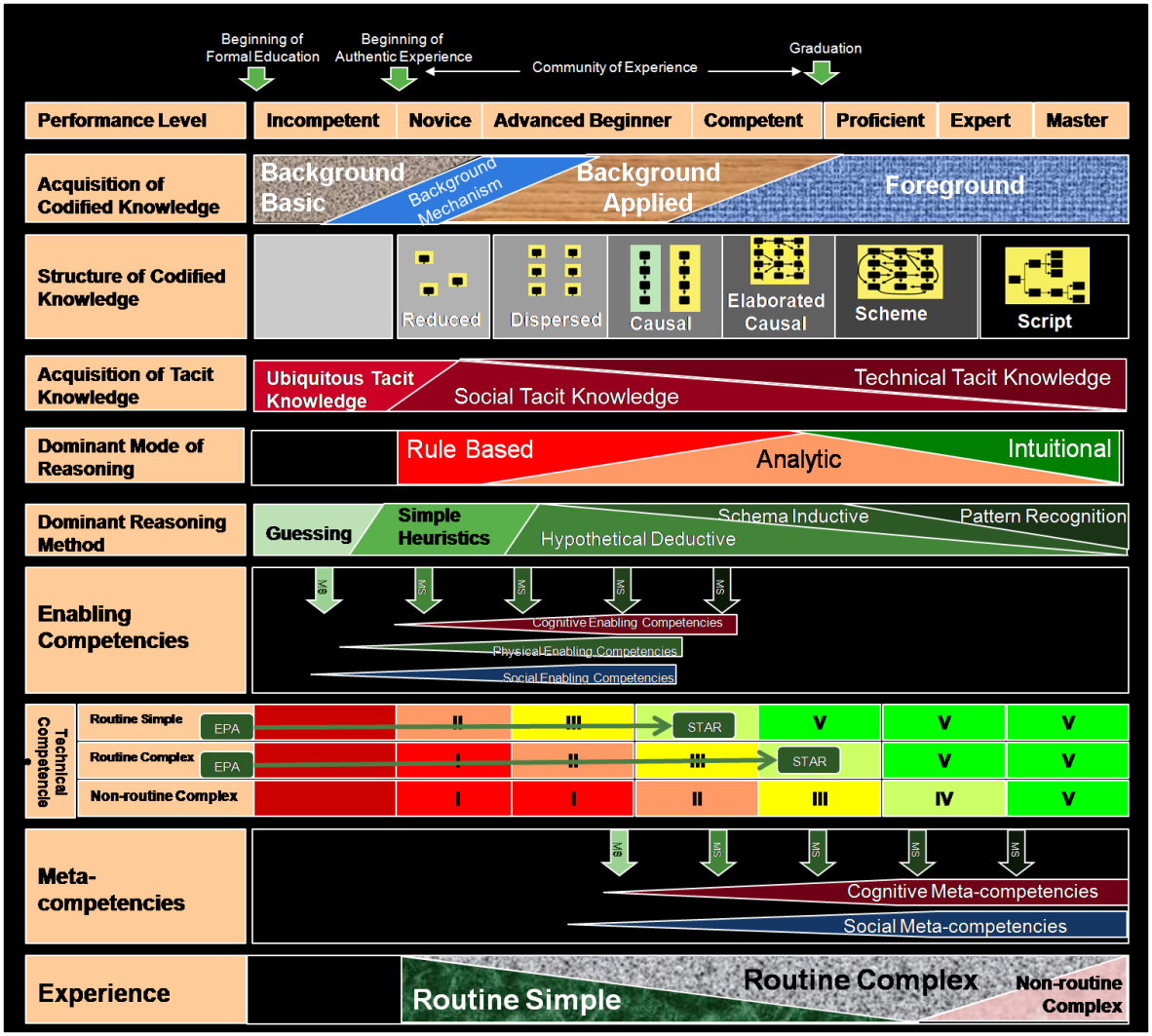


Figure 2. Meta-model of competency development.

according to the amount of experience and immersion in authentic work environments, this form of knowledge developed, which is at the beginning as social, in which the expertise and practice is associated to tacit knowledge in the language of that field and is gained through socialization in the field of language that continues as technical expertise due to hands-on experience.

❖ **The dominant mode of reasoning:** During the process of competency development, the individual acts primarily more on the basis of rules and guidelines at early stages of function levels and will gradually gain more experience with the practical experience and, at this stage, first the relevant task and situations are analyzed analytically and deals with the duty to act intuitively over time with obtaining more experience.

❖ **The dominant reasoning method:** During the process of competency development, the person primarily tries to solve the problem and reason by guessing and simple heuristic, then by hypothetic-deductive method, which is a form of backward reasoning (from recognition of assumptions towards data), causal and predictive method, in which a number of assumptions are tested and proved or disproved, then the individual reasons through scheme inductive and problem-solution question by this method of reasoning is carried out by primary information, which are used to differentiate among different conditions and priority of one condition to other conditions, with attention to existence or lack of findings; finally, the type of reasoning will be pattern recognition, a forward reasoning process (starting with observations and data and reaching diagnostic hypotheses) in the experts that are intuitive and pattern based.

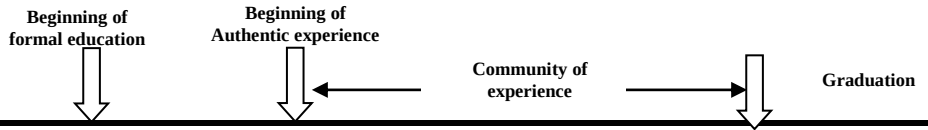
❖ **Technical competency development:** The changes explained so far will cause the individual to improve perform EPAs (units of professional practice, defined as tasks or responsibilities to be entrusted to the unsupervised execution by a trainee once he or she has attained sufficient specific competence.) in terms of entrustment levels provided by Ten Cate; the method of this development is displayed in the meta-model and these levels are presented in the table below.

❖ Regarding STAR, which is the equivalent of level IV Ten Cate, it is also necessary to explain that the learner should reach this level before graduation and represents the capability of impl-ementting independent execution. Once the person has obtained a STAR for a specific EPA, he or she is qualified to perform this activity with only background supervision.

❖ **Development of enabling competency and meta-competency:** According to what we had stated before in our pre-assumption, the promotion and development of function level require the simultaneous development of competencies (technical and enabling) and meta-competencies; their development is displayed in the form of observable development steps (milestone) that describes progress from beginner to the expected level of proficiency in the training course; the descriptions of these steps will be as follows:

MS_1: Positive Attitude toward Importance of EC (Enabling competency)/MC (Meta- competency)
MS_2: Relevant Knowledge of EC/MC
MS_3: Basic Skills of EC/MC
MS_4: Advanced Skills of EC/MC
MS_5: Integrating EC/MC with Technical Competencies

Table 4. Combination of horizontal and vertical dimensions of competency development meta-model



Performance level	Incompetent	Novice	Advanced beginner	Competent	Proficient	Expert	Master
Acquisition of codified knowledge	The person has no practical experience and is learning background basic codified knowledge.	Backgro und basic codified knowled ge is being complete	background basic and mechanism knowledge is being completed and the person is	Basic practical codified knowledge is completely learned in this step and the person learns foreground knowledge	Most of the person's learning of codified knowledge is foreground	Learning the codified knowledge is mainly foreground	

		d and the person is learning backgrou nd mechani sm	learning practical codified knowledge			
structure of codified knowledge	Background basic codified knowledge is not well-organized.	The structure of Backgro und basic codified knowled ge is reduced. In this function al level, the practical knowled ge of the person is low.	Organization of knowledge is dispersed, i.e. the practical knowledge of the person increases and is enough, but is dispersed that become more organized by obtaining more experience and identifying the causal relationship in causal chains.	Organization of knowledge has become elaborated causal net, due to learning background knowledge in the previous steps.	Organization of knowledge is formed as a schema network.	Organization of knowledge is formed as network of the simplified, highly relevant, and sequential structure
Acquisition of tacit knowledge	The type of tacit knowledge of the person is not specialist and is ubiquitous tacit knowledge, which the person learns through self-study (magazines, books, popular articles, and internet)	The person learns non-specialist ubiquito us tacit knowled ge, in addition to tacit social knowled ge, due to entering the commun ity of experien ce and interacti on with other professio nal people.	Tacit social knowledge increases and the dominant type is tacit knowledge, while the person immerse in activities, through which he obtains technical tacit knowledge, as well.	As the person is involved in activities as hands on, his technical tacit knowledge increases, as well.	Development of the technical tacit knowledge is due to obtaining much experience beside the social tacit knowledge.	Development of the technical tacit knowledge is due to obtaining much experience beside the social tacit knowledge.
Dominant mode of reasoning	-	Rule based: guideline , rule and maxim based reasonin g, has no ability to face complexi ties, and observes the tasks separatel y.	The dominant mode of reasoning is still rule based, with more experience than previous steps, and a bit analytic. Facing the complex tasks can only solve a part of the problem. He observes	The dominant mode of reasoning is analytic, the person evaluates, analyzes, and reasons all background factors, and acts not only based on rules, but also on previous experience. He is able to face complexities analysis and designing and observes the tasks as structure.	The dominant mode of reasoning is analytic-intuitional. Options further than provided tasks are observed.	The dominant mode of reasoning is intuitional. In complex cases, he can easily move in analytic and intuitional situations. All options related to the provided task are considered. He has a unique view towards the provided task.

			the tasks as a series of long steps.			
Dominant reasoning method	Guessing	Simple heuristics	Hypothetic-deductive, which is a type of backward reasoning from hypothesis design and testing it towards observation and data.	The dominant mode of reasoning is Hypothetic-deductive and schema inductive.	Considering the schema structure of knowledge, the dominant mode of reasoning is schema inductive.	Pattern recognition: the person has various schemas in mind due to great experience that tries to move forward from his data and observation towards reasoning when facing a specific case, as he matches the experienced case with the available schemas to reach reasoning.
Enabling competencies	The place of first milestone that is associated to creating positive attitude towards the importance of enabling competencies. In this step, the situation for physical and social enabling competencies is provided.	The place of second milestone that is associated to creating knowledge related to enabling competencies. In this step, the person learns the physical and social enabling competencies and starts obtaining cognitive enabling competencies, as well.	The place of third and fourth milestone that is associated to creating basic and advanced skills related to enabling competencies. In this step, the physical and social enabling competencies are completely learned.	The contract step, which prepares the person to be able to accomplish the simple or complex routine tasks at the end of this step, which is equal to graduation time.	The person has completely obtained enabling and technical competencies and has reached a level of technical competency that can supervise others.	The person has completely obtained enabling and technical competencies and has reached a level of technical competency that can supervise others in a (n) (inter)national level.

	Routine simple	As the person has no experience in practical environment, competencies have not formed in them.	Based on the routine simple experience for the person, he is placed in Ten Cate level II for this type of task, i.e. he can do tasks under proactive supervision.	The person can accomplish tasks by reactive supervision (level III Ten Cate)	The person can accomplish tasks by backstage supervision (level IV Ten Cate = STAR) and is certain that he has reached a level that can be trusted to do tasks without need for supervision.	The person has reached level V Ten Cate and supervises activities of others.	The person has reached level V Ten Cate and supervises activities of others in a (n) (inter)national level.	
	Routine complex		The person does not have enough knowledge and skill for this type of tasks (Ten Cate level I).	The person can accomplish tasks based on the experiences he has gained pro-active supervision (level II Ten Cate)	The person can accomplish tasks by reactive supervision (level III Ten Cate) and reaches Ten Cate IV, i.e. STAR, at the end of this step.	The person has reached level V Ten Cate and supervises activities of others.	The person has reached level V Ten Cate and supervises activities of others in a(n) (inter)national level.	
Technical competencies	**Non-Routine complex**		The person does not have enough knowledge and skill for this type of tasks (Ten Cate level I).	The person does not have enough knowledge and skill for this type of tasks (Ten Cate level I).	The person can accomplish tasks with pro-active supervision (level II Ten Cate) and reaches level III (reactive supervision)	For the task in this level, the person has reached level IV Ten Cate and can acts with backstage supervision.	The person has reached level V Ten Cate and supervises activities of others in a(n) (inter)national level.	
Meta competencies		-	-	The place of first milestone that is associated to creating positive attitude towards the importance of meta-competencies. Initiating the process of obtaining physical and social meta-competencies.	The place of second and third milestone that is associated to creating basic knowledge and skill related to meta-competencies, i.e., until graduation, the basic view, knowledge and skill for meta-competencies are provided and the person should go the rest of the route after graduation to reach meta-competencies.	The place of fourth milestone that is associated to creating advanced skill related to meta-competencies.	The place of the last milestone that is associated to integration of meta-competencies with technical competencies to do advanced activities.	Complete acquisition of meta-competencies and person's ability for top performance.
Experience		-	Providing simple routine experiences	Providing simple routine experiences and guiding the person to the zone of complexity and obtaining routine	The dominant experience provided in this step is complex routine experiences.	The dominant experience provided in this step is complex routine experiences.	Providing complex routine experiences and a bit of non-routine complex experiences.	The dominant experience provided in this step is non-routine complex experiences.

complex
experiences

❖ **Type of experience:** The final row of meta-model refers to types of experiences provided for the individual to develop the function and competency level, which start from simple and routine levels and gradually ends in complex routine and finally non-routine and provides different levels of immersion for the individual.

Describing the vertical dimension of competency development: Describing this dimension of meta-model leads to a redefinition of Dreyfus model.

❖ **Incompetent:** is the person who is at early stages of competency development, is gaining background basic knowledge; the type of his tacit knowledge is ubiquitous, tries to reason by guessing, is unable to do tasks due to lack of experience, and is in the first development step of acquisition of enabling competency.

❖ **Novice:** is the person who, in addition to gaining background basic knowledge, is gaining background mechanism codified knowledge with reduced structure, acquires social tacit knowledge because of the presence in environment of authentic experience and interaction with experts, tries to reason as rule-based and simple heuristic method, is able to implement simple routine tasks under the proactive supervision and is in the second development step of acquisition of enabling competency.

❖ **Advanced beginner:** Basic and mechanism knowledge are being completed and the person begins to gain codified knowledge with dispersed structure, the person may also acquire technical tacit knowledge due to more experience, tries to reason in rule-based and hypothetic-deductive method, is able to carry out simple routine tasks under reactive supervision and complex tasks under proactive supervision, and is in the third and fourth development step of acquisition of enabling competency and the first development step of meta-competency.

❖ **Competent:** The person seeks foreground knowledge with elaborated causal structure, his reasoning is analytical and hypothetic-deductive and scheme inductive, is able to do a variety of routine and non-routine tasks under different supervisions, acquisition of enabling competency has been completed and the person has reached STAR level and can be trusted to do tasks without supervision.

❖ **Proficient:** The dominant acquired knowledge at this stage is foreground with scheme structure, reasoning is performed by analytically-intuitive method through scheme inductive method, can supervise others in routine tasks, and can act under backstage supervision of non-routine tasks, is in the fourth development step of acquisition of meta-competency.

❖ **Expert, master:** The dominant type of acquired knowledge at this stage is foreground knowledge with script structure, reasons intuitive in pattern recognition method, can supervise all tasks of others at an international level, the development of meta-competency has been completed and the individual has achieved the top performance level.

❖ **Combination of horizontal and vertical dimensions of meta-model:**

Finally, this meta-model could achieve the goal of providing a re-definition for Dreyfus brothers' model, and explain the changes in the process of competency development, including acquisition and organization of codified knowledge, acquisition of tacit knowledge, development of the dominant reasoning method, and development of a variety of competency and meta-competencies. At the end, this meta-model can be used as a basis for competency-based curriculum development.

Conflict of Interest

The author declares no conflict of interest.

References

1. Ladhani M.B. Mc Peds competency based medical education guide.
2. Noblit GW, Hare RD. Meta-ethnography: Synthesizing qualitative studies. 1998;11:Sage.
3. Atkins S, Lewin S, Smith H, Engel M, Fretheim A, Volmink J. Conducting a meta-ethnography of qualitative literature: lessons learnt. BMC medical research methodology. 2008;8(1):1.
4. Campbell R, Pound P, Morgan M, Daker-White G, Britten N, Pill R, Yardley L, Pope C, Donovan J. Evaluating meta ethnography:

systematic analysis and synthesis of qualitative research.
5. Dreyfus SE, Dreyfus HL. A five-stage model of the mental activities involved in directed skill acquisition. California Univ Berkeley Operations Research Center; 1980.
6. Cheetham G, Chivers G. Towards a holistic model of professional competency. Journal of European industrial training. 1996;20(5):20-30.
7. Yielder J. An integrated model of professional expertise and its implications for higher education. International Journal of Lifelong Education. 2004;23(1):60-80.
8. Dall'Alba G, Sandberg J. Unveiling professional development: A critical review of stage models. Review of educational research. 2006;76(3):383-412.
9. Collins H, Evans R. Rethinking expertise. University of Chicago Press; 2008.
10.Kinchin IM, Cabot LB. Reconsidering the dimensions of expertise: from linear stages towards dual processing. London Review of Education. 2010;8(2):153-66.
11.Grenier RS, Kehrhahn M. Toward an integrated model of expertise redevelopment and its implications for HRD. Human Resource Development Review. 2008.
12.Garrett SK, Caldwell BS, Harris EC, Gonzalez MC. Six dimensions of expertise: a more comprehensive definition of cognitive expertise for team coordination. Theoretical Issues in Ergonomics Science. 2009;10(2):93-105