Taxonomy of Relevant Terms/Phrases

● **Concept**: Symbols or designations, e.g., categories, labels, relations, etc."on which there is shared agreement as to their meaning" (Reynolds, 1971, p. 46)

○ Example(s): [1] a Declarative *Concept* would include the "principle of least privileges" which has a definition; [2] a Procedural *Concept* would include "limiting access rights" which consists of steps to achieve a goal.

● **Formative Assessment**: designed to detail the areas of strengths and weaknesses of the learner; continually applied; is forward looking to guide the next learning path; is based on predictive analyses (e.g., job performance).

● **Summative Assessment**: applied once; backwards looking; based on task analysis

● **Threshold Concept**: "akin to a portal, opening up a new and previously inaccessible way of thinking about something. It represents a transformed way of understanding, or interpreting, or viewing something without which the learner cannot progress…They must be transformative, irreversible, integrative, bounded, and troublesome" (Meyer & Land, 2003, p. 1)

○ Example(s): Many learners have preconceived misconceptions about how and why electric charge flows within an electric circuit. It would be reasonable to believe that the charge that flows through a circuit to operate a flashlight bulb must originate in the flashlight battery compartment. However, in reality a electrochemical cell only supplies the energy needed to move a charge from a low potential location to a high potential location. The charge that flows through a circuit originates in the wires of the circuit. The charge carried in wires are simply the electrons possessed by the atoms that make up the wires. "Flow of charge" can be considered a *threshold concept* for any further studies on electronic circuits.
(http://www.physicsclassroom.com/class/circuits/Lesson-2/Common-Misconceptions-Regarding-Electric-Circuits)

● **Competency**: The bundle of knowledge, skill, ability necessary to effectively perform a task

● **Domain**: A set of tasks. These tasks are required to fulfill one or more responsibilities that are sufficient and necessary to accomplish one or more goals. The competency of the task performer differentiates how actions are performed or what is accomplished.

○ Example(s): [1] User account lifecycle management, [2] Firewall configuration; [3] network router configuration or [4] Windows system administration.

- **Field:** A set of domains. For domains in a set, there is shared agreement that the set is sufficiently and necessarily differentiated from domains in other sets; however, it is possible for a single Domain to be included in more than one set.

  - Example(s): [1] The field of Identity and Access Management may include the following set of domains: a) User Account Management, b) Access Control Lists, c) User Authentication, d) Security Group Administration (system access rights and application permissions), e) Physical Security (facility access rights), and f) User/system log file analysis. [2] The field of Network Security Administration may include the following set of domains: a) Firewall Configuration, b) Router Configuration, c) Access Control Lists, d) System Log File Analysis, e) Network Traffic Analysis, f) Incident Response Planning, g) Network Security Provisioning (ensuring proper system-to-system and application-to-application access), and h) Intrusion Detection System/Intrusion Prevention System (IDS/IPS) Configuration.

- **Proficiency (Proficient)**: Comprehensive and accurate understanding of a competency

- **Competence (Competent)**: Skillful application of proficient performances involved in a competency; the demonstration of skill in applying knowledge.

- **Expertise (Expert)** : Specialized transfer of competence within a domain

- **Mastery (Master)**: Generalized transfer of competence across domains within a field

- **Declarative knowledge**: Knowing **What** something means; the "concepts; facts, propositions and the richly interlinked associations among them. This form of knowledge can be spoken about and written down" (Billett, 2011, p. 26)

  - Example: A learner knows **what** are the letters in the alphabet and that the word "apple" means: The fruit 🍎.

- **Procedural knowledge**: Knowing **How** declarative knowledge is sequenced, interrelated, or intermixed to produce an output

  - Example: A learner knows **how** to write the word apple. An "a" followed by two "p"s, an "l" and an "e".

- **Conditional knowledge**: Knowing **When** a step in or branch of a procedure should be executed; the "if" state that determines "then" a procedure path should be executed

  - Example: A learner knows **when** to write the word apple with an "s" at the end. **If** there are multiple 🍎🍎🍎 **then** "s" is needed at the end.

- **Situational knowledge**: Knowing **Where** conditions exist: the environmental factors that are necessary or sufficient for conditions to be present

- ○ Example: A learner knows **where** in written prose the first letter in the word apple is uppercase or lowercase. Such conditions would be at the start of a sentence or if Apple 🍎 is a proper noun.

- *Situational Judgments*: the ability to analyze a situation and make appropriate identification (have awareness) of which conditions are present and choosing the procedure most likely to be effective given what may be declared to be known and unknown

- *Principles*: A collection of declarative knowledge for which shared agreement has been established among a group of people performing a competency or a domain

- *Practices*: A collection of procedural, conditional and situational knowledge for which shared agreement has been established among a group of people performing a competency or a domain

- **Response Confidence**: A self-expressed level of belief by a learner in the accuracy of their knowledge for choosing the selected answer which are valid indicators of confidence (Stajkovic & Luthans, 1998)

- *Understanding*: Complete and accurate knowledge accompanied by high confidence in the belief that one's knowledge is complete and accurate

- *Insufficient understanding*: Incomplete or lack of knowledge accompanied by low confidence in the belief that one's knowledge is complete

- *Misunderstanding*: A recognized inaccurate knowledge accompanied by low confidence in the belief that one's knowledge is accurate

- *Misconception*: An unrecognized inaccurate knowledge accompanied by high confidence in the belief that one's knowledge is accurate

- *Concept inventory*: A "reliable, validated assessment instrument [that] focuses on common student misconceptions [in] a specific domain" (Almstrum, Henderson, Harvey et al., 2006).

- *Action inventory*: A concept inventory focused on eliciting misapplication of skills.

- *Situational judgment inventory*: A concept inventory focused on eliciting ineffective transfer of abilities.

- *Learner*: A person who is engaged in the learning process by either taking formal education courses (i.e., a "student") or other types of training courses. Since learning takes place in many different venues using different formats, media, and techniques, using the term "Learner," provides broader coverage than using "Student," which traditionally is limited to an academic environment.

REFERENCES

Almstrum, Vicki L., Peter B. Henderson, Valerie Harvey, Cinda Heeren, William Marion, Charles Riedesel, Leen-Kiat Soh, and Allison Elliott Tew. "Concept Inventories in Computer Science for the Topic Discrete Mathematics." In *ACM SIGCSE Bulletin*, 38:132–145. ACM, 2006.

Billett, Stephen. "Integrating Experiences in Workplace and University Settings: A Conceptual Perspective." In *Developing Learning Professionals: Integrating Experiences in University and Practice Settings*, edited by Stephen Billett and Amanda Henderson, 21–40. Dordrecht, Netherlands: Springer, 2011.

Meyer, J. H. F., and R. Land. "Threshold Concepts and Troublesome Knowledge: Linkages to Ways of Thinking and Practising within the Disciplines." In *Improving Student Learning Theory and Practice - 10 Years on: Proceedings of the 2002 10th International Symposium Improving Student Learning*, edited by Chris Rust, 1–15. Oxford: Oxford Centre for Staff & Learning Development, 2003.

Reynolds, Paul D. *A Primer in Theory Construction*. Indianapolis: Bobbs-Merrill, 1971.

Stajkovic, A. D., & Luthans, F. (1998). Self-efficacy and work-related performance: A meta-analysis. Psychological Bulletin, 124(2), 240–261.