Assessing Complex Learning and Knowing:

Prescriptions from the theory of Totally Integrated Education (TIE)

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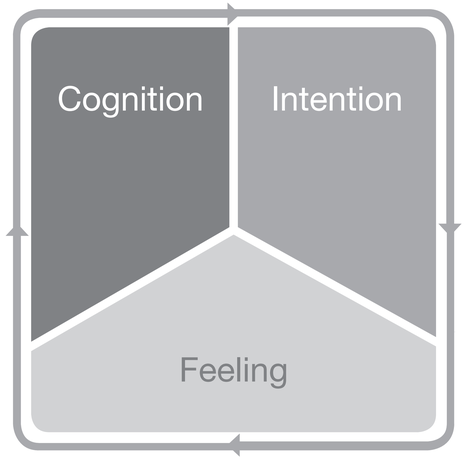
What makes a task “authentic” or “real world”? What makes a complex task “whole”? How can teachers assess learning when students perform complex, whole, authentic tasks? In grappling with this problem, it became clear that a well-defined educational theory is needed. What has emerged is a new theory of Totally Integrated Education (TIE), currently under development. This poster session introduces TIE.



There are three types of mental structures The three types of knowing (know-that, know-how, and know-that-one) are all types of the **cognitive** mental structure, which, while essential do not define the whole of a learning experience. **Conative** (the intent or desire to learn) and **affective** (feelings of excitement, boredom, satisfaction, etc.) mental structures are equally valuable to the learning experience. The challenge for education is to create conditions for each student to connect or align their individual affective, conative, and cognitive mental structures so as to strengthen these structures and make them whole. Educational events should include all three types of mental structures for optimal learning.

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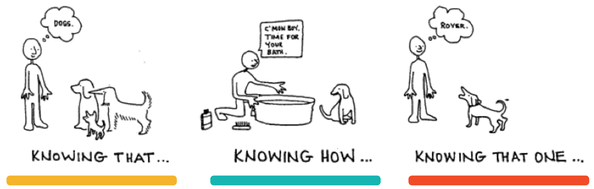
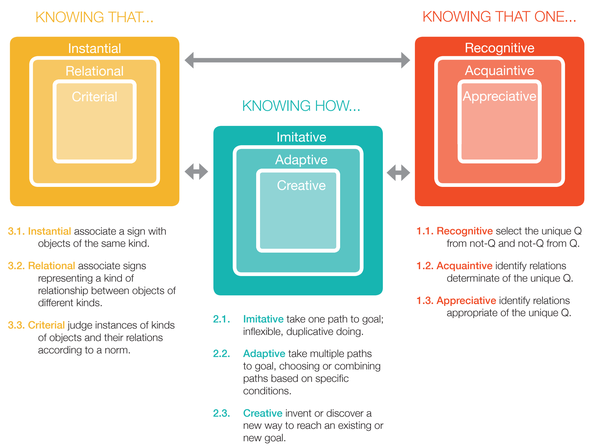
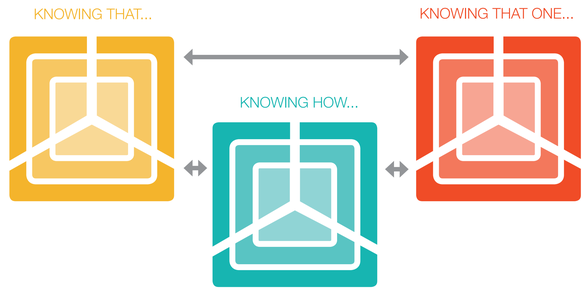


The three **types of knowing** are not mutually exclusive. We can know-that-one, know-how and know-that with respect to some object. These kinds of knowing may not connected as illustrated. For example, a person’s know-that could be disconnected from their know-how. A person could know-that-one without know-how or know-that. However, when kinds of knowing are connected as shown, then such knowing is whole, and expected to be less vulnerable to forgetting.

Each type of knowing contains three **categories of knowing**, which build from the outside in. Thus, within each type of knowing, each higher level requires the lower level. For example: appreciation requires acquaintance, and acquaintance requires recognition. Creative know-how requires adaptive know-how which in turn requires imitative know-how. Criterial knowing requires relational knowing, and relational knowing requires instantial knowing.





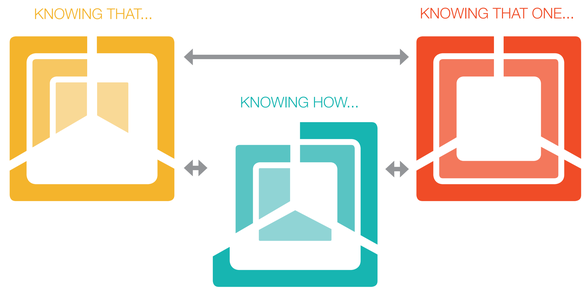
The ideal connected/aligned learning experience In the TIE theory, learning is defined as a process of increasing the complexity of a person’s mental structure; whereas knowing is taken as cognitive mental structures that consist of beliefs that are true, right opinions, and capabilities for effective conduct. TIE theory predicts that when cognitive, conative, and affective structures are more completely connected (i.e. well-aligned), then complexity, strongness, and wholeness are increased. When wholeness increases, flexibility is predicted to increase and vulnerability to forgetting is expected to decrease.

TIE theory has several implications for instruction. For integrative teaching, instructors should combine all three types of mental structures and types of knowing into activities which guide students to learn to know-that-one, know-that, and know-how; and to make connections among them. Hitting a “bull’s eye” in this sense, means that all types of mental structure and types of knowing were included in a learning task or experience.

A positive example of alignment of structures would be when:

- Student intends to learn X (conative)
- Student comes to know X (cognitive)
- Student feels good about having learned X (affective)

Although the ideal may not be reached with every complex task, it is a goal worth striving for. The challenge for education is to create conditions for each student to connect or align their individual affective, conative, and cognitive mental structures to as to strengthen these structures and make them whole. If (when) these structures are misaligned or disconnected within an individual, then such disconnectivity or conflict would weaken the mental structures that students form, leading to potentially negative consequences, such as students dropping out of school.



TIE theory will establish prescriptions for measuring complex learning and knowing. Future development of this theory has potential implications for choosing instructional strategies in educational settings, and then accurately measuring the success of those strategies. Instructors will have the information they need to continually improve their teaching and the learning experiences of their students.

References

Frick, T., Myers, R., Thompson, K. & York, S. (2008). New ways to measure systemic change: Map & Analyze Patterns & Structures Across Time (MAPSAT). *Featured research paper presented at the annual conference of the Association for Educational Communications & Technology, Orlando, FL*.

Frick, T., Chadha, R., Watson & Zlatkovska, E. (2010, in press). Improving course evaluations to improve instruction and complex learning in higher education. *Educational Technology Research and Development*.

Koh, J. and Frick, T. (2007). Measuring System Structural Properties of Autonomy-Support in a Montessori Classroom. *Proceedings of the Association for Educational Communication and Technology, Anaheim, CA*. Retrieved March 4, 2010: http://www.indiana.edu/~tedfrick/montessori_AECT2007_proceedings_koh_frick.pdf

Maccia, G. (1988). Genetic epistemology of intelligent systems: Propositional, procedural and performative intelligence. *Paper presented at the Fourth International Conference on Systems Research, Cybernetics and Informatics, Baden-Baden, West Germany, August*.

Merrill, M. D. (2002). First principles of instruction. *Educational Technology Research and Development*, *50*(3), 43–59.

Merrill, M. D. (2007). A task-centered instructional strategy. *Journal of Research on Technology in Education*, *40*(1), 33–50.

Merrill, M. D., Barclay, M., & van Schaak, A. (2008). Prescriptive principles for instructional design. In J. M. Spector, M. D. Merrill, J. van Merriënboer, & M. F. Driscoll (Eds.), *Handbook of research on educational communications and technology* (3rd ed., pp. 173–184). New York: Lawrence Erlbaum Associates.

Rangel, E., & Berliner, D. (2007). Essential information for education policy: Time to learn. Research Points: *American Educational Research Association*, *5*(2), 1-4.

Thompson, K. R. (2008). ATIS graph theory. Columbus, OH: System-Predictive Technologies. Retrieved March 4, 2010: https://www.indiana.edu/~aptfrick/overview/reports/11ATISgraphtheory.pdf.

van Merriënboer, J. J. G., Clark, R. E., & de Croock, M. B. M. (2002). Blueprints for complex learning: The 4C/ID model. *Educational Technology Research and Development*, *50*(2), 39–64.

Van Merriënboer, J.J.G., & Kester, L. (2008). Whole task models in education. In J. M. Spector, M. D. Merrill, J. J. G. van Merriënboer and M. P. Driscoll (Eds.), *Handbook of research on educational communications and technology* (pp. 441-456). New York: Routledge, Taylor & Francis Group.