

Reconceptualizing the Model of Formal Education Utilizing Montessori as Evolutionary Epistemology

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Although most Americans steadfastly maintain that getting a good education guarantees a better society and opens the door to more rewarding careers, it has been debated regularly throughout this nation's history what the best set of educational priorities and practices that constitute good schooling should be (Tyack & Cuban, 1995). Sociopolitical considerations of power and control have often driven the agendas of educational reform movements in the United States, and these have typically clustered around adult priorities and ideas of how knowledge should be transmitted to children (Cuban, 2003; Kliebard, 1995; Perkinson, 1984).

It is asserted that approaches to educational reform should instead be derived from an informed understanding of naturalistic human learning and that curricular structures and pedagogical practices should start from children and work *backwards* so that both theory and practice support learners' intrinsic curiosity and search for regularities in the world around them. It is further asserted that philosopher Karl Popper and educator Maria Montessori's combined work provide support for how a reconceptualized educational model could be developed. The Education-as-Evolutionary Epistemology (EEE) model for educational reform is a proposed example.

Research questions

As part of an interdisciplinary theoretical research study conducted for a doctoral dissertation, three research questions were investigated:

- To what extent does philosopher Karl Popper's theory of knowledge acquisition, referred to as an evolutionary epistemology, provide a theoretical framework from which to build educational systems that complement naturalistic human learning?
- To what extent does the Montessori system of early childhood education evidence the principles and practices of an evolutionary epistemology applied to classroom learning?
- In what ways can a combined Popperian/Montessorian perspective inform educational models that reconceptualize the principles and practices of formal learning environments so that they cohere with naturalistic human learning?

Karl Popper's evolutionary epistemology and Montessori

Dating from the time of the ancient Greeks, western philosophers have attempted to define what constitutes human knowledge of the natural world. Knowledge accumulation has traditionally been conceived as an *inductive* process: Multiple observations of phenomena are made and hypotheses that explain the observed phenomena are verified, thereby ultimately confirming a universal law or truth. However, philosopher David Hume (1711-1776) famously pointed out the illogical logic of inductive reasoning: Induction incorrectly assumes uniformity in natural phenomena and that the future will resemble the past. For Hume (1748/2003), what appear to be

consistent results from multiple observations can only be described accurately as “provisionally true up to now,” consequently rendering universal theories unverifiable.

Philosopher Karl Popper’s (1902-1994) response to the Humean problem of induction was to instead conceive knowledge building as a *deductive* process focused on error discovery and elimination. Represented by the schema $P1 \rightarrow TT \rightarrow EE \rightarrow P2$, Popper (1934/1959, 1994) stated that a problem (P1) occurs when an anticipation about the world does not match the reality of what is experienced in the world. A tentative theory (TT) is then hypothesized to solve the problem, and it is “put to the test” to determine the extent to which the theory may be in error. Finding and eliminating error (EE) advances the knowledge building process until a new, more sharply focused problem (P2) is noticed, and the process of trial-and-error elimination continues.

Popper further asserted that different theories compete with each other, with bolder theories predicting more but also incurring a greater risk of falsification when tested against the environment. Campbell (1974) famously characterized this approach of hypothesis testing and competition among theories as a Darwinian struggle for survival of the fittest, declaring Popper’s philosophy an evolutionary epistemology that necessarily proceeds through a blind-variation-selective-retention (BVSr) knowledge building process.

Four aspects of the Montessori system of early childhood education are especially indicative of the principles espoused by Popper’s evolutionary epistemology:

- Students act as autonomous agents who independently conduct multiple trials towards mastering cognitively intriguing tasks without fear of failure, making mistakes, or adult intervention
- The control of error resides within the didactic apparatus, thereby providing students with an ideal scaffolded balance between variation and selective-retention possibilities
- Teacher presentations of new work to students is timed according to anticipated student readiness for the task but the timing of the presentation may be misjudged and may need to be tried again at a later time; this error is instructive, not pejorative
- Dr. Montessori’s development of the Montessori system and its didactic apparatus evolved over her 50-year career through its own trial-and-error elimination, BVSr process

The Education-as-Evolutionary Epistemology (EEE) model

The EEE model’s 12 integrated recommendations address three general areas that are critically important for successfully reconceptualizing formal learning environments:

Design curricula and assessments to support students’ trial-and-error learning processes

- Create multi-purpose interdisciplinary learning plans that avoid the fallacy of discipline-specific learning and that adapt to students’ interests
- Shift the control and responsibility for determining curricula from adults to students by utilizing student-designed curricula and individual study plans, called Problem Solution Plans

- Describe student achievement through assessment mechanisms that highlight the holistic process of trial-and-error elimination learning

Establish new roles and training for all of the learning environment's participants

- Shift the paradigm of “good” teaching from transmitting facts to facilitating student trial-and-error problem solving
- Require a three-year graduate teaching degree with advanced interdisciplinary course work to become licensed as a professional practitioner, similar to what those training for the medical and law professions receive
- Institute a one-year post-graduate professional teaching residency of which at least half is to be conducted in settings with students of different socioeconomic, linguistic, and/or cultural backgrounds than that of the teacher-in-training
- Educate families for their important participatory role as supporters of their children's learning

Revise the structure and organization of the learning environment

- Increase the number of school days per year to 210 days to provide greater continuity for student learning over the entire calendar year
- Revise daily instructional schedules to mirror the Montessori practice of allowing for longer periods of uninterrupted learning time (3-hour work cycles)
- Group students heterogeneously to capitalize on the advantages of mixed-age classrooms
- Design learning spaces that are intriguing, comfortable, and able to be flexibly configured to suit multiple learning styles and purposes
- Use educational technology to complement students' natural ability to identify problems, formulate tentative theories, and eliminate error

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