



**Simulation Interoperability
Standards Organization**

"Simulation Interoperability & Reuse through Standards"

Learning Analytics and Deep Learning: Emerging Standards for Instructional Metrics



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Theme

Students, university administrators, parents, colleagues and society all need an effective way to evaluate professors (and educators in general). Currently this is very hard to identify and quantify. Emerging technologies may hold promise for finally being able to establish correlations between teaching qualities and goals achievement. That brings to the fore: What qualities? Which goals? When achieved? In each of these cases, the M&S Standards community may have skills to offer. That community has long been a bridge between the behaviorists and the software coders and the hardware engineers. The vast majority of the stakeholders in the opening sentence are often not as proficient in the needed disciplines.

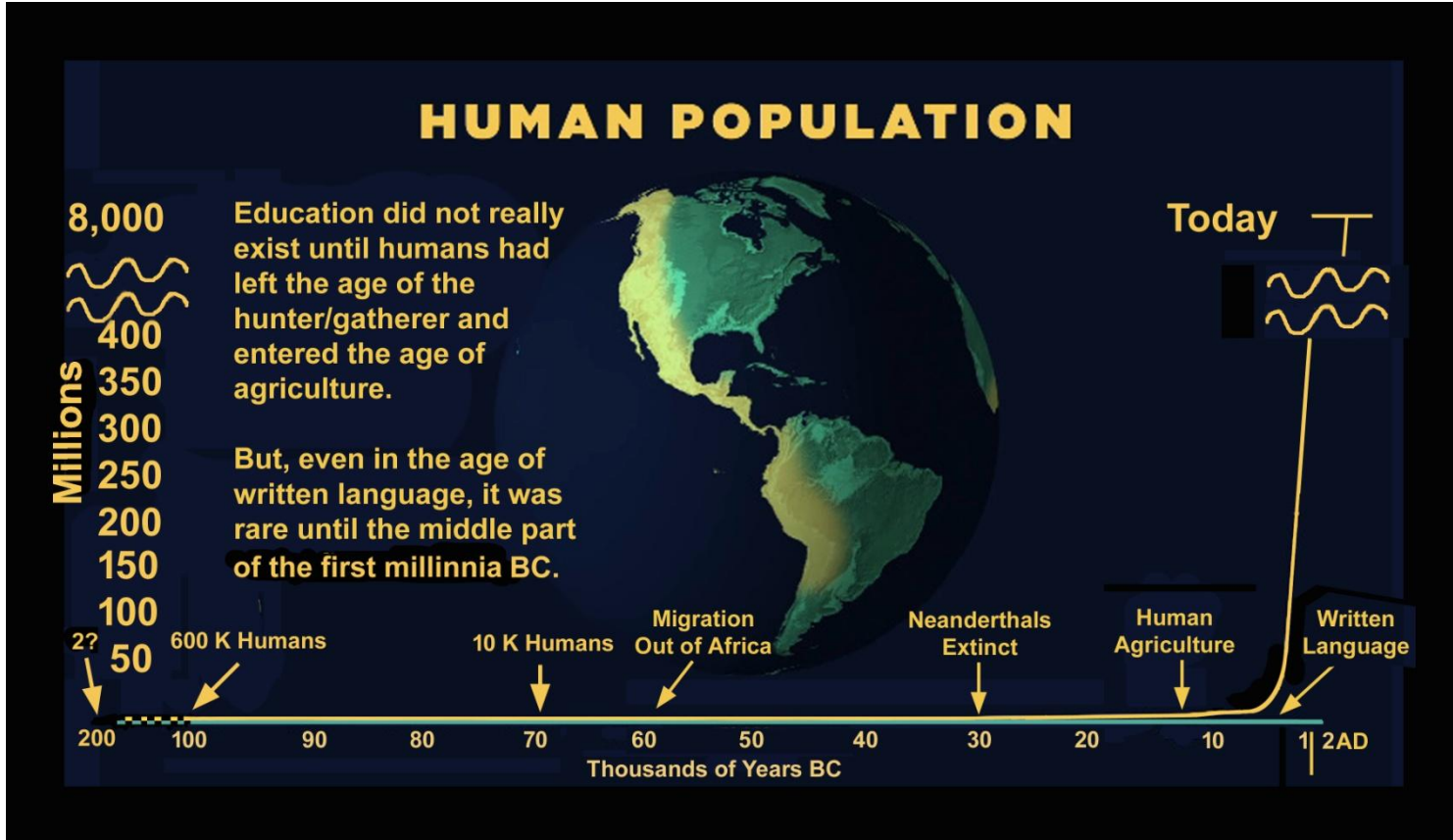


Education has a Long History

- Education has been around a long time
- Accepting some kind of apprentice tradition, it may have existed since the inception of human speech some 200,000 years ago
- About the time of the advent of writing (five thousand years ago), some forms of education were extant, but probably not very formal
- By the period of the classical Greeks, a more formal approach and tutor tradition came into being
- The University system appeared about the time of Norman Conquest
- Democracies in the latter part of the 18th century required literacy
- The industrial age induced an emphasis on discipline and science



Human Population and Education





Teacher Evaluations Over the Centuries

- Over the millennia, teachers have held a special position in society
- But standards were often more ethical the rational (Socrates, Scopes)
- In Europe, the Church carried the torch of education post Roman era
- Tutoring was a major model in both Europe and Asia
- In the early democracies, literacy was so low any literate person could be considered a good teacher, *c.f.* Samuel Clemmons
- The industrial revolution brought more demand for universal educational achievement
- One scholar is reported to have advised a Harvard-bound student: “Select the professor, not the subject.”



Evaluation Methods

- **There are a number of evaluation methods extant**
 - Teachers themselves
 - Senior teachers
 - Students
 - Research records
- **All have their weaknesses**
- **The intended recipients/beneficiaries of the graduates say otherwise**
 - Students find they did not master skills needed for life
 - Grad School Profs say students are under-prepared
 - Employers complain students are not ready



Student Evaluations

- **Elementary School students rate by attractiveness**
- **High school students focus on wrong goals and often disregard and denigrate their teachers**
- **College students are asked to do rankings**
 - Formal response by university
 - Input to student rating web sites
- **Criteria listed are useful, but students admit they were swayed by:**
 - Entertainment quality of professor
 - Ease of workload
 - Generosity of grades given
- **Again, the Wizard of Oz Syndrome: “I am here to get a piece of paper”**



Current Professor Evaluation by Students

5 Always 4 Often 3 Sometimes 2 Rarely 1 Never NA "not Applicable" (I can't answer.)

| My professor | | 5 | 4 | 3 | 2 | 1 | NA | Comments |
|--------------|--|---|---|---|---|---|----|----------|
| 1. | Begins and ends our class on time. | | | | | | | |
| 2. | Is well-prepared for class. | | | | | | | |
| 3. | Is organized and teaches clearly. | | | | | | | |
| 4. | Checks during class to see if students understand the material. | | | | | | | |
| 5. | Encourages students to ask questions and participate. | | | | | | | |
| 6. | Answers questions clearly. | | | | | | | |
| 7. | Knows the subject matter of this course. | | | | | | | |
| 8. | Shows interest in the material that we are studying. | | | | | | | |
| 9. | Encourages me to think and explore new ideas. | | | | | | | |
| 10. | Tells the class at each meeting what we are going to do and what we are expected to learn. | | | | | | | |
| 11. | Treats all students respectfully. | | | | | | | |
| 12. | Returns my papers, tests, and other work within two weeks of collecting them. | | | | | | | |
| 13. | Responds to my work so I know how I'm doing and what I need to work on. | | | | | | | |
| 14. | Responds to me when I need help outside of class. | | | | | | | |
| 15. | Follows the grading guidelines in our course syllabus and explains my grade if I ask. | | | | | | | |
| 16. | Helps me meet the goals and learning objectives/outcomes of the course. | | | | | | | |



Goals

- **Goals have changed over the decades**
- **Some were misplaced**
- **Some are still very much in question**
- **Major (MAJOR) dichotomy between “users”**
 - Students
 - Parents
 - Faculty
 - Employers
- **Goals should be a rational, desirable and quantifiable**
- **Platitudes and politics can be destructive**



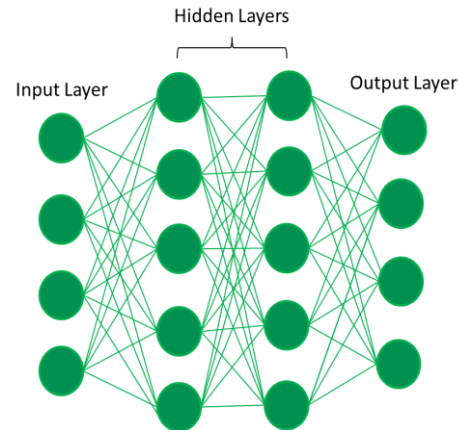
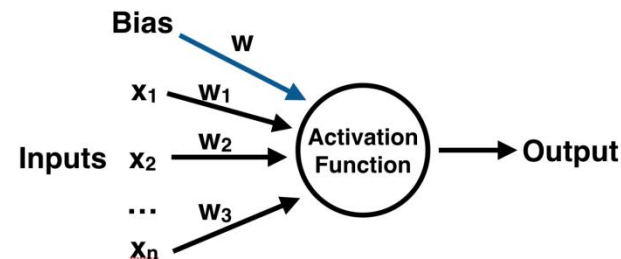
Capabilities that the Classical Greeks Lacked

- **Neural Nets**
- **Big Data**
- **Sensors to measure attention**
- **NLP to make sense out of written (or spoken) words**
- **Linear programming to integrate multiple inputs**
- **Deep Learning**
- **Learning Analytics**
- **Standards' Community expertise in all these areas**



How do Some of These Work

- Neural Nets
- Big Data
- Deep Learning
- Learning Analytics





Privacy and Ethics Issues

- **New sensitized demand of protection for users and accountability for program personnel**
- **Embarrassing or even harmful use could be made of data**
- **Differing parties have differing goals, so many may not want to share either their positions on matters or data that may impact them**
- **Integrity and diversity issues are especially likely to evoke strong reactions**
- **Any machine driven analytic device, especially those with not human intervention, may generate result offensive to some**



Can Changes be Made

- **Output of insights may be hard to implement using old methods**
- **Differing goals of various individuals in one class may make one unified type of delivery less attractive to some at the same time it is optimal for others**
- **Machine generated teaching might be able to avoid this issue or, at least, ameliorate the discordance**
- **In addition to the rating and coaching for the individual teacher/professor, it could provide a special path of unique needs**
- **Several computer-agent technologies would be applicable**



A Conversational Teacher/Professor

- **Impact of virtual conversationally capable teachers or mentors**
 - MentorPal and Sim Coach Projects
 - Not only effective, could be trainable
 - Collect sensor data
- **High Marks from surveys**
- **High involvement from users**
- **Very non-judgmental**
- **Available and pacing variable**
- **Instruct and measure progress**
- **Training possibilities via Neural Nets**





Conclusions

- **Rating teachers could be improved**
- **Necessary for good Education**
- **Used to assess**
- **Capabilities**
- **Areas for improvement**
- **Hiring and retention decisions**
- **Many personal and ethical issues**
- **M&S Standards community would be a good source of counsel**
- **Similarly, advances may be applicable to DoD education issues**



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Q&A / Discussion