

## Learning Analytics for Painters

Now, what does Learning Analytics mean to a painter, to you, perhaps? I believe that Learning Analytics is not about statistical information about the tests I've passed or failed in or, even worse, the learning objects I attended in some sort of digital – virtual – cyber – mobile – cool learning environment and for how long. Well, no, I'm also not the person who is keen on learning in the tram while commuting to work/school. As a psychologist I could talk eons about the downsides of dynamically changing learning contexts (I mean the real ones, like the tram stations) and the permanent distractions one encounters in mobile, pervasive, ubiquitous learning scenarios. I suggest watching more *Simpsons* episodes; that teaches a lot of real life! Now, this is what I don't mean. Now come to the complicated problem of what I do mean.

I mean learning is a human psycho-biological process. A process that is hard for the one and harder for the other. Some things can be learned easily, some can be learned almost not at all. In some ages, human beings learn just like so and in another age it's really hard – just like in a gym. There are very clear rules of what learning is and how it occurs, clear rules what fosters learning and what hinders it. Simply throw an eye on the corresponding psychological research body (one example: <http://uwf.edu/wmikulas/Webpage/learning/intro.htm>). In addition to that, we have psychology's big neighbouring research area, pedagogy. Psychology tells you a lot about serial position effects or affective inhibition (just one: [https://en.wikipedia.org/wiki/Hermann\\_Ebbinghaus](https://en.wikipedia.org/wiki/Hermann_Ebbinghaus)), pedagogy tells you how to avoid these problems when aiming at teaching somebody something. And there are lots of theories (cf. [https://en.wikipedia.org/wiki/Learning\\_theory\\_\(education\)](https://en.wikipedia.org/wiki/Learning_theory_(education))). My most preferred approach, where I believe psychology and pedagogy is coming together as close as possible, is Lynch David Merrill's "First Principles of Education" (<http://mdavidmerrill.com/Papers/firstprinciplesbymerrill.pdf>). In a very simple, easy and intuitive way, these principles subsume all (most of) the research from the preceding years and decades. Over the years the notions of formative feedback and competence-orientation of education appeared. Just the incarnation of the "first principles". Ultimately, it's the wish of understanding learning processes on an individual basis and to have the ability to draw the right conclusions and make the right pedagogical decisions, the support each and every individual learner as good as possible. And of course, there is a lot of other good psycho-pedagogical approaches and learning theories as well, no doubt!

Now, for a very big community of education-related researchers the question appeared, how such dream could be realized. One very prominent excrescence was and is the area of intelligent and adaptive tutorial systems. Basically, a mixture of computer scientists, AI researchers, and psychologists – all realistically technology-affine – tried to build the most intelligent and perfect "super-educational system", perhaps best explained with famous IBM's Deep Blue super chess computer that could beat any human being in chess. Now, after decades, apparently this wasn't the right solution, obviously. Not for the western world, at least?!? The reason was simply, AI was too dumb. Still. Another reason was that there wasn't this perfect-world super learning environment. Education was and is still happening primarily in the real, analogues world. Thank god! Now, the answer of science was Learning Analytics. Distilled to its essence, Learning Analytics means using digitally available/accessible data for providing teachers with more insight into students' learning processes in order to provide them with the best possible help. OK. Sounds great. Let us have a deeper look.

What does digitally available data mean? In the best possible case its test data and activity protocols in some sorts of digital environments. We had projects in cool virtual environments before (cf. <https://www.youtube.com/watch?v=dYdSdDiV3Q8>). What does this tell us about learning or engagement with a subject, what does that tell us about individual ways of reaching individual learning goals? Nix, niente, nada! Now, the real case is that there are most often not even digital performance data available at all. If you think about school reality today, there is not comprehensive digital data set available to be analysed. School and university reality on this planet is still, educationally relevant information are stored in a paper and pencil way or at best in some sort of Office style way (I guess Powerpoint is still the most important educational tool, perhaps chased by Excel). So, we are facing major challenges here. It is definitely not easy to get solid and significant datasets of students – in most cases.

So let us assume an ideal world, where people having online courses and online tests, and we can access all those data. Ehm, so? It simply leads us back to my initial argument or question: what can we learn from performance data in a digital environment? In reality, we are facing a battery of moderating and mediating factors, that serious analyses and predications are not really possible. Just looking at the performance might be confounded with usability aspects, aspects of the validity of the “educational AI” of our system, aspects of the quality of learning materials, the biased-ness of tests, and all sorts of unknown individual aspects such as being tired or inattentive. I think a key message is, we cannot build a sophisticated educational model on the basis of a soft, sandy ground. The usual stats don’t help much here, seriously!

I think where we have to start from is the understanding of what pedagogy is talking about at all – subject matter. The first step must be (and most often this step isn’t done at all) gaining insight and understanding about a knowledge domain. This, certainly, is in itself makes a full scientific community. Also, it leads to the question of how defining competencies, how to talk about human competencies, how they relate to real world requirements, and how to translate them to different contexts. In LEA’s BOX we give one potential answer. We are defining the atomic junks, the small pieces of knowledge/aptitude in a domain. Basically, the reason is to find a solid, valid, and reliable common ground about what didactics, pedagogues, instructional designers, and psychologists are talking about. That is no simple task in itself. Believe me!

The next question, we suggest raising, is about how those competencies are acquired by humans; at which age, in which order, under what circumstances. In all likelihood there is a natural sequence in which we learn math, languages, ....., whatever. In LEA’s BOX we suggest identifying those relationships between competencies: first you have to understand  $a$  to learn  $b$ . This gives us an understanding of how humans learn certain subject matter; and we have technical didactics and teachers to inform us. Perhaps the simplest example is that the competency of adding integers is developed before learning how to multiply integers. That is perfectly understandable and agreed. Now what if we have those “big” performance data contradicting to this hypotheses? What, if we have an online test that revealed a person mastered a multiplication item and failed in an addition task? What does that mean in terms of the simple, statistical Learning Analytics dashboards? I can’t say, honestly.

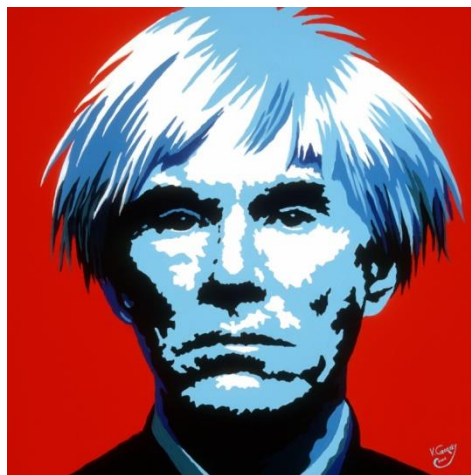
Our suggestion is to follow famous Noam Chomsky. Simply and clearly separate performance (what we can observe) from competence (the ability/aptitude/knowledge) of a person, which we cannot see or measure directly. The most simple example: Given a multiple choice test, a student might fail

in an item because he/she was inattentive and tired or, on the other hand, might succeed by making a lucky guess (and the chances are good). What we can observe is the one thing. What a student can do or know is another thing. Basically, this heavily depends on the way of assessment. The problem is that it is hard to impossible to find the perfect test item for a set of competencies. So, our logical answer is: Do not over-estimate what you see. We have very well-elaborated competency and domain models, even if they might not be perfect and, on the other hand, we have a set of more or less trustful evidences (such as tests, teacher records, homework, etc.). We are linking them together and we are linking them in a careful, conservative way. Whatever we can see is just an indicator for a set of competencies, but only to a certain extent. In the end, the Lea's Box approach suggests using as much observations and evidences as possible, but using them carefully and cautiously. We assume a latent domain model and we link observable performance in a conservative probabilistic way.

What we can gain from that is a careful picture of learning which in all likelihood is very close to reality. In addition, there is the freedom to change things. If we find out, the domain model is not perfect, we can alter it, test it, and validate it. If we find out, our evidences, tests, interpretations may be not 'bullet proof', we can use different instruments. We can improve the two worlds, the latent competence models, and the visible world of evidences and tests, without destroying the entire competence ecosystem.

What does all that mean for painters, for artists? I think about Andy Warhol and the 'Factory' and perhaps Lou Reed (Check it out:

<https://www.bing.com/videos/search?q=lou+reed+hello+it%27s+me+youtube&view=detail&mid=C69F6546C085E5F03850C69F6546C085E5F03850&FORM=VIRE3>).



Let me start with Lou Reed's famous album "Songs for Drella" (A must see: <https://www.youtube.com/watch?v=aKYaKzexlHY>). Drella is a mixture of Dracula and Cinderella. It was a nickname of Andy Warhol, mirroring his nature. And now this very much reminds me of Learning Analytics: It can be an "evil monster" that sucks your blood or a wonderful sensitive story with a great happy ending! And, it's clear, "there is no Michelangelo coming from Pittsburgh".

What I try to say is, education is so often treated as a bureaucratic, static, normed, almost sterile thing. It is not. Being a great teacher is not a profession, it is a form of art. Subtle, carefully, crafty, cunning, inventive, fancy, dedicated. This is what a great teacher makes. Likewise, technology must support this form of art and technology should not be the "significant statistical evaluation of hard facts", at least not only. When we are talking about learning analytics for painters, we need to give

room and still acknowledge the very fine details. Most importantly, we must accept personality and still meet basic standards. Learning Analytics must help educators, teachers, trainers, learners to walk that thin line.

I suppose, each of us already tried to make a painting, and if it was in Kindergarten. ☺ There are always these two aspects, quality in terms of “craftsmanship” and quality in terms of “artistsmanship”. Which of the images bellow do you find more interesting? Which of the images do you find more important for daily lives?



Do you know Bob Ross (<http://www.bobross.com>)? Perhaps the anti-thesis to Andy Warhol. Bob was some sort of ‘industrial’ painting teacher who died in 1996. All in all, the pictures are great but each is more or less the same, based on the same technique and in the end it doesn’t take much longer than 20 minutes to make such paintings. Don’t get me wrong, Bob was a great guy!



All this has a massive impact on education and how we approach it. There are good and bad teachers and they decide to tend to the one or the side. Also the fields of application define where to go. What I want to highlight is, that each Learning Analytics solution should support both sides; the more formal one and the more open, ‘artistic’ one. It’s (not only) about how many brush strokes you can make per minute! And it’s not about, “what, you don’t like these mountain side paintings?”

That of course, is easier said than done. I think the key statement is, yes there are key competencies in the curriculum, no matter how useless they are, but there are key strength of learners as well, and

these should be counted equally. The great thing about Lea's Box's formal approach is that we can have both in our models, the rigid, domain-centred competencies but also the open 21<sup>st</sup> century-like meta-skills, that are so important to translate each and every bit of latent power into visible achievements. Even a single pixel can be our goal: <http://streetartnyc.org/blog/2015/12/19/invader-in-the-big-apple-with-joey-ramone-lou-reed-andy-warhol-michelangelo-leonardo-and-more/>



Good Learning Analytics and opening up our learner models can support and guide our learners on their individual way, no matter where they are heading to!