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The Second Loop of Engagement: How Learning Analytics Erodes What It Claims to Measure

Maura Gancitano [1,*]

[1] CASE – Center for Advanced Studies in Education, Università Pegaso, Naples; mauraga85@gmail.com
* Correspondence: mauraga85@gmail.com

Abstract: Learning analytics dashboards report engagement as a single figure that schools and platforms increasingly read as evidence of learning. This theoretical contribution reads that figure through the distinction Argyris and Schön (1978) drew between single-loop learning, which corrects action toward a fixed goal, and double-loop learning, which questions the goal, and argues that the dashboard erodes the second loop twice over. In dashboards that rely mainly on behavioural indicators, which is still the common case, it records only the behavioural strand of the construct Fredricks, Blumenfeld and Paris (2004) defined as behavioural, emotional and cognitive together, so a student who stops halfway through a module to ask why it was built this way appears as a dip the platform is designed to correct. When improved instruments invite, log and score the questioning of premises itself, the second loop risks being absorbed into the first, since reflection performed for the report becomes one more goal pursued efficiently. The paper develops this second movement as its central claim, shows through the capability approach that the students least able to refuse the performance are those with the fewest other routes into a subject, and closes with a criterion that teachers, designers and institutions can apply to any engagement metric, whether it leaves a learner more able or less able to revise the goal she is being measured against.

Keywords: student engagement; learning analytics; double-loop learning; capability approach; attentional justice

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1. Introduction

On a Tuesday afternoon a sixteen-year-old has the chemistry module open in one tab of the school laptop and a group chat open in another, and for the forty minutes the lesson lasts the learning management system records a logged-in session, two page views and one quiz attempt. The weekly report her teacher receives on Friday turns those three signals into a green bar under the heading engagement, although the chat is where the forty minutes went and nothing in her grasp of covalent bonds has shifted, since the instrument has access to the open tab, the minutes and the click and takes them for the student herself. Media education came into being to form minds able to resist an economy that sells attention by the fraction of a second, so the moment its own instruments begin to reward captured attention as though captured attention were learning, the field quietly turns against the purpose that justifies it.

EDIZIONI UNIVERSITARIE ROMANE
editoria scientifica dal 1952

The suspicion is older than this paper, since Selwyn (2019) has already listed the charges that critical scholars bring against learning analytics, from the reduction of education to what can be logged to the drift from support toward surveillance, and Macfarlane and Tomlinson (2017) have gathered the critiques of the wider engagement agenda under six headings, performativity first among them, by which they mean the demand that students display their involvement in forms an institution can observe and grade. The usual reply to these critiques is that the instruments are young and will improve, and that a dashboard able to see thinking as well as clicking would dissolve the objection. This paper takes the reply seriously and argues that it is where the real difficulty begins. Read through the distinction between single-loop and double-loop learning that Argyris and Schön (1978) drew for organisations, the dashboard erodes the second loop in two ways, first by failing to see it, since a student who questions the premises of a module leaves the same trace as one who has stopped working, and then, once it has learned to see it, by measuring it, since the questioning of premises that a system invites, logs and scores becomes one more target that a student learns to hit. The first movement is a limit of the instrument and could be repaired, whereas the second arises wherever a measure of reflection is turned into a target for evaluation, and no better sensor repairs it. The argument is theoretical and proceeds by conceptual analysis of published research, from the construct of engagement through the two loops and the chain that turns a measure into an intervention, to the central section on what happens when reflection itself becomes something to log, and from there to who pays for it and to what a teacher, a designer and an institution can still do.

2. Engagement before and after datafication

In the Review of Educational Research in 2004, Fredricks, Blumenfeld and Paris went through two decades of school engagement studies and sorted what they found into three kinds, a behavioural engagement made of attendance, participation and homework turned in, an emotional engagement made of interest, boredom, anxiety and the sense of belonging to a class, and a cognitive engagement that they described through investment, strategy use and the willingness to go beyond what the task requires, which in a classroom looks like the pupil who reads the paragraph on natural selection a second time because it contradicts what her grandmother told her and she has to decide which of the two accounts she now holds. The three were meant to be studied together, and the review closed by asking for richer accounts of how students behave, feel and think (Fredricks et al., 2004), and Kahu (2013) later made the point sharper for higher education, observing that the behavioural perspective, the one most popular with institutions because it yields comparable indicators, foregrounds what students do and what institutions provide while leaving the student's inner life and the wider social context out of the frame.

In the platforms schools actually buy, the clickstream and the questionnaire remain the primary sources (Sharma & Giannakos, 2020), and when Henrie, Halverson and Graham (2015) reviewed 113 studies of engagement in technology-mediated learning they found that 77 per cent had operationalised the construct behaviourally, through attendance, assignments completed and time logged in, against 43 per cent that reached for cognitive indicators, and they noted that system logs gather such behavioural data unobtrusively, behind the scenes, while students

learn. Gašević, Dawson and Siemens (2015) had to remind their own field that learning analytics are about learning, and Biesta (2010) described the pull they were resisting as the habit of valuing what we measure in place of measuring what we value. The instruments are improving, and this matters for what follows, since Noroozi and colleagues (2020) reviewed 207 multimodal studies that reach for cognitive, motivational and emotional processes through eighteen kinds of data, from interviews and observation to heart rate and facial expression, and Paulsen and Lindsay (2024) found student-facing dashboards moving, year by year, toward theory-informed designs that draw on more than activity logs. The cognitive strand that dropped out of the picture when only clicks were counted is on its way back in, and the question this paper asks is what happens to it when it arrives.

3. The first and the second loop

The gap between the strand that is counted and the strand that matters maps onto an older account of how any system learns at all. A household thermostat corrects the room toward the temperature it was handed, switching the heat on and off to hold that figure without ever asking whether twenty degrees was the right thing to want, and this closed correction toward a target nobody reopens is what Argyris and Schön (1978) named single-loop learning, whereas the second loop begins only when someone interrogates the setting itself, doubts the premise, and walks away from the goal that was passed down.

Carried into a course, the distinction separates two students whom a dashboard cannot tell apart, or tells apart the wrong way round. The first returns to the module every evening, retries the quiz until the score improves, and follows the recommended path to its end, which is to say that she corrects her performance against a target somebody else fixed, exactly as the thermostat does. The second stops halfway through the same module because something in its framing bothers her, and she wants to know why the topic is presented in this order, whose account of it she is being given, and whether the question at the end of the unit is the one worth asking. She has entered the second loop, and from the platform's side she has simply gone quiet. What separates the two is the object of the revision and nothing visible, since the first student may also stop for eleven minutes to check a date, which is a metacognitive act that stays entirely inside the first loop, and the second may keep clicking through the module while she doubts its premises, so that the same trace can accompany either process and a dashboard has no way of telling, from activity alone, which kind of learning it is looking at. A school that never allows the second movement, the deviation and the doubt, has reduced learning to the efficient pursuit of goals nobody is permitted to examine, and yet on the dashboard that movement leaves no bright trace, appearing instead, when it appears at all, as a dip that reads like disengagement, the flat stretch on the graph that a manager reviewing weekly numbers is trained to treat as a problem to be fixed.

4. From measure to intervention

A dashboard does more than hold a mirror to what a learner does. Williamson (2017) traced through a decade of educational technology how analytics systems shape the conduct they claim only to record, since a platform built to keep a metric climbing will design itself toward whatever makes the metric climb, and Campbell

(1979) had already observed, for social programmes in general, that the more a quantitative indicator is used for social decision-making, the more it distorts the processes it was meant to monitor. Knox, Williamson and Bayne (2020) gave the educational version of this pattern a name, machine behaviourism, by which they mean the coupling of data-intensive systems with the nudges and choice architectures of behavioural economics, so that the learner's decisions are steered toward aims fixed in advance. Measurement on its own erodes nothing, and a dashboard that only recorded what students did would leave the interval of doubt where it was, so the chain has three links, what the platform makes visible, what the institution counts as success, and what the system does to correct a deviation, and the damage is done at the third link, where autoplay, streaks and reminders, which belong to persuasive interface design and can exist without any analytics at all, are wired to the score. Once that wiring is in place, whatever the system cannot recognise as learning becomes something it works to remove.

The concrete price is paid in the interval of doubt. A student who has spent eleven minutes on one page of a history unit, because the page says the famine was a policy and her textbook last year said it was a harvest failure, generates eleven minutes without a click, and eleven minutes without a click is what an inactivity threshold is written to catch, so the platform does what its settings tell it to do, and where those settings follow the defaults of consumer learning apps, which many school platforms have copied, that means a reminder notification, the next video starting on its own after a countdown, and a streak counter that will reset at midnight if she completes nothing. Mary Budd Rowe found, with a stopwatch, that teachers waited less than one second after a question before answering it themselves, and that stretching the wait to three seconds made students' answers longer and brought questions back from them (Rowe, 1986), and a platform wired to an engagement score reverses that finding for every student logged in at once, setting the wait at zero and removing the adult who might have noticed what the silence contained. This is the first erosion, and it is the one the field already knows how to answer, since the obvious remedy is an instrument that can see the doubt.

5. When the dashboard learns to see the second loop

The strongest people in the field have been building that instrument for a decade, because the best learning analytics long ago stopped chasing raw clicks and aim instead at self-regulated learning, prompting a student to plan a task, to monitor her own comprehension, to notice the moment she has misunderstood and double back. The models behind this work are serious ones, since Zimmerman (2002) describes a cycle of forethought, performance and self-reflection, and Winne and Hadwin (1998) describe studying as a sequence in which the learner defines the task, sets goals, enacts tactics and then adapts her whole approach, so that in theory the goals belong to the student. Reviews of the dashboards actually built on these models report that few are grounded in the learning sciences at all and that most offer the class average as the only reference frame (Jivet et al., 2018; Matcha et al., 2020), but nothing in principle stops a platform from going further, and some do, by letting students write goals of their own, log the questions that occurred to them and record a change of mind. Take the field at its word, then, and suppose, as a thought experiment, that the instrument is finished. A platform adopted by a liceo

adds to every unit a reflection box with the prompt which assumption in this unit did you question, and why, and the box feeds a score called critical engagement that appears, next to attendance and completion, on the report that goes to parents and to the teacher's annual review. Within a month, in this scenario, the class has worked out that three kinds of sentence score well, the one that names the textbook's point of view, the one that mentions a source the unit left out, and the one that ends with a question, and the sixteen-year-old of the opening page, who has a real objection to the way the unit frames the famine, writes the three sentences instead, because the objection is long and would take the week and the box is due on Friday.

Nothing in this scene is a failure of the instrument. The dashboard now sees the second loop, and sees it well, and what it has done by seeing it is to hand the student a goal called questioning and watch her pursue it efficiently, which is the first loop by definition. The movement that Argyris and Schön described was valuable because the governing variable itself came up for revision, and a student can still question the variable once it is scored, she can contest the score, refuse the prompt or write that the whole procedure is absurd, so the closure is a tendency of the institution and no law of logic. What the score adds is a reason, since once questioning is a requirement with a mark attached, the student acquires an interest in optimising its performance over following its consequences, and the forms of questioning that score best are the ones that leave the scoring itself untouched. The capture needs three things together, a reflection that has been standardised into a prompt, a prompt that has been turned into an indicator comparable across students, and an indicator that has been wired to something the student or the teacher cannot afford to lose, and a teacher who reads an argument and judges it has only the first of the three, which is why she can assess a critique of her own framing without neutralising it. An invitation to question premises can work as long as it stays an invitation, a space on the page where a student may write that the unit's framing seems wrong to her, which nobody counts, and the moment the same space is scored, summarised and fed back into the evaluation of the student or of the course, reflection performed for the report becomes the first loop wearing the clothes of the second. This is the second erosion, and it is the deeper one, because the first could be met by a better sensor and the second is produced by the better sensor. Widening what the platform measures therefore helps only while the new measure is kept out of the chain of evaluation and intervention described above, since regulating oneself efficiently toward a given target, even when the target is called critical reflection, is the closed correction the thermostat was already performing without complaint.

6. *Thauma*, or what cannot be delegated

The movement that both erosions foreclose is a very old one. The Greeks gave the name *thauma* to the wonder that stops a person in front of something she cannot yet explain, and Plato has Socrates tell the young Theaetetus, who has just confessed that the puzzles make him dizzy, that this wonder is the only beginning of philosophy (*Theaetetus*, 155c–d). Any teacher who has watched a room go quiet after a hard question knows that the silence is the work rather than its absence. In the psychology of curiosity the same opening appears as an information gap, since

Loewenstein (1994) explained curiosity as a cognitively induced deprivation that arises when a person perceives a gap between what she knows and what she wants to know, and Desvaux, Abdelghani, Oudeyer and Sauzéon (2026) describe how a large language model that answers the instant it is asked closes the gap a good question needs in order to stay open, delivering the resolution before the learner has passed through the productive discomfort of not yet knowing. Wonder and curiosity are different things, and curiosity also feeds on partial answers and on feedback, so an open gap teaches nothing by itself, and what the two accounts share is that the gap has to be noticed by the person whose gap it is, which is the one part of the process that cannot be delegated, whether to an interface that resolves the uncertainty before the question is formed or to a reflection box that asks for the question on schedule. A doubt that arrives on Friday because the box is due is a doubt somebody else has had on the student's behalf.

7. Who pays when the loop closes

What the metric drains away has a name in the vocabulary of human capability, the difference Nussbaum (2011) drew between a functioning, the thing a person is actually doing, and a capability, the freedom she has to do otherwise. A dashboard logs the functioning to the minute and cannot see the capability at all, so it counts as a success the afternoon a student spends dutifully inside an assignment she was never free to leave, and the reflection box of the previous section counts as a success the three sentences she writes instead of the objection she had, wearing down, before anything else, the freedom education most depends on, the freedom to set the assigned path down and follow instead a question that has become genuinely her own.

The freedom to leave varies with what Robeyns (2017) calls conversion factors, the personal, social and environmental conditions that decide how much real freedom a person can draw from a given resource, and a learning platform is a resource of exactly this kind, identical on every screen and very different in what each student can make of it. Attentional justice is the name this paper gives to the distribution of those conditions, the material, social and technological circumstances under which a learner can direct her attention, hold it, and reconsider where it goes. Take two pupils in the same class with the same platform licence. The first has a bedroom of her own, a father who reads at the kitchen table and a shelf where the subject exists in three other forms, so when the module bores her she closes it, picks up one of the other forms and comes back a week later with a question the module never asked, and when the reflection box appears she can afford to leave it half empty, because her objection will reach the teacher by another route. The second shares a room with two brothers, does her homework on a phone between a shift at an uncle's shop and dinner, and has never watched an adult read anything slowly, so for her the platform is the whole of the subject, each notification that fills a pause closes the only space in which she might have discovered that the sequence on the screen was arranged by somebody, and the reflection box is the only place her questioning will ever be seen, which means she will learn the three sentences faster than anyone, because the critical engagement score is the one thing about her that reaches the report. The second pupil may also be the one for whom a well-timed reminder is the difference between finishing the unit and losing it to the shop and

EDIZIONI UNIVERSITARIE ROMANE
editoria scientifica dal 1952

the brothers, since the freedom the capability approach protects includes the freedom to lean on a structure for a while, provided the structure can be questioned and switched off, so the test of a notification is whether it leaves her more able or less able to revise the goal it is nudging her toward. A media education governed by the dashboard alone would hand the second loop to the students already equipped to seize it and a well-rehearsed imitation of it to everyone else, enlarging the distance it exists to reduce.

8. Pedagogical implications

None of this asks the field to give up measurement, only to refuse the quiet substitution by which the measurable comes to stand in for the educational, so that a design gets counted a success on the sole ground that a number went up. Learning analytics observe the strands of engagement that can be made to leave a trace, pedagogy is answerable for all three and for the one movement that stops being itself when it is traced, and the distance between the two has to be covered by somebody's judgement, because a finer sensor will not cover it. From that relation follows a single criterion, which asks of any tool whether it leaves a learner more able or less able to revise the goal she is being measured against, and in practice that room begins with the pause in which she can doubt and deviate, which is why the pause is where the criterion is first applied.

For a teacher the criterion comes into play the next time the dashboard turns red. The alert says that one student has logged forty per cent less activity than the week before, and it cannot say that the chapter in question was the one on the deportations, that the student is the one who asked two lessons ago whether her own town had had a ghetto, and that she has been reading about it at home in a book that no platform logs, all of which the teacher knows, so the decision about whether to send a reminder or to leave the silence alone belongs to her and to the three strands of engagement that Fredricks and her colleagues described, of which the dashboard holds one. Read this way the alert becomes a reason to walk over and ask what the student has been thinking about, and what she answers counts for more than the curve, and the same holds for the reflection box, which a teacher can read as a place to look rather than a number to collect, and can refuse to let into the grade.

Designers meet the criterion in the defaults they set, since autoplay, streaks and automatic reminders are choices about how long a pause is allowed to last, and each of them can be switched off, delayed, or handed to the learner, just as an inactivity flag can be made to distinguish a student who has vanished from one who has slowed down over the hardest unit in the course. The reflection space, if a platform offers one, can be built so that nothing is computed from it, no score, no summary, no comparison with the class, and a dashboard can also carry on its face a statement of what it does not measure, which costs a line of text and changes how the figure is read.

At the level of the institution the question is what uses the number is put to, because, following Campbell, the distortion grows with the weight of the decisions attached, so engagement scores are safest when kept away from grading, from teacher evaluation and from the renewal of contracts with vendors, and when joined in every case by evidence a log cannot produce, such as the questions students ask

and the work in which they depart from the brief. Media education has its own contribution to make here, since reading a dashboard critically, asking who built the metric and what it rewards, is the one form of questioning the platform that no reflection box will ever ask for.

9. Conclusions

An instrument built to detect involvement sees only the first loop of learning and reads the second as its absence, and an instrument improved until it can see the second loop risks turning it into a target as soon as what it sees is wired to a score, so that the dashboard erodes what it claims to measure once by omission and, under those conditions, once by inclusion. The limits of the argument are those of a conceptual analysis, and both movements are open to empirical test, the first by comparing what dashboards record during the stretches of a course that students later describe as the ones in which they changed their mind, the second by following what happens to the content of students' reflections in the months after a reflection score is introduced. Until that evidence is in, a field founded to train critical readers of media should assume that the curve on the dashboard and the education in the room can move in opposite directions, and should treat the promise of a better sensor with the suspicion it teaches students to bring to any promise of a better feed. What is at stake is whether a school can keep alive forms of learning whose value includes the right to question the criteria by which learning is judged, and a platform can get better every year at measuring how engaged its students are, and then at measuring how critically engaged they are, while the students, year by year, get less practice at deciding what their engagement is for. The sixteen-year-old of the opening page will close the laptop at some point in the year to think about something the module said, and the dashboard of today will record that afternoon as the moment she disengaged. The dashboard of tomorrow will see her perfectly, and will ask her to write it down by Friday.

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