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Discursive pattern recognition and production vs. dialogic meaning making in education

Eugene Matusov

My main thesis in this essay is that learning in conventional school mainly involves pattern recognition and pattern production patched and facilitated with occasional dialogic meaning making process. Let me provide an example. I often asked my undergraduate college students, future teachers, what they are proud of learning in school – what they have learned in school that they feel that they learn deep and they proud of this learning. In math, many of my students often pick up adding fractions with different denominators, like 1/2 + 1/3. They often feel very proud to demonstrate the math procedure of multiplying both the nominator and denominator of 1/2 by 3 and both the nominator and denominator of 1/3 by 2 to make the common denominator 6 and then add the new, transformed, fractions 3/6 and 2/6 together to get 5/6. So far so good. But then, I ask them why we cannot do simpler addition by adding the

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two nominators 1 and 1 together and by adding the two denominators 2 and 3 together to get 2/5. My students usually say that it would be wrong addition of the fraction. I ask them what makes the first addition of fractions that they did right and while the second addition that I did wrong. This is where the most interesting thing starts because my students rarely can answer this question. Many of them get angry at me for tricking them. They say, "It's forbidden." I ask, "By whom?" They say, "You will fail a test." I suggest, "Why don't we change the tests." And so on. Finally, I ask my students how and why the humans, the humankind, came to this strange rule of adding fractions. They do not know.

A similar question in science often brings an answer that the Earth is round. When I ask them how they know that it is true, my students often say that they learned it from their science textbooks. When I ask how the textbook, the scientists, the humankind know for sure that it is true. At best, my students could tell me that the humans can see the Earth from the space. I often counter-argued that the humans knew that the Earth was around long before they could go to space – but how did they know? It is clear that for the vast majority of my students these questions are new.

In my view, the issue here is not that most of my college students have experienced a particularly poor instruction and particularly bad teachers. The issue seems to be that apparently, something is very rotten with conventional schools themselves. Although a conventional teacher can teach my students to answer to my questions correctly, still the problem will reemerge when new, "tricky", questions, unexpected by the students, arrive. In conventional schools, students are positioned to be enactors of ready-made knowledge and skills on their teacher's demand, rather than to be authors of their own education, learning, and knowledge. Let me illustrate this point by considering experiments by the famous Soviet cultural-historical psychologists Luria and Vygotsky (LURIA, 1976; VYGOTSKY, LURIA, 1993) that were then critically re-thought by the American psychologist Scribner (1977).

Unpacking schoolish pattern recognition

In the early 1930s, Luria went to the Soviet Asia to conduct psychological experiments with illiterate and unschooled versus literate and schooled local population. Vygotsky and Luria (1993) expected to find evidence of qualitatively differences in the participants' psychological functions such as cognition because they believed that literacy and school provide people with new psychological mediational tools, which transform their cognition and other psychological functions. The results of the experiments seemed to confirm the Vygotsky-Luria hypothesis about cognitive mediation by cultural tools. They found that, in contrast to literate schooled local activists, illiterate unschooled adults could not solve logical syllogisms invented by Aristotle:

> [Syllogism] In the Far North, where there is snow, all bears are white. Novaya Zemlya is in the Far North and there is always snow there. What color are the bears there?
>
> 1. Illiterate Unschooled Peasant: ...We always speak only of what we see; we don't talk about what we haven't seen.
>
> 2. Experimenter: ...But what do my words imply? [The syllogism is repeated.]
>
> 3. P: Well, it's like this: our tsar isn't like yours, and yours isn't like ours. Your words can be answered only by someone who was there, and if a person wasn't there, he can't say anything on the basis of your words.
>
> 4. E: ...But on the basis of my words--in the North, where there is always snow: the bears are white, can you gather what kind of bears there are in Novaya Zemlya?
>
> 5. P: If a man was sixty or eighty and had seen a white bear and had told about it, he could be believed, but I've never seen one and hence I can't say. That's my last word. Those who saw can tell, and those who didn't see can't say anything! (At this point a young [schooled] Uzbek [Communist activist] volunteered, "From your words it means that bears there are white.")

6. E: Well, which of you is right?

7. P: What the cock knows how to do, he does. What I know, I say, and nothing beyond that! (LURIA, 1976, p. 108-109).

Vygotsky and Luria argued that the illiterate, unschooled peasant could not abstract for his everyday experiences and did not possess the cognitive abilities of hypothetical thinking. However, later, American psychologist Scribner (1977) re-analyzed the case and pointed out that the illiterate, unschooled Uzbek peasant demonstrated his hypothetical thinking perfectly well when he argued, "If a man was sixty or eighty and had seen a white bear and had told about it, he could be believed, but I've never seen one and hence I can't say" (see turn 5 above). Scribner also showed that he demonstrated abstract and generalizable thinking as well, although different than what Vygotsky and Luria expected. Thus, the reason, for which the illiterate, unschooled peasant rejected the syllogism premise, "In the Far North, where there is snow, all bears are white," was not rooted in "imprisonment by everyday experiences" and a lack of abstract and hypothetical thinking, as Vygotsky and Luria thought, but in something else.

Scribner attracted our attention to the fact that the syllogism premise, as probably all syllogism premises, do not make much sense outside of this syllogism game. Indeed, what does it mean, "In the Far North, where there is snow, all bears are white"? Who said that? Are those people trustworthy? What does it mean "all"? Is it about (somebody else's) past or about everybody's future? What if somebody brings a black bear to the Far North, would the Far North stop being the Far North or would snow disappear? What if non-white bears exist or existed on the Far North but we do not know that yet? And so on. The premise seems to be arbitrary.

Scribner turned the table around: instead of considering the strange peculiarity of illiterate, unschooled society, we should focus on the strange peculiarity of schooled societies. In a clever research, Scribner and her colleague Cole (1981) disentangled literacy and schooling and

came to a conclusion that it is schooling and not literacy per se that is responsible for the phenomenon observed by Luria. It seems that what people learn in school is not so much new cognitive mediational tools, as Vygotsky and Luria argued, but rather a peculiar ability to seamlessly abstract or decontextualize from their own meaningfulness, rooted in meaning making critical questions, and uncritically accept any arbitrary premise imposed by the authority. In the next chapter, I will try to address the important question of why conventional school does that and what role it serves in our society (and what "our society" means). For now, in this chapter, we will continue exploring the peculiar learning in conventional schools.

I argue that this type of learning, alienated from the student's own meaning making process, is mainly rooted in the pattern recognition and pattern production processes, guided by the authority's approval or disapproval. Such patterns may involve cognitive patterns like syllogistic problem solving, discursive patterns like talking about invisible electrons, action patterns like adding fractions with different denominators, perceptional patterns like seeing 4 in the 2+2 statement, communicational patterns of not talking until allowed by the teacher, power patterns like unconditionally accepting any question or any assignment demanded by the teacher, and so on. Students have to recognize patterns desirable by the authority and successfully produce them as judged by the authority. Of course, pattern recognition and pattern production occur outside of conventional school. Even more, one can legitimately argue that pattern recognition and pattern production are ubiquitous and omnipresent. Yes, but pattern recognition and pattern production in conventional school is different from occurring elsewhere by at least two mutually related accounts.

First, in conventional school, patterns to be recognized and produced are arbitrary and most often outside of the immediate experiences of the learners and not rooted in the everyday practices of the society. In extreme, the teacher can teach whatever nonsense the teacher wants to teach regardless of its truthfulness or usefulness. In other words, conventional school is a perfect tool to shape students' subjectivity in

whatever way a teacher or the entire society want or need. That is why conventional schools in politically, socially, and economically different societies – whether totalitarian, authoritarian, or democratic – look pretty much the same. The content of teaching (i.e., teaching curriculum) can be different at times – e.g., in the totalitarian Communist USSR it was taught that mostly the Red Army won the WWII, while in the democratic Capitalist US it was taught that mostly the US Army won the WWII. However, the organization of educational practices is often very similar: quizzing, exams, lecturing, sitting silent, unconditional assignments, the unquestionable teacher authority, expulsions, and so on. In contrast, in many other practices and contexts, patterns to be recognized and produced are pragmatic – not arbitrary – but embedded and subordinated to the practices and contexts themselves. There, what guides pattern recognition and production are success or failure in the pragmatics of the practice or context, mediated by the person's own sense making, rather than the arbitrary authority of the teacher or the society at large.

Second, in conventional school, the meaning making process is subordinated to the pattern recognition and production rather than the other way around. In conventional school, a student's own sense making is often overruled by the teacher's pattern of thinking, action, perception and so on. It often does not matter what makes sense for the student, what matters is what makes a good answer (for the teacher), good performance, good grade, and good mark produced by the teacher, testing agency, or the society at large. The role of the student's meaning making is diligently to serve the latter. For example, a first grader may sense that for some objects 2+2 is not always 4 (e.g., two friends and two friends does not always make four friends) (MATUSOV, 2009) but this sense making is in contradiction with the school unconditional pattern that 2+2 is ALWAYS 4 when one counts the same things and one should not challenge it. At best, to be successful in a conventional school, a student may develop double-consciousness (DU BOIS, 1961) to learn that in school 2+2 is always four, but outside of school it may not be so. At worst, the student may be brainwashed in accepting the school pattern as true. In-between, the student may give up on school success by rejecting the school pattern,

while remaining faithful to his/her own private sense making. In any case, the student's private authorial sense making remains undeveloped by a public critical dialogue that is genuine education.

One the other hand, the student's authorial sense making can become a legitimate and public aide (facilitator) when it is subordinated to the school pattern recognition and production. If, according to school pattern, 2+2 is always 4, then two hundred(s) plus two hundred(s) is four hundred(s) regardless how perceptually confusing it may look for a child (MATUSOV, 2009). A student is allowed to reason and make sense if and only if it leads to the authoritative school pattern and the student's reasoning is approved by the school authority. A student's personal sense making can also patch school patterns when they become obviously out of touch with the reality by rationalizing the questionable school arbitrary patterns. For example, when I challenge my student who, based on a school science textbook, insists that the Moon passes monthly the space between the Earth and the Sun, argues that the sun eclipse happens every lunar month but it just happens in different parts of the Earth and thus unregistered by the most of the people. Conventional schools are often criticized for learning being decontextualized for their students (FORMAN, MINICK, STONE, 1993; LAVE, 1988, 1992), which is, of course, true. But even more, conventional school learning is de-ontologized, de-personalized, voiceless, and stripped of any student activism and authorial agency.

Example of schoolish pattern recognition and production in a science lesson

In his book "Talking science" on science education in conventional school, Lemke (1990) argues that this process of pattern recognition and pattern production occurs through and in a special pedagogical discourse. In conventional school, students are guided by the teacher to learn to recognize and produce certain ready-made themes about science (or other academic subject) approved by the authority of the teacher (and tests, and exams, and a broader society). Lemke argues that this learning goes much beyond rote memorization of vocabulary, procedures, or definitions but

it is rather recognition and production of holistic thematic patterns that involve certain beliefs, perceptions, actions, semantics, social relations, contexts, and power. Students not only learn to hear and talk the pattern but also to see the world through and act by this discursive pattern.

The science in the dialogue is not just a matter of vocabulary. Classroom language is not just a list of technical terms, or even just a recital of definitions. It is the use of those terms in relation to one another, across a wide variety of contexts. Students have to learn how to combine the meanings of different terms according to the accepted ways of talking science. They have to talk and write and reason in phrases, clauses, sentences, and paragraphs of scientific language.

…

The pattern of connections among the meanings of words in a particular field of science I will call their thematic pattern. It is a pattern of semantic relationships that describes the thematic content, the science content, of a particular topic area. It is like a network of relationships among the scientific concepts in a field, but described semantically, in terms of how language is used in that field. There is science in the dialogue exactly to the extent that the semantic relationships and the thematic pattern built up by the dialogue reproduce the thematic pattern of language use in some field of science (LEMKE, 1990, p. 12-13).

Lemke illustrates this pedagogical discursive process of the teacher's guiding his students into this pattern recognition and pattern production process by the following excerpt from a science lesson discourse about the quantum model of the atom:

> Before his first question, the teacher describes the diagram he has on the board (see Figure 1). He points to the central area of the diagram and identifies it as "the 1 s orbital." He points out that the diagram does not show that it really looks like a sphere, that is, three- rather than two dimensional as it appears on the board. Only then does he ask a question which refers directly to the diagram, and not to the

> whole of it, but specifically to the part of it he has just described. He has prepared a context for his question first. Without the preparatory statements, the question would have been ambiguous or confusing for the class. (p. 6)

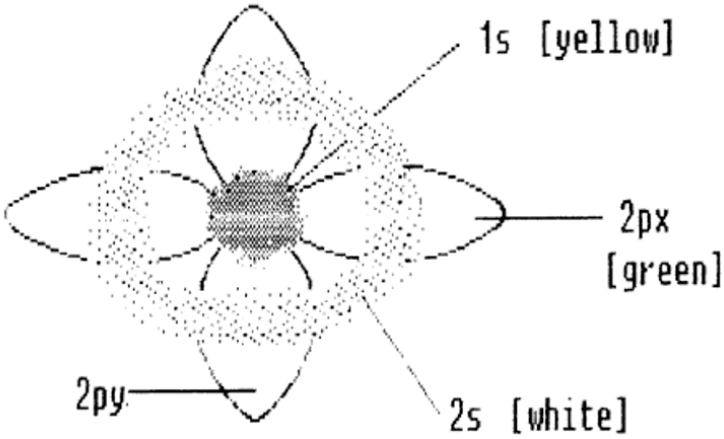

Figure 1. Atomic Orbital Diagram (LEMKE, 1990, p. 6)

Teacher: This is a representation of the one S . . . orbital. S'pozed to be, of course, three dimensional… What two elements could be represented by such a diagram? . . . Jennifer?

Jennifer: Hydrogen and helium?

Teacher: Hydrogen and helium. Hydrogen would have one electron... somewhere in there, and helium would have . . .?

Student: Two electrons.

Teacher: Two… This is… one S, and… the white would be…? Mark?

Mark: Two S.

Teacher: Two S. And the green would be…? Uhh…

Janice: Two P. Two P.

Teacher: Janice.

Janice: Two P.

Teacher: Two P. Yeah, the green would be 2P x and 2P y. (p. 5)

In this expert, the students learn a discursive pattern of the quantum model of the atom by the correct way of talking about it through making the correct clarifications, correct inferences, and correctly answering the teacher's questions. The teacher's quizzing questions are aimed at testing the students' existing understanding of the model but also at expanding this knowledge, which is nothing more but a complex thematic pattern, as Lemke argues. Students may doubt or guess in their reply to the teacher's quizzing questions as Jennifer did ("Hydrogen and helium?). Their answer can be not elaborated or incomplete as in the case of Janice (it was not just 2P but 2Px and 2Py. It can be fully correct, like in the case of Mark. Of course, it can be partially or even totally wrong, which was not presented in the excerpt.

Mechanism of schoolish pattern recognition

Student semantic sprouting

Pattern recognition – the term emerged in German gestalt psychology (KOFFKA, 1935; KÖHLER, 1929) and then actively used in computer science (BISHOP, 2006) – involves emergence or active production of diverse potential patterns that may or may not approximate well the targeted pattern (what I call "sprouting"). The sprouting can be guided ("supervised") by an expert or unguided (SUTTON, BARTO, 1998), mediated or unmediated (KÖHLER, 1973). These diverse potential patterns are sequentially evaluated about how likely each of them can be close to the targeted pattern. In each evaluation, the probabilistic confidence of some patterns grows while some other patterns decreases. Strictly speaking, the winner pattern always remains probabilistic and never 100% certain as a new evaluation may change its probability to be the correct pattern. Evaluation of potential patterns involves an action, in which the potential patterns are tested against the targeted pattern.

Often, the pattern recognition involves many targeted patterns at once and is organized in a complex. For example, OCR (optical character recognition) that involves a program recognizing a scanned photo image of a text may involve-letter pattern recognition, word-pattern recognition, sentence-pattern, context-pattern recognition, and so on (BISHOP, 2006; SUTTON, BARTO, 1998). One can argue that the modern computer-based pattern recognition can be called "*cognitive probabilistic behaviorism*" as it is indifferent to goals, subjectivities, desires, rules, strategies, and so on and essentially based on rewards and punishments that change probabilistic weights for possible outcomes of a complex system.

In conventional school, students are active in sprouting out new sematic connections-inferences in the classroom subject-thematic discourse, as the students did in the excerpt in their response to the teacher's lecture and questioning. Some of this sematic sprouting is done by the students privately and some publicly. Some students probably sprout the sematic connections when they were listening to the teacher's lecture and watching the visual model of the atom (see Figure 1 above). The teacher's mini-lecture promotes and provokes the students' semantic sprouting. I agree with Lemke that, "Without the preparatory statements, the [teacher's initial] question would have been ambiguous or confusing for the class" (p. 6). We do not know how present, active, and deliberate this private process of semantic sprouting was in each and every one student in the class. That is why probably a conventional teacher often seeks for students' public sprouting in a public discourse. By asking challenging quizzing questions, the teacher promotes public sprouting through the students' answers. It is reasonable to assume that when Jennifer, Mark, Janice, and other students provide their replies to the teacher's quizzing questions, they do not only publicly reveal their existing sematic sprouts-connections, privately produced in response to teacher's mini-lecture (and prior discourse) but also they publicly make new sematic sprouts-connections. Also, their peers may continue producing their own semantic sprouts silently and privately in response to the teacher's questions, their peer's replies, the teacher's evaluations and elaborations on the peer's replies, and even their own discursive thinking. As to the nature of students' sematic sprouting

– how much it is emergent in reaction to other people's (teachers' and peer students') discourse and demonstrations and how much it is based on deliberate actions on the part of the students – remains unclear and may differ from a student to a student.

Emergent semantic sprouting involves perceptual and semantic pattern recognition, described by cognitive psychologist Daniel Kahneman as System#1[1] (2011). Deliberate semantic sprouting involves internal dialogue, reasoning and meaning making, Kahneman's System#2 (but not only, see, MATUSOV, 2017). Deliberate sematic sprouting also includes emergent semantic sprouting – in a way, deliberate semantic sprouting is always a hybrid – but the reverse is not always true. Probably (my hypothesis), more autodidact, active learners generate more deliberate semantic sprouting, while more peripheral and passive students experience more emergent semantic sprouting. Since conventional schooling heavily promotes the former (emergent semantic sprouting) and discourages the latter (deliberate semantic sprouting), I expect the overall prevalence of *emergent* over *deliberate* semantic sprouting in conventional school[2].

Both pedagogical and psychological (indirect) evidence suggest that students' semantic sprouting does exist but is never guaranteed. The students' sematic sprouting exists because without the teacher's direct instruction (lecturing, demonstration, and so on), without the teacher's quizzing questions, without the teacher's providing evaluative feedback and elaborations, the students' semantic sprouting is less likely (but not impossible) in many students (but not in all!) (e.g., NICOL, MACFARLANE-DICK, 2006). At the same time, the teacher's guidance does not guarantee students' sprouting, not in all students, not all the time, not predictable type of sprouting. It is safe to assume that students' semantic sprouting is unpredictable in each and

[1] However, in contrast to Kahneman (and VYGOTSKY, 1978), I do not equate meaning making with mediation. Kahneman seems to include non-deliberate and unmediated pattern recognition in his System#1, while include deliberate mediation in his System#2. Since he equates meaning making with mediation, meaning making is also a part of his System#2. Although I agree that meaning making process involves mediation, it cannot be reduced to mediation (see my discussion of meaning making below in this chapter).

[2] See my discussion below in this chapter.

every case but rarely random or arbitrary. That is probably why the classroom discourse involving the teacher's quizzing and feedback is so ubiquitous in the modern conventional school.

Teacher's approving and cropping the students' semantic sprouts

The role of a conventional teacher is to approve the students' correct connections and crop out the students' wrong connections, affirm the students' right connections, clarify some of their fuzzy right connections, and encourage building still missing right connections through the triadic classroom discourse: 1) Teacher's quizzing question, 2) Student's reply, 3) Teacher's evaluation (MEHAN, 1979). To explicate the triadic discourse, the above exchange will look like:

> Teacher's quizzing question: This is a representation of the one S . . . orbital. S'pozed to be, of course, three dimensional… What two elements could be represented by such a diagram? . . . Jennifer?
>
> Student's response: Jennifer: Hydrogen and helium?
>
> Teacher's evaluation and elaboration: Hydrogen and helium. Hydrogen would have one electron... somewhere in there… (p. 5)

The student (Jennifer) was sprouting a connection, although she was not sure that her connection to the teacher's question was correct from the teacher's point of view. The teacher approved the student's sprouting and elaborated on its justification (i.e., why the pattern is correct).

In another example, the teacher cropped a student's wrong sprout,

> Teacher's quizzing question: If I have one electron in the 2Px, one electron in the 2Py, . . . two electrons in the 2S, two electrons in the IS, what element is being represented by this configuration?... Ron?
>
> Student's response: Ron: Boron?
>
> Teacher's evaluation and mediation: That would be—That'd have uh . . . seven electrons. So, you'd have to have one here, one here, one here, one here, one here . . . one here—Who said it? you?

> The teacher tacitly rejected Ron's answer and mediated his rejection by explanation of why the chemical element boron did not fit the pattern presented on the diagram. Other students provided the correct spouting accepted by the teacher,
>
> Student's response: Carbon.
>
> Teacher's quizzing question [beginning]: What's—
>
> Students' response: Carbon! Carbon!
>
> Teacher's evaluation and elaboration: Carbon. Carbon. Here. Six electrons. And they can be anywhere within those—confining—orbitals. (pp. 15, 17)

The last exchange slightly deviated from the strict triadic discourse because the first student was making a response, unsanctioned by the teacher. Other students joined that student interrupting the teacher who seemed to want to reiterate his previous question, since Ron was wrong. The teacher sanctioned the student's response by evaluating their answers as correct ones. The teacher accepted unsanctioned (unnamed) student's response before.

In conventional school, the teacher's guidance of the students' discursive pattern recognition and pattern production goes much beyond direct instruction (e.g., lecture, demonstration) and the triadic discourse, described above. Psychologist Jerome Bruner and his colleagues (BRUNER, WOOD, ROSS, 1976) describe the guidance employed in conventional school as "scaffolding." The goal of the scaffolding is to actively lead the student by the teacher to a curricular endpoint preset by the teacher in advance. In Lemke's case the preset curricular endpoint apparently was the quantum model of the atom (and, specifically, the atomic orbits of electrons in the atom). Rogoff argues that scaffolding involves much more than the organization of discourse but also the teacher's management of the students' motivation, frustration, and challenges, the teacher's presentation of the idealized pattern, and so on:

1. Recruiting the child's interest in the task as it is defined by the tutor.

2. Reducing the number of steps required to solve a problem by simplifying the task, so that the learner can manage components of the process and recognize when a fit with task requirements is achieved.
3. Maintaining the pursuit of the goal, through motivation of the child and direction of the activity.
4. Marking critical features of discrepancies between what a child has produced and the ideal solution.
5. Controlling frustration and risk in problem solving.
6. Demonstrating an idealized version of the act to be performed (ROGOFF, 1990, p. 94).

In Lemke's excerpt above, #2, #4, and #6 of Rogoff's principles of scaffolding are evident as the teacher's chunks the quantum atomic model by his quizzing questions (and probably in his lecturing) and by revealing possible discrepancies between the ideal model and the students' replies via providing his evaluation of the students' responses. Also, the quantum atomic model remains idealized as it simplifies its certain aspects (e.g., from quantum mechanics' point of view, strictly speaking, electrons do not have trajectories and their "orbits" represent probability distributions). The #1, #3, and #5 principles are not present but they may occur outside of the excerpt. At the same time, Lemke's excerpt has two aspects that are not present in Rogoff's list: 7) triadic discourse involving teacher's quizzing question, student's response, and teacher's evaluation and elaboration; and 8) managing the discourse to make sure that the students' replies are always sanctioned by the teacher. The list of essential features of scaffolding probably is probably incomplete and the issue of how much essential each of the aspects remains open for the future investigations.

Now I want to turn to the issue of contrast of the conventional school pattern recognition and production with: 1) pattern recognition and production in everyday life, outside of conventional school, 2)

learning guided by meaning making rather than by pattern recognition and production, and 3) the concept of intrinsic genuine education.

Pattern recognition/production in conventional school vs. everyday life

I consider three dimensions that reveal the prevalent contrast between pattern recognition and production in conventional school vs. in everyday life. These three dimensions involve: i) the relevance of the pattern recognition/production to the students, ii) the ownership of underlining values of the pattern, and iii) the realness of the pattern. I argue that in contrast to conventional school, the pattern recognition and production process in everyday life is more often than not ontological rather than alienated (relevance), more authorial rather than technological (ownership), and more experiential rather than discursive (realness). I also consider progressive pedagogy as a pattern recognition/production hybrid between conventional school and everyday life.

Relevance: ontological vs. alienated

Ontological pattern recognition and production involves person's genuine interest in and/or genuine pragmatic need for this pattern. For example, a person who got a new remote control may search for new patterns of his or her actions with the new remote control leading to desired outcomes on the device, associated with the remote control. In contrast to Lemke's case, in this case of the new remote control, the person's motivation is rooted in the actor him/herself – his/her own ontology – and not in the teacher – in the teacher's pedagogical actions, motivating the student. In everyday pattern recognition and production, the pattern is desired and owned by the actor, while in school the pattern is demanded and, thus, imposed by the authority. *Alienated* pattern recognition and production involves unconditional pleasing the authority (MATUSOV, 2011a). This pleasing – the student's desire to get the teacher to approve the pattern that emerges in or actively is designed by the student – guides the student's

pattern recognition and production. The pleasing is unconditional because the student is not legitimately involved in negotiation of what patterns he or she needs to recognize or produce. In conventional school, a student does not have a legitimate voice in shaping the curriculum.

Ownership: Authorial vs. technological

Authorial pattern recognition and production involves the actor's generating (or at least negotiating) his/her own values, defining the recognized and/or produced patterns' success or failure. In conventional school, the values, defining the patterns' success and failures are firmly controlled and possessed by the authority (i.e., the teachers, the test designers, graders, governmental agencies imposing the prescribed curriculum). In the case of a new remote control, the actor him/herself decides what outcome is desirable (e.g., switching on the TV) and whether it is successful or not. In conventional school, pattern recognition and production is technological because the teacher treats the student as a tool to produce the pattern that the teacher pedagogically desires to produce. Authorial pattern recognition and production promotes authorial learning (MATUSOV, 2011a) that organizational psychologists Argyris and Shon (1978) called Learning 2. Since authorial pattern recognition and production is guided by the actor's desires owned by the actor, the actor has an opportunity to reflect, revise, or even abandon the desire altogether. This is authorial learning or Learning 2. In contrast, in technological learning, the desire guiding the pattern recognition and production process is owned by the authority and often non-negotiable for the student. This type of situation promotes Learning 1, or thermostat-like learning, or deficit model learning, focusing on the gap between the ideal desired pattern, controlled by the teacher, and the student's actual discursive or action-based performance as judged by the teacher (#4 on Rogoff's list of scaffolding). In contrast, in authorial learning, Learning 2 and Learning 1 co-occur, with Learning 2 is guiding the process. Analyzing everyday problem solving, Lave (1988) concluded that everyday problem solving (Learning 1) often is based on problem redefining (Learning 2). For example, while shopping for the cheapest cereal, a shopper may redefine the criterion of the successful shopping by also considering space for storing large

box of the cheapest cereal and not only its price. The shopping process often involves redefining what exactly the shopper wants through considering the choices of the products available in the store.

Realness: Experiential vs. discursive

Finally, *experiential* pattern recognition and production involves person's holistic experience rather than discourse organized by the teacher that becomes the guiding force to form a desired perceptual or action-based pattern. Experiential pattern recognition and production has "the reality check", while discursive pattern recognition and production does not. In the latter case, "the resistance of material" – i.e., makes student's perception and action right or wrong – is fully controlled by the school authority, which makes it arbitrary. In extreme, school can (occasionally does) teach whatever nonsense – whatever untrue, irrelevant, and/or useless patterns for the students – it may wish (see chapters 1.2 and 1.3 above). In contrast, in the former case, however arbitrary the actor's desires may be (e.g., making the TV fly by pressing certain buttons on the TV), the realizations of these desires – i.e., patterns for desired actions – are never arbitrary because they are firmly grounded in the reality of the world. I call conventional schoolish knowledge "conventional" (MATUSOV, 2009) because its truth is based on the conventional authority for the students: something is true because the teacher or textbook or school exam or scientists or powerful societal traditional norm say so (see my examples of conventional knowledge at the beginning of the chapter).

Saying all that, I want to nuance that of course, in everyday life, there are many occasions of discursive pattern recognition and production learning as well (e.g., learning language). Also, experiential pattern recognition and production can happen in conventional school as well (e.g., lab science classes). In addition, discursive pattern recognition and production may involve experiential aspects (e.g., semantic sprouting based on the student's past experiences), while experiential pattern recognition and production may involve discursive aspects (e.g., symbols on a remote control or the remote control manual or verbal guidance by other people).

Finally, there can be school-like situations in everyday life and everyday-life-like situations in conventional schools (MATUSOV, 2009). Nevertheless, the overall contrast of the domination of ontological, authorial, and experiential aspects of the pattern recognition and production in everyday life and the domination of alienated, technological, and discursive pattern recognition and production in school remains intact, in my view.

Progressive pedagogical education hybrid

Progressive pedagogical[3] education, represented by famous American educational philosopher John Dewey, tries to address the problem of irrelevance, alienation, and non-authenticity of the students' school experiences by blending together conventional school and everyday pattern recognition and production. Progressive pedagogy organizes instruction in a form of pragmatic experiential learning activities that funnel the students into the curricular endpoints preset by the society (i.e., "curricular standards") – i.e., a body of democratically elected local and national political representatives of the general public, educational scholars and philosophers, and disciplinary scholars (i.e., scientists) (DEWEY, 1956). It promotes the ontological and experiential nature of pattern recognition and production in the learning activities from everyday practices. However, it preserves the control of the curriculum inherited in conventional schooling making the ownership of the patterns pseudo-authorial. It may feel like authorial at a local level of activities as students may have some freedom of defining their own values and set their own problems and goals in the learning activities but eventually the students' values, problems and goals have to be funneled into the curricular endpoints preset by the society. However, besides this preset curricular core, the students can arrive at their own emergent curricular endpoints, which can be considered as personalized, authorial, extracurricular enrichment and may involve meaning making outside of the pattern recognition and production requirement.

[3] Progressive *pedagogical* educational movement has to be distinguished from progressive *administrative* educational movement. The latter focused on the organization of the institutional practices to make them more scientifically efficient and rational. The former focused on pedagogy to increase the relevance of the pedagogical experiences for the students (LABAREE, 2010).

Dialogic meaning making vs. pattern recognition/production in education

According to Russian philosopher of dialogism Mikhail Bakhtin, meaning making is defined as the relationship between a genuine, interested, information-seeking, question and a serious response to it (BAKHTIN, 1986, 1999). This dialogic definition of meaning making is dramatically different from a common monologic understanding of meaning making. From a conventional monological view, meaning making is located in a particular statement. From the Bakhtinian dialogic perspective, a statement does not have any meaning until it is viewed as a reply to some question[4]. Often a statement like the mathematical 2+2=4 is viewed meaningful because it tacitly considered as a reply to some question like, for example, "What is 2 plus 2?" But in this case, the 2+2=4 is really meaningful only if the question, "What is 2 plus 2?" is a genuine, interested, information-seeking, question, which is probably not the case for most or all of my readers. The meaning of my 2+2=4 statement for me is answering my own genuine question of what an example of dialogic meaning making can be. However, my readers may imagine a different genuine, interested, information-seeking, question behind my use of 2+2=4 example and, in this case, they may have their own meaning, different from mine. Also, my (and other people's) meaning making may not need to be stable as we can come with different questions while re-reading 2+2=4 in "the same text" (thus, the text never remains the same). Although not necessarily language-based, meaning making is always discursive and rooted in language. In the speech- and language-rich environment, human actions and silence find its discursive properties of raising and addressing questions of others. Although not necessarily always literally (physically) collective – as meaning making can occur in one person during an internal dialogue or when reading the others' written text, – meaning making is an inherently social phenomenon. Any internal or imaginary dialogue within or by one person is always a purified and reduced genuine dialogue among real, alive, people, who can genuinely (not imaginary!) reply on their own behave (LOBOK, 2012, 2014; MATUSOV, 2009; NIKULIN, 1998, 2006, 2010; SIDORKIN, 1999).

[4] Actually, Vygotsky also has an example of how a statement "the watch fell" may mean two entirely different things based on what questions is it answering (VYGOTSKY, KOZULIN, 1986). This is one of the times where he comes close to discussing dialogic meaning making,

From an educational practice perspective, a student's meaning making process starts with a genuine, interested, information-seeking, question raised by the student. At least, when a student cannot yet formulate this genuine question, he or she has to be pregnant with such question, experiencing a certain puzzlement, uneasiness, curiosity, tension, and so on. Without genuine question or at least puzzlement, uneasiness, curiosity, or tension, a student cannot be involved in a meaning making process (BERLYAND, 2009; BIBLER, 2009). That is why I argue that there is little visible evidence of meaning making process in Lemke's excerpt from a conventional science lesson above. Even when meaning making may occur there, like in the student's (Jennifer) question, "Hydrogen and helium?", it is not clear how genuine, interested, and information-seeking, this question was for Jennifer and even if so, her meaning making was clearly subordinated to her pattern recognition to please the teacher. A full-blown meaning making process does not know preset curricular endpoints, educational standards. It disrupts them. It is wild and unpredictable (LOBOK, 2001, 2012). It does not bow any authority (BAKHTIN, 1991). It is bottomless (BAKHTIN, 1986), it is unfinalizable in time and in principle as more and more questions can be raised and different replies can be given (NIKULIN, 2010).

Students' meaning making is a social process that may require a teacher's, peers' and other people's help. Let's consider the following case of emergent meaning making process in students:

A primary consideration in developing a community of inquiry is to give students ownership of the tasks and problems posed. Throughout the year, many mathematical investigations grew out of students' questions and observations from mathematics class, other subject areas, personal experiences, and children's literature. The following conversation prompted us to engage the students in a rich exploration in finding patterns in rational numbers. The students were working on a computer-assisted spelling program that reported individual results as a statement, such as "19 correct out of 20 or 95%."

> *Thom:* I only missed one this time! [His report showed that he got 15 correct out of 16, or 94%.]
>
> *Will:* Me, too! I got a 95. [He points to the screen and shows the other student. His report says that he got 19 correct out of 20, or 95%.]
>
> *Thom:* Hey, why did you get a 95 when I got a 94? We both only missed one. That's not fair!
>
> *Will:* I think your computer is broken.
>
> …

To begin our investigation, Thom and Will shared their conversation, about their spelling scores. Some students agreed that the computer must have made an error; others thought that the computer could be right but were not sure why the percents were different. Although some students thought that the magnitude of the numbers might contribute to different percents, most of the students' conversation focused on the difference between the number of words spelled correctly and the total number of words. To prompt the students to explore the problem further, I posed the following question: "Suppose that you took a spelling test with only two words on it and you misspelled one of them. The computer reports that you got one word correct out of two. What percent of the words did you get correct?" The students discussed this question for several minutes with their "math buddies." When asked to share, one pair of students responded that 1 out of 2 was 50 percent because only half the words were correct and 50 percent means half. Other students chimed in and nodded agreement. We pointed out that 1 out of 2 means that you missed only one word, just as Thom got 15 out of 16 and Will got 19 out of 20. We then asked why the percent scores were different.

> *Sheila*: Ninety-five percent means that you almost got all the words correct. So 15 but of 16 and 19 out of 20 should both be 95 percent, since you almost have all the words correct.
>
> *Teacher*. Do you think that 1 out of 2 should also be 95 percent?
>
> *Sheila*: One out of 2 is usually 50 percent, but it also could be 95 percent, since you almost have all the words correct.

> *John*: No, 1 out of 2 is always 50 percent because 1 is half of 2 and half of something is 50 percent, just like 50 cents is always half of a dollar.
>
> John, and most others, had a clear understanding that 1 out of 2 was always 50 percent; however, they were not able to reason why the three ratios resulted in different percents (DRIER, 2000, p. 359).

Please notice that here it was students Thom and Will and not their teacher who initiated the genuine question, inquiry, and puzzlement for themselves and the class (but not necessary for the teacher who might feel that she knew the answer). However, in a meaning making pedagogy, a teacher can provoke students' questions, inquiries, and puzzlements. It was OK for the teacher to recognize this math inquiry raised by the students as legitimate learning problem during a language-art lesson. Meaning making does not know academic subject boundaries or, actually, any boundaries – Bakhtin (1986) called this feature of the meaning making process "heterodiscoursia"[5], literally "diversity of discourses." Another important aspect of the full-blown meaning making process is that it is not and cannot be validated by an authority (e.g., the teacher) but only by the discourse itself. Bakhtin (1991) called it "internally persuasive discourse", contrast to "authoritative discourse" (e.g., of a conventional school) where validation of contributions come exclusively from the authority. However, my colleague and I argue that in this discourse, *the internal* of its persuasion and validation come from the discourse itself – it is internal to the discourse itself – and not from the individual (i.e., the internal to the individual mind) (MATUSOV, VON DUYKE, 2010). In an internally persuasive discourse, each and every participant remains the only legitimate judge of how much each meaning making contribution is valid or contested.

The third important feature of the internally persuasive meaning making discourse is that the outcomes of the discourse, viewed by the participants as always provisional, are unpredictable and can lead to many directions. In the given case, the computer (and, apparently, the teacher)

[5] Unfortunately, in the English translation it was used a wrong term "intertextuality" for Russian term "raznorech'e" ("разноречье") (TODOROV, 1984). I introduced a better translation "heterodiscoursia" (MATUSOV, 2011b).

accessed spelling accuracy by the proportion of the total words to the correct words. This mathematical model was based on many questionable assumptions apparently rejected by Thom, Will, and Sheila. Thus, this mathematical model implied that all mistakes were the same. However, imagine that a student made a spelling mistake and learned from it, avoiding similar mistake in the future. In this case, arguably a student's spelling accuracy becomes 100%, since a student becomes a perfect spelling. In another case of a spelling bee competition, making one mistake means that the contestant lost the competition – it does not matter when it occurred and with how many words. The computer's (and the teacher's) math model implies, among other things, the spelling accuracy continuity – i.e., if a student makes one mistake out of 2 words, for example, he or she will continue making mistakes with the same frequency of 50%. Of course, this is very questionable. A student who made one mistake out of 20 (like Will) might continue not making spelling mistake for the next 1,000 words (or not). For this perspective, students who made just one mistake were equally accurate regardless how many words they wrote. This is what Thom, Will, and Sheila seemed to imply to me but unfortunately, the teacher did not investigate their assumptions that require different math models than both the computer and the teacher used. John's position was unclear to me and also seemed not to be explored by teacher. This leads me to conclude that the meaning making process was limited and unguided.

As the case suggests, dialogic meaning making may not guarantee any productive outcome, however, provisional it may be. It may flexibly dissolve any particular thematic focus (NIKULIN, 2006, 2010). In this particular case, we do not know how much the teacher respected this principle of the full-blown meaning making process – she might or might not funnel the discursive process to her preset curricular point. If she did, she would be a progressive educator, subordinating and exploiting the students' meaning making for the pattern recognition process (see above).

Although pattern of perception, pattern of action, pattern of communication, pattern of relation, pattern of power, pattern of thinking, and so on can become a subject of meaning making, there is the important difference between pattern and meaning as such in, at least, two

important aspects. First, in the meaning making process, people are not only genuinely, ontologically, interested in *it* – resolving some question, tension, puzzlement, inquiry, and so on – but also in other people: 1) in what other people may think and how they feel about *it*, however these people define this *it*, and 2) in *other people* as such – in what they are doing, feeling, relating, and thinking about; in the relationship with these people; in the potential that these people may realize and offer; and so on (NIKULIN, 2006, 2010). I called this aspect of dialogic meaning making as "interaddressivity" – i.e., genuine and deep interest in the people's dialogic interlocutors (MATUSOV, 2011b). The interaddressive interest in *it* vs in *people*, i.e. in one's dialogic partners, may vary and can create an important tension a dialogic meaning making process. In contrast, pattern recognition is always concerned with *it* – would it be things, processes, behaviors, or even people. Pattern recognition does not address or reply – meaning making does. Second, in pattern recognition one tries to grab the complete form of the things, processes, behaviors, actions, perceptions, and events. As with creating any form, one finalizes and conceives of the pattern as is finalizable, even when this form of the pattern is probabilistic (e.g., a probabilistic pattern of winning in a lottery) – a pattern of probability. Pattern recognition is exhaustible and has its bottom. In contrast, meaning making is relational (i.e., the relation between the genuine question and serious answer), bottomless, inexhaustible, unfinalized, and unfinalizable in the principle (BAKHTIN, 1986; NIKULIN, 2006, 2010). In sum, pattern recognition is essentially monologic, while meaning making is essentially dialogic.

Conclusion: Pattern recognition/production and dialogic meaning making vs. education

In the conclusion, I want to address a question of how the pattern recognition/production pedagogies and meaning-making pedagogies are located within the goal of education. I define pattern recognition/production pedagogies, both conventional and innovative, as such, in which meaning making, if exists at all, is subordinated to emergence the correct pattern – either correct from the authority's point of view or/and

the pragmatic point of view. I define meaning making pedagogies as ones, in which the educators recognize, appreciate, and promote full-blown open-ended inexhaustible meaning making processes and where occasional pattern recognition/production is subordinated to this meaning making. I can envision pattern-meaning hybrid pedagogies, which may have both forces at play.

I argue that the pattern recognition/production pedagogies are mainly concerned with and primarily focused on reproduction of the existing ready-made culture and cultural practices. Alienated pattern-recognition of conventional school approaches this task by chunking the ready-made culture on self-contained basic skills (e.g., reading, writing, calculating), basic prescribed knowledge, and basic dispositions. The students' authorial agency is postponed until their education is over (MATUSOV, VON DUYKE, KAYUMOVA, 2016). Some educators call this type of education – "training" (e.g., DEARDEN, 1984). In contrast, innovative pattern-recognition of progressive school approaches this task by engaging the students in ontologically attractive learning activities that are the funnel to the carefully preselected holistic ready–made cultural practices. My colleague and I called this type of education – "closed participatory socialization in a targeted cultural practice" (MATUSOV, MARJANOVIC-SHANE, 2012). We call it "socialization" because in contrast to training it views the ready-made practice holistically, involving the participants' social relations and identities. We call this socialization "closed" because it does not view students' contributions to transform, modify, or transcend this ready-made cultural practice as legitimate.

The meaning making pedagogies are interested in transcending the existing ready-made practices, relations, and communities of practices and in creating new ones through creative dialogic meaning making about these ready-made and new cultural practices by raising questions, concerns, issues, inquiries, curiosities, problems, challenges, controversies, and so on (KOVBASYUK, BLESSINGER, 2013). Ana Marjanovic-Shane and I (2012) distinguish at least two major meaning making pedagogies. We called one "open participatory socialization" because it mainly focuses on successful socialization of the students in existing and innovative

practices, while this socialization remains open for the student's authorial inputs and contributions. We call the other meaning making pedagogy "critical dialogue" because it is mainly focuses on critical examination of the existing and new self, culture, world, practices, and society, while it views open participatory socialization as its by-product. We presented all four pedagogies in the following table (I slightly updated this table by adding the new column on types of pedagogy and by adding references):

Table 1. Diverse approaches to education (based on MATUSOV, MARJANOVIC-SHANE, 2012, p. 165)

Approaches to education	**Example**	**Types of pedagogy**	**Curriculum**	**Instruction/ guidance**
Alienated Learning	Often conventional schooling	Pattern recognition/ production (alienated, technological, discursive)	*Poiesis*: reproduction of the ready-made culture	*Poiesis*
Closed Participatory Socialization	"Imitative participation", appropriation of the ready-made culture (VAN OERS, 2012; VYGOTSKY, 1978)	Pattern recognition/ production (ontological, pseudo authorial, experiential)	*Poiesis*: reproduction of the ready-made culture	*Praxis*
Open Participatory Socialization	"Community of practice", "legitimate peripheral participation" (LAVE, WENGER, 1991; WENGER, 1998)	Dialogic meaning making (creative)	*Praxis*: production of culture	*Praxis*
Critical Dialogue	"Dialogic Education For Authorial Agency" (MATUSOV, SMITH, SOSLAU, MARJANOVIC-SHANE, VON DUYKE, 2016)	Dialogic meaning making (critical)	*Praxis of praxis*: critical stance on culture	*Praxis*

We used Aristotelian notions of "poiesis" and "praxis" to characterized curriculum and instruction in these four types of pedagogy (ARISTOTLE, 2000; CARR, 2006). *Poiesis* refers to an activity, in which its goal and the definition of quality preset (standar'ds) and preexist the activity itself. In contrast, *praxis* refers to an activity, in which its goal and the definition of quality emerges in the activity itself. Thus, alienated pattern recognition/production of conventional school involves poiesis of both standardized curriculum and standardized instruction as both of them are preset. "Standardized social and cultural behavior patterns limit creative and authentic communication between individuals and groups" (DUMAZEDIER, 1974, p. 72). Instrumentalism, servility, efficiency, survival, and necessities are enemies of true democracy, true dialogue, true education, and true self-realization. In a pattern recognition/production pedagogy of closed participatory socialization in progressive schooling, curriculum remains to be poiesis while instruction becomes authorial praxis. In a meaning making pedagogy of open participatory socialization, both curriculum and instruction becomes praxis. Finally, in a meaning making pedagogy of critical dialogue, instruction remains to be praxis while curriculum becomes "praxis of praxis" – i.e., critical examination of life. In this book, I argue that only the latter should be the legitimate overall goal of the genuine education[6]. But the question exists of why it is alienated pattern recognition/production pedagogy of conventional schooling that remains so prevalent in the past and present of our society?

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[6] One may argue that by this statement defining the goal of genuine education, I made the education practice close and finalized – i.e., poiesis-like, in contradiction to my previous claims that genuine education should be praxis-like, in which its goal has to emerge in the activity itself. However, in my view, my definition of genuine education is self-constructive because it involves critical examination of education itself as an aspect of one's life (and critical exanimation of the criticality itself – its limitations).

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