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Affective transgression in learning mathematics

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Mathematics as a school subject raises a lot of negative emotions within students. It is seen as a difficult, detached from reality, full of useless in everyday life definitions and theorems field of knowledge. Not surprisingly, it causes a lot of anxiety, emotional tension and internal discord. Nowadays, many students declare their humanities preferences in purpose to justify the lack of involvement in learning mathematics. This article looks at this state of affairs through the lens of psychological concept of transgression. The first and foremost cornerstone of this paper is the notion of “affective transgression”. It is introduced after a brief exposition of transgressive concept of a man. This theoretical approach sheds some new light on teaching and learning mathematics.

Keywords: Transgressive concept of a man, affective transgression in learning mathematics, beliefs, meta – affect.

INTRODUCTION

A lot of attention has been paid to students’ achievement in mathematics so far. Although researchers and teachers’ efforts seek to improve the quality and efficiency of mathematics education, there are still many students who – for several reasons – achieve low scores in this school subject. What is more unsettling, is that many students declare humanities preferences in order to explain and legitimize their lack of engagement for learning mathematics and even among those who reveal their potential, there might be a significant number of underachievers (Rimm, 2008). There is a general agreement amongst mathematics educators that, regarding students’ achievement, neither affect nor cognition should be underestimated (e.g., McLeod, 1992; Vinner, 2013). In that sense, many researchers have been examining how affect influences the field of mathematics education (e.g., DeBellis & Goldin, 1997, 2006; Schlöglmann, 2005). Fortus (2014) goes even further, stating that all science educators ought to pay more attention to affect. He claims there is a great urgency to lift students from boredom and indifference, because “without engagement, learning is partial, at best”.

It is thus, of fundamental importance to focus research on understanding the role that students’ beliefs about the egalitarian nature of mathematics and the importance of mathematics education in their lives, in the process of learning mathematics. Considering the transgressive concept of a man within mathematics education, brings new ideas that address these issues. The last part of this paper, attempts to compress (Thurston, 1990) efforts and considerations made by affect researchers so far, into a thinkable concept (Tall, 2004) of affective transgression.

MATHEMATICS FOR ALL OR FOR MATHEMATICALLY GIFTED

Many students hold the belief that to be good at mathematics, one needs to have some innate predispositions to grasp it, and that ordinary students cannot be expected to understand this school subject (Schoenfeld, 1992). In contrast, some psychologists or educators try to convince the broad audience to the egalitarian nature of mathematics. Already in 1973, Piaget mentioned that fact:

Any normal student is capable of correct mathematical reasoning, if attention is directed to explaining and legitimizing their lack of engagement for learning mathematics and even among those who reveal their potential, there might be a significant number of underachievers (Rimm, 2008). There is a general agreement amongst mathematics educators that, regarding students’ achievement, neither affect nor cognition should be underestimated (e.g., McLeod, 1992; Vinner, 2013). In that sense, many researchers have been examining how affect influences the field of mathematics education (e.g., DeBellis & Goldin, 1997, 2006; Schlöglmann, 2005). Fortus (2014) goes even further, stating that all science educators ought to pay more attention to affect. He claims there is a great urgency to lift students from boredom and indifference, because “without engagement, learning is partial, at best”.

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Any normal student is capable of correct mathematical reasoning, if attention is directed to activities of his interest, and if by this method the emotional inhibitions, that too often give him a feeling of inferiority in lessons in this area are removed. (...) There is no field where the “full development of the human personality” and the mastery of the tools of logic and reason which insure full intellectual independence are more capable of realization. (Piaget, 1973, pp. 98–99, 105)

Aligned with those thoughts, also Krygowska referred to the nature of mathematics:
There are different levels of mathematical activity and with the exception of extreme cases, we can find an appropriate level of activity to any normal student. (...) When it comes to the development of mathematical thinking, we must not write any student off. (...) The student has to take a fancy to mathematics, find pleasure in solving mathematical tasks, even though it requires effort and difficult concentration. (Krygowska, 1975, p. 243)

Although these statements were given in purpose to emphasize that mathematical skills can be developed by any student, they also refer to affect and explicitly ascertain that it impinges on learning mathematics. It is reasonable to expect that students who are afraid to expose their emotional or intellectual shortcomings will tend to avoid doing mathematics (and consider that they are not able to learn it). Many students tend to have a distracting behaviour in classrooms in order to try to deviate their colleagues and teacher attention from their own mathematics difficulties. As part of my research, I have interviewed a high school student having low scores in mathematics. According to the information given by his teacher, the boy usually had side conversations, made sniping remarks and was playing around on every lesson. In an individual talk we had, the student confessed that he was showing off to get the rest of the class laughing. The real reason why he was doing that, was that he wanted to divert his colleagues' attention from his mathematical misunderstanding. He said that it seemed easier to hold on when they were all laughing with him, under his control, on the jokes he made, than to hear the laughter on his failure. Thus if we want to convince young people, especially reluctant and disobedient low-achievers, that they may become ‘good at math,’ we need to take into account students’ vulnerability to affective stimulation coming from mathematics. It is most remarkable that mathematics, like no other field of knowledge, evokes human’s affective responsiveness. For example, in the scope of the theoretical review one can find many references to math anxiety, and only very few references to anxiety outside mathematics (e.g., “chemistry anxiety” or “biology anxiety”). Nobody likes to experience negative frustration, fear or helplessness, being, in this context, the teachers’ responsibility to develop their work allowing students to overcome such experiences. That’s why some students prefer to avoid mathematics, rather than take the challenge and confront the constraints.

Paradoxically, all of these negative experiences related to mathematics, could be seen as a positive phenomenon. Intentional reversing negative affective patterns (Rimm, 2008) may be recognized as much more than just about the achievement in mathematics, being linked with the reinforcement of a widely understood personal development and fulfilled life.

(GOOD) REASONS FOR LEARNING MATHEMATICS

In light of the above remarks, it is no surprise that one of the most frequently encountered questions that students pose to their teachers is “Why do we have to learn mathematics?” Every teacher should have the answer well considered in advance. This problem opens up a long list of questions collected by Posamentier and colleagues (2013), who recognize this question as a symptom indicating that students do not appreciate mathematics. They deem convincing answers like, for instance, mathematics is useful in everyday life, it provides a wide range of career opportunities. However, the most important reason they give, refers to the remarkable nature of the discipline:

Mathematics is a huge, logically and deductively organized system of thought, created by countless individuals in a continuous collective effort that has lasted for several thousand years and still continues at breathtaking pace. As such, mathematics is the most significant cultural achievement of humankind. It should be a natural and essential part of everyone’s general education. (Posamentier et al., 2013, p. 3)

The reasons one can present for learning mathematics are wide different and can inclusively be controversial. Some of the possible reasons could be by the fact that mathematics is “beautiful”, and it’s worth learning this subject for its own sake (e.g., Davis, 1993; Lockhart, 2009). From another point of view, learning mathematics can be seen as a stepping-stone to further education at all levels of the academic studies (e.g., Vinner, 2013). Some authors emphasize the assumption that mathematics trains the mind, and provides universal mental tools that enable us to reason correctly (e.g. Dudley, 2011). Others pay attention to the role that mathematics plays in our daily life or in STEM-related professions (e.g., Fortus, 2014). Several publications consider mathematics as a source of social empowerment, a central element of culture, art and life, and the driving force for the development of
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civilizations (e.g., Ernest, 2010). Some of the reasons given above are controversial. For example, there is no consensus neither within the case of usefulness of mathematics in everyday life (e.g., Lockhart, 2009; Wu, 1997) nor the demand for mathematical skills in the workplace (e.g., Dudley, 2011; Vinner, 2013). As part of my research, involving high school mathematics teachers, participants were asked for reasons for learning mathematics. Most of the given answers, akin to taglines, were related to mathematics usefulness and importance for daily situations (e.g. counting money, shopping) and shaping logical reasoning. But there were also answers as:

I tell my students they should learn mathematics today, so they could teach others mathematics in the future.

I tell my students, there is no escape from mathematics! Mathematics is everywhere!

Look at lawyers for example. Do you think they could do the same work as a simple worker does? [The answer was “Yes”]. And now, look at the worker. Do you think that he could do the same things as the lawyer does? [“No.”] Hence, you see, it’s worth learning more because it gives you a wider range of possibilities.

What are possible responses a student could give to refute these arguments? They are easy to figure out: “I’m not going to teach mathematics to anybody”, “Oh, it sounds scaring! Though you say there is no escape from math, ... I will try the best I can”. A friend of mine told me an authentic story about a woman who was trying to encourage her son to doing mathematics, so he could have better life opportunities than she ever had. The boy said: “There is no sense in learning. Dad is a scavenger, you are a cleaner. What future do I have? I’m sure I will be doing exactly the same”.

However, there is one undisputed answer, that no student could ever debunk. The transgressive concept of a man, discussed further, provides a new reason justifying the value of learning mathematics. Moreover, the concept yields a new perspective on students as both learners and humans concerned about their growth. Finally, the idea of affective transgression in learning mathematics emerging from this psychological concept, may be successfully implemented in school practice and result in improving “weak” students’ achievement.

TRANSGRESSIVE CONCEPT OF A MAN

The term transgression is defined in different contexts (e.g. geology and genetics). In geology transgression is the spreading of the sea over land as evidenced by the deposition of marine strata over terrestrial strata; in genetics it means a peculiar case of heterosis - the increase in growth, size, fecundity, function or other characters in hybrids over those of the parents. In its transposition into psychological ground, Kozielecki (1987) uses terms of an intentional and deliberate overcoming of physical, social or symbolic boundaries. The concept of psychological transgression is devoted to the importance of the role that crossing over personal boundaries and subverting limitations play in everyone’s life. From this standpoint, a man is a self-directed, expansive creature who intentionally crosses the boundaries understood as demarcation lines separating what he is and what he owns, from what he may become.

Kozielecki (1987, 1997) has outlined four worlds of transgression wherein the exceeding boundaries can be taken towards: 1) material objects - territorial expansion in the physical world, 2) other people - expanding the control over other people but also altruism and extension of individual freedom, 3) symbols - intellectual expansion; going beyond the information given, development of knowledge about the world and 4) oneself - self-creation, self- development, unlocking one’s potential, coping with one’s weaknesses. In that sense, transgressions may be of different kinds: psychological or historical, individual or collective, constructive or destructive, but also, in other level, it can be creative or inventive and expansions (e.g., material, interpersonal, intellectual).

The human being is assumed to be able to carry both the telic (goal-oriented) and autotelic (intrinsically rewarded) actions. In the former, he acts in pursuit of a variety of goals and creates new values that satisfy his needs. In the latter kind of actions, the goal is less important than the satisfaction and pleasure simply coming from carrying out activities. Moreover, regarding autotelic actions indicated by high level of involvement, Kozielecki states that goals emerge from activity not conversely, because goals in this case have no distinguished status. The author notices
that goal-oriented activities become exhausting and boring in a short time, hence when the motivational tension relieves and the goal is achieved, a person ends up the task and refuses further actions. On the contrary, those who are totally committed to any kind of activity, do not feel tired. They forget about the lapse of time and even experience the state of flow (Csikszentmihalyi, 1991). Kozielecki (1997) emphasizes that thanks to the commitment we become more self-governing instead of being just human – robots.

However, from the viewpoint of transgressionism, another distinction is of higher importance. Kozielecki (1987, 1997) focuses on two kinds of actions that entities undertake: protective - designed for the maintenance of the status quo and transgressive ones – exceeding the boundaries and enabling the development of personality. The juxtaposition of these two types of human activity is presented in the table below.

Kozielecki puts forward the view that personality is equipped with a kind of internal comparator (a part of human’s will), which allows comparing plans with achieved state of affairs. It is also the comparator that decides whether to stop the action or continue. The salient feature of the protective actions is that they are directed by the principle of negative feedback – reaching the goal (namely restoring or maintaining the status quo) ends up the activity taken by a man. On the contrary, transgression is directed by the principle of positive feedback which works reversely: not only isn’t the motivation reduced, but also it is sustained or even increases during the activity. The notion of affective reallocation is introduced to name the positive correlation between adaptation and negative emotions on the one hand, and between transgression and positive affective experiences on the other. Hope may serve as a good example of such a positive experience. It is defined as a multidimensional cognitive structure, in which the central factor is the belief that in the future one will be offered the good (achieve an important objective), and the degree of certainty, or probability, is stated (Kozielecki, 2006).

These two kinds of behavior exposed briefly above, differ also in terms of the motivation involved. Two kinds of human’s motivation are distinguished by Kozielecki (1987): homeostatic – a typical motivation for protective actions, (however, sometimes transgressions could also be stimulated by this kind of motivation) and heterostatic – a specific motivation for transgressive actions. The former arises if and only if in human’s brain there are two independent information at one time: one concerning the desired state of affairs (S) and the second one, involving the actual state (A). When the comparator ascertains the existence of discrepancy D(S,A), the organism engages in behaviors designed to reduce the psychological imbalance. To get back to homeostasis, considered as a preferable state, a man undertakes actions intended either to dismantle the deficits or to remove the excess. This process leads to satisfaction and relief.

<table>
<thead>
<tr>
<th>Protective actions</th>
<th>Transgressive actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>play key role in adaptation and survival</td>
<td>satisfy higher needs of a human being</td>
</tr>
<tr>
<td>regulated by the needs of deficit</td>
<td>regulated by the needs of growth</td>
</tr>
<tr>
<td>undertaken to maintain the status-quo</td>
<td>orientated toward a meaningful change</td>
</tr>
<tr>
<td>other-directed; depend more on the changing external environment</td>
<td>inner-directed; depend on the components of personality, for instance, creativity, knowledge, motivation, courage, perseverance</td>
</tr>
<tr>
<td>necessary</td>
<td>Possible</td>
</tr>
<tr>
<td>“I know I have to”</td>
<td>“I know I am able to”</td>
</tr>
<tr>
<td>repeatable</td>
<td>non-recurring</td>
</tr>
<tr>
<td>planned</td>
<td>Spontaneous</td>
</tr>
<tr>
<td>often predictable</td>
<td>harder to predict</td>
</tr>
<tr>
<td>accompanied by negative emotions, especially fear</td>
<td>accompanied by positive affective experiences, especially hope</td>
</tr>
<tr>
<td>performed similarly to following an algorithm</td>
<td>inherently heuristic, fallible, underspecified</td>
</tr>
</tbody>
</table>

Table 1: Protective actions vs. transgressive actions
Homeostatic theory focuses on the maintenance of the internal physiological environment. However, this theory doesn’t describe all human’s behaviors adequately. For example: it is not sufficient to explain why people sometimes explore their environment and intentionally seek for arousal disrupting the equilibrium. What underlies human’s motivation in this case is the driving force of growth. The discrepancy $D(L,A)$ between the level of aspiration ($L$) and the actual state ($A$) raises internal tension that leads to actions oriented on growth and satisfaction. However, a man seen as an insatiable creature can never reduce $D(L,A)$ completely. This discrepancy exists permanently. The role of the comparator is then twofold: it detects the existence of $D(S,A)$ and evaluates the extent and the content of persisting $D(L,A)$. Overall, then, we can state that homeostatic motivation serves to minimize annoyance, whereas the role of heterostatic motivation is to maximize the pleasure.

There are two specific types of the heterostatic motivation that lead to transgression. The first one, which has been coined by Kozielecki, is the hubristic motivation, “conceived as a cluster of motives that make people assert and enhance their self-worth” (Kozielecki, 1987, p. 177). It is the major driving force of transgression. Hubris (also: hybris) is a term derived from Greek literature and philosophy. In the past it meant pride, insolence and arrogance, but here it is deprived of pejorative meanings. Transgressive concept of man takes into account that every human being has the desire, at some point, to be distinct from others, to be important, to shine the spotlight on others. The hubristic motivation manifests itself as striving for superiority or striving towards perfection. It is insatiable, very affective, sated with egocentric and hedonistic drives.

The second type of the driving force specific for transgression, is cognitive motivation. It is nongnostic, instinct to master and competence, governed by the principle of growth. It can be stimulated by the novelty or complexity of the subject, uncertainty or lack of information, as well as by the cognitive conflict raised when two or more contradictory beliefs, ideas, or values are held at the same time, or when existing beliefs etc. are confronted by some new directly contradicting information.

**AFFECTIVE TRANSGRESSION IN LEARNING MATHEMATICS**

In this section the focus is on providing a clear link between transgression and mathematics education.

A wide range of affect literature from around the world provides a considerable number of research reports exploring, in its depth and breadth, affective conditions of learning mathematics. The common reason why all these efforts are taken, is the more or less implicit assumption that identifying obstacles for effective learning, will contribute to a meaningful change in the quality and effectiveness of teaching. Paraphrasing Thurston, we can say that mathematics education is amazingly compressible, and “once you really understand it and have the mental perspective to see it as a whole, there is often a tremendous mental compression” (Thurston, 1990). Attempting to compress previous considerations made within the affect domain, into a thinkable concept (Tall, 2004), I hereby introduce the notion of affective transgression in learning mathematics (short: affective transgression).

By affective transgression I mean an intentional process of overcoming personal affective barriers that preclude one’s mathematical growth and development. The process is a psychological, individual and constructive transgression toward oneself. It is, by definition, highly recommended for low- and underachievers. Affective transgression might occur if and only if a person a) has insight into emotions (s)he experiences, b) is aware of the belief systems (s)he holds and c) has the will to make changes, believing they are good and possible. Meta-affect, considered to be the most important component of affect (DeBellis & Goldin, 2006), is inevitably required here. It should be developed to make all emotional experiences productive for learning and accomplishment.

Learning mathematics, seen through the lens of transgressive concept of a man, becomes an activity leading to inner growth and personal development. This argument seems to be a good and irrefutable reason that provides powerful meaning to the learning of mathematics. From the concept of hubristic motivation, we can deduce that even if students reject mathematics (as a school subject or as a domain where they are expected to be active), they will never write themselves off. Hence, until students (especially low- and underachievers) don’t see doing mathematics as an autotelic
activity enhancing their self-worth, they might refuse commitment. What is of the utmost importance, transgression accompanied by positive affective experiences (i.e. hope, faith), has a great impact on the language being used to describe students’ relationship with mathematics. Every problem becomes a challenge now, impossible turns out to be achievable, or not easy to achieve and the harder to achieve, the more wanted. Protective actions that students take (Vinner, 1997), are replaced by transgressive ones, they are encouraged to. Thanks to this approach, external goals (like passing exam or having good grades) are eclipsed by the pleasure and satisfaction coming from student’s endeavour.

Teachers have to meet two general prerequisites to make the affective transgression possible:

1) establishing growth-promoting climate in the classroom – which requires genuineness, unconditional positive regard and empathetic understanding. What counts most in effective treatment (Rogers, 1995) seems to be not a particular technique, but the personal relationship between teacher and his student,

2) transgression – oriented teaching, comprising both (meta)cognition and (meta)affect (DeBellis & Goldin, 2006).

*Meta-belief systems activity* (Moscucci, 2007) and *diagnostic teaching* (Schoenfeld, 2011) enriched with affect and meta-affect, may serve as transparent examples of practices that might evoke student’s affective transgression.

As belief systems constitute the weak element of affect structure (Moscucci, 2007), they need to be identified first. This may come through observation or individual interviews. There are also scales, constructed and validated in purpose to measure beliefs (i.e., Kloosterman & Stage, 1992). It is the role of a teacher to recognize students’ beliefs and bring them to their attention. If beliefs turn out to be a hindrance for one’s growth and achievement in mathematics, they need to be restructured. Counterexamples as well as class or small group discussions of beliefs can be effective for reflecting on negative beliefs (Kloosterman & Stage, 1992). This is already a stepping-stone towards overcoming them.

**FINAL REMARKS**

This paper has offered an explanation of what transgressive concept of a man is. It is my attempt to bring closer and describe the phenomenon of affective transgression, I have observed many times in my teaching practice. The notion of affective transgression, introduced in this paper, is hoped for to be powerful inspiration for researchers in the affect domain.

Given the paper length restrictions, I shall conclude by few brief personal comments. First of all, it is very hard to reach out to low- or underachievers. Whoever remains just a mere teacher instead of being a whole person, will surely fail. And the second remark (last but not least) is that teaching to transgress stands in relation to ordinary teaching mathematics, much as giving a fishing rod stands in relation to giving a fish. A student who has experienced his personal “mathematical transgression”, will never stop hungering for more. Just like once turned into a beautiful swan, the ugly duckling felt neither ugly, nor the duckling.

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