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NOVEL APPROACH TO STUDENTS FOR EFFECTIVENESS AND EFFICIENCY IN MATH EDUCATION

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Abstract. There are numerous proven effective methods for corresponding math knowledge transfer as well as arguments to which methods correspond to certain circumstances within math education. This work's focus, however, is not upon WHAT is used as methods, neither upon WHY those methods are used, but rather upon HOW the teacher may effectively and efficiently use whichever methods he or she finds appropriate. The novel approach is suggested, which is expected to enable significant improvement in the outcome of the math knowledge transfer, without any limitation to the set of methods that are used by the teacher. The approach is individually created with regard to the notion of Drivers and Working styles and Transactional Analysis as recognized and widely used personality theory. The communication doors of the students relevant to behaviour, feelings and thinking are discussed as well as sentences patterns as indicators to dominant student Drivers and/or Working styles.

The results and conclusions are summarized according to several students' Working styles categories.

1. INTRODUCTION TO THE CONCEPT OF DRIVERS AND WORKING STYLES

The theory of Drivers has been introduced about half a century ago by Taibi Kahler [14], and has been developed into five characteristic styles since. Kahler named the Drivers after Freud's drive, or basic instinct for repetitive behaviour. He defined them as programmed responses to the messages we carry in our heads, that we have subconsciously adopted from important people in our past (parents or other parental figures, including teachers) as in Fig.1, manifested as a certain set of a person's compulsive behaviours, particularly when the person is under stress [11],[14]. In fact, Drivers are unconscious behavioural patterns, which affect each segment of our lives, regardless to whether we are at home, at school, at work, alone, or with anyone. They are subconscious attempts by us to behave in ways that will gain us the recognition we need from others [3],[15]-[17],[24]. Drivers represent a type of survival mechanisms or subconscious mental strategies that we develop to counterbalance injunctions.

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This concept had later been developed and elaborated by many researchers: Gellert, Silver, Tudor and others [19]. Drivers' characteristics are very specific and can be both positive and negative, their orientation can be from or toward people [3]-[6],[22],[24]. They have specific behavioral indicators (words, voice, posture, facial expressions and gestures). Drivers may be observed as preferred styles of social interaction in contact, and as specific reactions to problems and stress. An early review to the positive aspects of Drivers has been given by Klein, however Hay is to one to elaborate and focus specifically on the positive aspects and has given the name Working styles to such aspect of the Drivers [12],[13]. Hay has created her well known Questionnaire to identify the concept of person's Working styles under professional conditions.

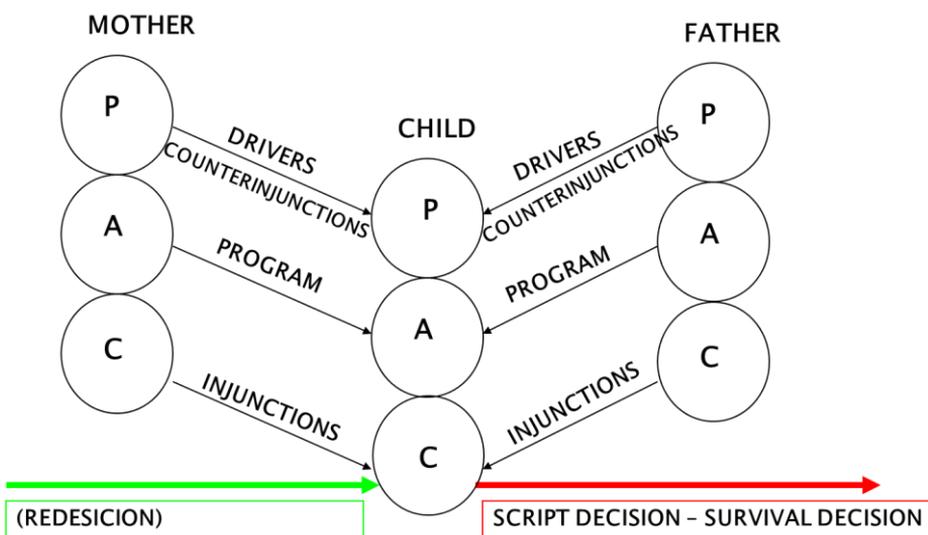


Figure 1. Scheme for developing dominant Drivers (Working styles)

Identifying the Drivers (Working styles) that an individual is manifesting enables the possibility for the individual to recognize and develop the potential of the positive aspects of their behavior and to constructively react to the negative ones. This work is focused on the Working styles only as the positive aspects of Drivers, and the theory is used to offer a novel approach to math students for improving and sustaining their work effectiveness and efficiency.

There are five identified Working styles with their characteristics, benefits and drawbacks, and they are named after the characteristic behavior manifested [3]-[6],[13],[22],[24],[25]:

- Be Perfect
- Be Strong
- Try Hard

- Hurry Up
- Please Others

In a person's real life, there is usually an influence of two Working styles [22],[24]. Such a combination seems to be in accordance with the experience, and people tend to a combination of two (sometimes and more rare three) Working styles. Some research and publications show that each profession, based on previous statistical evaluation, has a highly predictive presence of specific dominant Working style (Driver) [19]. For example, for the mathematicians, Be Perfect was identified as the primary dominant Driver, which is "justified" by necessity of having strong logic, organizing skills and ability to recognize and synthesize facts (Kahler, 2006), whereas Try Hard is present as a secondary dominant Driver. In contrast to that, the Try Hard Driver is not present at all as a dominant Driver in the profession Legal Advisor. It could be explained by the clearly established principles within the profession in the form of laws and regulations which does not require finding new and innovative solutions. Within the professional selection of staff, the concept of Working styles can be used as a tool for verifying the presence of the necessary skills and abilities in accordance with the job qualification. Within the professional selection of staff, the concept of Drivers can be used as a tool for verifying the presence of the necessary skills and abilities in accordance with the job qualification. Kahler in 2013 has developed and used PCM (in which the basis is the drivers) in the selection of astronauts for NASA (National Aeronautics and Space Administration) for more than 10 years. The concept of Working styles is also applicable in the field of employee motivation [2]-[6]. Kahler summarizes the incentive strategies that can be used to direct people towards optimal performance.

2. THEORY, METHODS AND DISCUSSIONS

The main characteristics of the Working styles will be discussed with regard to their behavioural features [22],[24], their communication doors opening order, and correspondingly summarized in tables. Positive values for each Working Style are given in each description.

2.1. WORKING STYLE BE PERFECT (BP)

If one may answer positively to the following questions: *Do you pride yourself on your accuracy? Does it worry you when you see mistakes? Do you enjoy the challenge of bringing order into the world?*, then he/she may find to be driven by the Be Perfect Working Style. Specific characteristics are presented in Table 1.



Table 1. BP characteristics

WS	Words	Tones	Gestures	Postures	Facial Expressions
BE PERFECT	“of course” “obviously” “efficacious” “clearly” “I think” (tells more than asked)“	clipped, righteous	counting on fingers, cocked wrist, scratching head	erect, rigid	stern, shame, embarrassment

The Communication doors that this person communicates through, open by the following order:

1. Thinking (T) communication door
2. Feelings (F) communication door
3. Behavior (B) communication door

This would help us to communicate easily to a BP person if the communication doors order would be followed. Positive values of this WS may be making a real hit and being precise, while permissions and advices in everyday work to be given are to make a point, to define time limits for completing the work or to define content and aims.

2.2. WORKING STYLE HURRY UP (HU)

If one may answer positively to the following questions: *Do you enjoy having lots to do? Are you usually in a hurry? Can you pull out all the stops when urgent work comes up?*, then he/she may find to be driven by the Hurry Up Working Style. Specific characteristics are presented in Table 2.



Table 2. HU characteristics

WS	Words	Tones	Gestures	Postures	Facial Expressions
HURRY UP	“let’s go” interrupts people-finishes their sentences	up & down	squirms, taps fingers	moves quickly	frowning, eyes shifting, rapid

There is no specific order in Communication doors. The main reason for this is that HU may not be a dominant Driver, and the contact door is determined by the dominant Driver.

Positive values of this WS may be being aware of time, while permissions and advices in everyday work to be given are to take as much time as he/she needs, to make a break and take a rest between two different works, or to plan and define their priorities.

2.3. WORKING STYLE BE STRONG (BS)

If the person finds himself/herself familiar to the following statements: *You pride yourself on your ability to cope. You may even welcome pressure because it gives you the chance to show how well you can deal with it. You stay calm when there is a crisis*, then he/she may find to be driven by the Be Strong Working Style. Specific characteristics are presented in Table 3.



Table 3. BS characteristics

WS	Words	Tones	Gestures	Postures	Facial Expressions
BE STRONG	“no comment” “I don’t care” doesn’t use here-and-now feelings	hard, monotone	hands rigid, arms folded	rigid, one leg over	plastic, hard, cold

The Communication doors that this person communicates through, open by the following order:

1. Behavior (B) communication door
2. Thinking (T) communication door
3. Feelings (F) communication door

With regard to successful communication, the BS person may be reached mostly by questions/statements considering the behavior, and such person will not be easily responsive when asked about feelings.

Positive values of this WS are reacting correspondingly in problematic situations, while permissions and advices in everyday work to be given are to

experience and verbalize their feelings, to listen to their feelings and to express them in a corresponding way.

2.4. WORKING STYLE PLEASE OTHERS (PO)

If the person can give a positive answer to the following questions: *Is your priority to get on well with people? Are you intuitive about how people are feeling? Are you happiest working in a team where everyone's views are taken into account?*, then he/she may find to be driven by the Please Others Working Style. Specific characteristics are presented in Table 4.

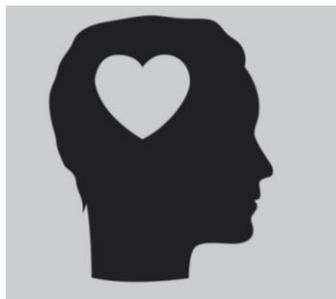


Table 4. PO characteristics

WS	Words	Tones	Gestures	Postures	Facial Expressions
PLEASE OTHERS	“You know”	high whine	hands outstretched,	head nodding	raised eyebrows,
	“Could you”		head nodding		looks away
	“Can you”		frequently		
	“Kinda”				
	“Um				
	Hmm”				
	“Would you”				

The Communication doors that this person communicates through, open by the following order:

1. Feelings (F) communication door
2. Behavior (B) communication door
3. Thinking (T) communication door

If we tend to successful communication, the BS person may be reached mostly by questions/statements considering the feelings, and such person will not be easily responsive when asked about their thinking.

Positive values of this WS are being highly emphatic to other people, while permissions and advices in everyday work to be given are to take care of their own feelings, to take some time to think and to think about what they want for a mutual success.

2.5. WORKING STYLE TRY HARD (TH)

If the person can give a positive answer to the following questions: *Are you motivated by almost anything as long as it's new? Do you enjoy most the early stages of each new project or task? Is it a challenge to explore different areas of work?*, then he/she may find to be driven by the Try Hard Working Style. Specific characteristics are presented in Table 5.



Table 5. TH characteristics

WS	Words	Tones	Gestures	Postures	Facial Expressions
TRYHARD	"It's hard" "I can't" "I'll try" "I don't know" (doesn't answer questions-repeats, tangents)	impatient	clenched, moving fists	sitting forward, elbows on legs	slight frown, perplexed look

The Communication doors that this person communicates through, open by the following order:

1. Behavior (B) communication door
2. Feelings (F) communication door
3. Thinking (T) communication door

If we tend to successful communication, the TH person may be reached mostly by questions/statements considering the behavior, and such person will not be easily responsive when asked about their thinking.

Positive values of this WS are being active and doing their work, while permissions and advices in everyday work to be given are to tell them when it is enough, to make a break, to organize their time to get some rest, to set the work within time intervals with high level of energy, to create an appropriate (peaceful) working atmosphere, and that it is necessary to evaluate the time needed.

3. DRIVERS AND SCRIPT PATTERNS

Considering the fact that each individual is driven by mainly two Working styles, the combination of the two implies some specific characteristics which influence the way of living lives and thinking, feeling, and behaving in a certain pattern that is named a life script pattern. Taibi Kahler describes 6 script patterns (of which 5 that are most common will be subject of our interest) that influence the individual thinking, feeling and behaving manner. This theory perfectly applies for students who are part of math education. Considering the time aspect, these script patterns are related to our perception of time and manner in which we tend to focus to our past, to our present or our future [7].

According to d-r Kahler, the script processes connected to these patterns are:

AFTER – “I am afraid something bad will happen.“;

UNTIL – “I can’t have fun until...“;

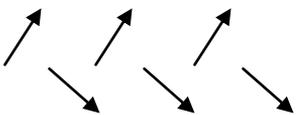
ALWAYS – “Feeling of being cornered“, blames or waits for a rescue, or manipulates others from a position of “being cornered“;

NEVER – Has difficulties of finishing life projections;

ALMOST – Almost completes the work, but not all of it.

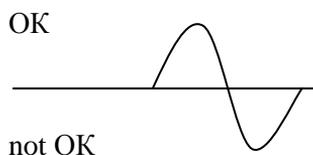
Each of the Working styles may be found within the corresponding script pattern that has specific characteristics [1],[2],[22]. Most of us follow one script pattern in each aspect of life. However, there are people who follow one script pattern in their private life, and some other in their professional or social life. It is important to point out that the script pattern is being expressed or manifested in the person’s lifestyle, as well as in their overall life plan. A lot may be read in literature [7]-[10],[12],[13],[18],[20]-[24] and further the main characteristics considering particularly the sentence patterns of the most common life scripts will be summarized as presented in Table 6.

Table 6. Characteristic sentence pattern for different life scripts

Script patterns (combination of WS)	Characteristic sentence pattern
NEVER (TH, rarely others)	 <p>- Discontinued, seem like it will never end</p>
ALWAYS (BS, HU, sometimes others)	<p>- Nonconsistent sentences - A lot of qualifying words (maybe, we’ll see, I’m not sure, sometimes ...)</p>

+ feelings, but – feelings:

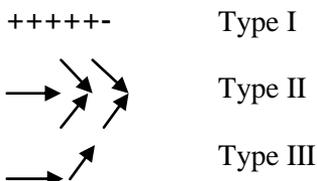
AFTER
(PO, HU)



UNTIL
(BP, combined with HU
or BS)

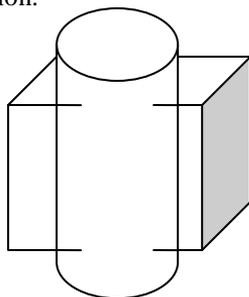


ALMOST
(TH, PO)



4. APPLICATION TO MATH STUDENTS APPROACH

Math problem: Find the volume of the intersection.



The theory of script sentences pattern may be successfully applied to any math student, considering the fact that these patterns are subconscious. There will be given 5 examples, one of each script patterns, and proposals of how to overcome personal member drawbacks or interruptions due to their characteristic script behavior.

Suppose a student is given a math problem by the teacher to be solved and he/she is not able to fulfill it easily. Within the following examples the students' sentence reactions are considered and there are several permissions proposals to each example of reaction to unfulfilled task, in accordance to the script pattern and tending to script disruption.

Example 1. Script process: NEVER

Student: I...hmmm,...well, I am not sure if you will agree with me,... or...perhaps you will think I am overreacting... um...I don't know...

Considering the characteristics and sentences patterns given in Table 6, there are several permissions and script disruptions that may be proposed:

- (1) Stroke (lavishly) each step toward OKness, no matter how small.
- (2) Confront the TRY HARD Working style by inviting the student into perception of here-and-now.
- (3) Stroke student spontaneity and ability to enjoy him/herself and the world around.

Example 2. Script process: ALWAYS

Student: I am not quite sure I understand this very complex math problem, if it is important at all.

Considering the characteristics and sentences patterns given in Table 6, there are several permissions and script disruptions that may be proposed:

- (1) No hedging or disowning
 - It's OK to make decisions ("What do you want?")
 - It's OK to make commitments ("What will you do?")
 - It's OK to state feelings, thoughts, opinions ("What do you feel/think?")
- (2) Encourage and stroke student's risk-taking – it is OK to make mistakes, it is OK to change your mind.

Example 3. Script process: AFTER

Student: I really love solving these kinds of math exercises, but I think I will never be good at it.

Considering the characteristics and sentences patterns (see Table 6), there are several permissions and script disruptions that may be proposed:

- (1) Give permission and make contract with the student not to use work to invite bad feelings later.
- (2) Stroke the student after positive statements (before negative statement follows).
- (3) End work on positive note - watch for escalations later.

Example 4. Script process: UNTIL

Student: I read it well and, due to the complexity and language used, I don't understand this math problem.

Considering the characteristics and sentences patterns given in Table 6, there are several permissions and script disruptions that may be proposed:

- (1) Do the work now (don't let the student ramble first, work later).
- (2) Keep the work short.
- (3) It's OK to work on it before it's all figured to details.

Example 5. Script process: ALMOST

Student:

Type I – *I find this math problem very interesting, however, I think its aim should have been explained better.*

Type II – *This math problem as a given assignment/homework... I mean... I was not expecting it to be like this ... anyway, we have to do this...*

Type III – *This math problem... can you tell me how long until the lunch break?*

A person driven by the script process ALMOST may use one of the three types of sentences patterns given in Table 6, and for each of them, the following proposed permissions and script disruptions hold:

(1) Finish the work (if not finished, ask the student to summarize progress and state future direction).

(2) Finish each sentence (no “but’s”).

Summarized permissions that lead to script disruption are given in Table 7.

Table 7. Summarized permissions according to script patterns

SCRIPT PATTERNS	PERMISSIONS AND SCRIPT DISRUPTION
NEVER (TH, rarely others)	(1) Stroke (lavishly) each step toward OK-ness, no matter how small. (2) Confront TRY HARD by inviting into perception of here-and-now. (3) Stroke spontaneity and ability to enjoy him/herself and the world around.
ALWAYS (BS, HU, sometimes others)	(1) No hedging or disowning -OK to make decisions (“What do you want?”) -OK to make commitments (“What will you do?”) -OK to state feelings, thoughts, opinions (“What do you feel/think?”) (2) Encourage and stroke risk-taking - OK to make mistakes, change mind.
AFTER (PO, HU)	(1) Give permission and get contract not to use work to invite bad feelings later (2) Stroke after positive statements (before negative statement follows) (3) End work on positive note-watch for escalations later
UNTIL (BP, combined with HU or BS)	(1) Do the work now (don’t let him/her ramble first, work later). (2) Keep work short. (3) OK to work before it’s all figured to details.
ALMOST (TH, PO)	(1) Finish the work (if not finished, ask him/her to summarize progress and state future direction). (2) Finish each sentence (no “but’s”).

5. CONCLUSIONS

Working styles (Drivers) as a concept is an extremely useful tool in improving and strengthening the communication both between the math teacher and each student individually and among the students themselves. Knowing one's own Working styles may:

- Clarify the subject of the math problem, as well as its purpose,
- Clarify the very essence of student's work interruption,
- Strongly motivate engaged students to improve their work,
- Use the maximum potential of each student,
- Stimulate teamwork,
- Improve communication with other students.

The elaboration enriched with corresponding examples enables appropriate on time teacher's reaction and greatly improves both effectiveness and efficiency individually as well as in teamwork.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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