

Learning Motivators of School Children

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Table of Contents

Learning Motivators of School Children.....	1
Introduction.....	3
Extrinsic and Intrinsic sources of motivation.....	4
Levels of motivators.....	5
Deficiency and growth motivators.....	6
Human need psychology.....	6
Gender differences in motivation.....	7
Brain differences.....	7
Behavior differences.....	8
Developmental differences.....	9
Physiological conditions for learning.....	10
Hypothesis.....	11
Method.....	12
Subjects.....	12
Procedures.....	12
Results.....	13
1st-2nd grade.....	13
3rd-4th grades.....	13
7th-8th grades.....	13
12th grade.....	14
Discussion.....	17
Correlation between maturation/development and primary motivation.....	18
Significance.....	18
Other considerations.....	18
Further research suggestions.....	18
Conclusion	19
References.....	20

Introduction

Motivation is the cause of any action. Motivators can be extrinsic or intrinsic. Intrinsic motivation in learning can border inspiration – motivation coming from within. This is ideal for learning.

Our brain development is established to be a basis for cognitive development (Travis, 2011). This study will examine assumption that motivation develops as brain develops. Given this is true, motivation is triggered by various levels of life and our existence, by deficiency and by need for growth. These stages of motivators develop in correlation with brain and cognitive development.

Parallel to correlation between brain development and motivation, motivation is influenced by gender differences and it can also be enhanced by proper nutrition, hydration, light and other environmental factors. In our study, we observed 1st-2nd, 3rd-4th, 7th-8th and 12th grade students and their motivators in classroom setting. We will consider motivation for learning, although motivation is applicable to achieving anything.

Extrinsic and Intrinsic sources of motivation

Sources of Motivation				
Extrinsic Motivators		Intrinsic Motivators		
Operant conditioning		Body	Cognition	Affect
	Social conditioning			Spiritual

Table 1: Extrinsic and Intrinsic sources of motivation (Travis, 2011)

Extrinsic motivation consists of social and operant conditioning. Social pressure, rewards, punishment and bribes belong to this category as ineffective methods. Social conditioning and operant conditioning can be used for positive purposes when they trigger or reinforce intrinsic motivation. For example when positive emotion is conditioned with learning, it can help learning motivation. Effective extrinsic motivators to trigger intrinsic motivation are: Providing a safe environment, setting clear expectations and giving prompt, accurate and positive feedback.

Intrinsic motivation is the kind of motivation that comes from within a person, rather than suggested from outside the person. On this side we have biological bodily needs governed by our reptile brain(hypothalamus etc), cognitive needs like curiosity and meaning. We also have affective and emotional needs ruled by our limbic system and spiritual needs related to purpose of life and higher brain functioning.

The best way to motivate anyone is to engage the intrinsic motivation (Song, 2006). This often means to help the person to find out what he/she is interested in, and let that interest guide the learning. In this way learner is self-motivated by his/her own reasons to learn and will easily go the extra mile. This will make the learning process more pleasurable and fun, plus it will provide the kind of results we are looking for.

Here is a list of some of the intrinsic motivators(Travis, 2011)(Jensen, E. 2008)(RSA 2010):

- Engage Intrinsic Motivators**
- Explain importance of learning content or skill
- Create curiosity
- Provide a variety of activities
- Provide games and simulations
- Set goals for learning
- Relate to student's needs and goals
- Help student make an action plan
- Provide sense of control and choice
- Encourage and provide positive social bonding
- Engage strong positive emotions
- Encourage adequate nutrition
- Share success stories
- Provide acknowledgment
- More frequent feedback
- Model the joy of learning
- Autonomy**
- Mastery**
- Challenge**
- Contribution**
- Purpose**

Levels of motivators

In case of extrinsic motivation, intrinsic motivation is triggered. On the other hand, if extrinsic motivators are repelled, result is less motivation. Thus, motivation always comes from within.

Considering our brain development and levels of functioning, we can find motivators from the lowest brain functioning (biological needs) to the highest brain functioning (spiritual needs):

Level	Motivator
Biological	Senses, hunger, thirst, arousal
Behavioral	Towards pleasure/avoid pain
Social	Role models, or group pressure
Cognitive	Attention, meaning, cognitive dis-equilibrium, curiosity
Affective	Feel good/bad, threat to security, meaning in life
Conative	Goals, control of life, will
Spiritual	Understand purpose of life

Table 2: Motivators related to levels of existence and functioning. (Travis, 2011)

It appears that some of these needs are driven by deficiency and are more related to lower brain functioning (reptilian brain, hypothalamus etc). Similarly, some needs are growth driven related to higher brain functioning.

Deficiency and growth motivators

According to Maslow (1943), needs are grouped based on nature of deficiency and need for growth:

Maslow's model	
Level	Motivator
Growth Needs	Transcendence Self-actualization
Growth Needs	Aesthetic needs Need to know and understand
Deficiency Needs	Esteem needs Belongingness & Love Needs Safety Needs Psychological Needs

Table 3: Maslow's model of deficiency and growth needs.

The deficiency needs are important to meet, otherwise they will dominate attention. On the other hand, to freely focus on meeting the growth needs, deficiency needs must be met. However, by fulfilling the growth needs first, one can more easily meet the deficiency needs. As an example, practice of Transcendental Meditation and its effects on every day life, open potential to fulfill deficiency needs on the basis of fulfillment of growth needs (Alexander 1990).

Human need psychology

In order to understand the very core of motivation, we need to boil down the motivators into two groups and a total of six fundamental human needs.

Needs of the EGO	(analogous to Maslow's deficiency motivators)
	Love and Connection Significance Certainty Variety
Needs of the Spirit	(analogous to Maslow's growth motivators and self-actualization)
	Growth Contribution

Table 4: Basic human needs (Robbins 1991)

Needs of the EGO are constantly met by everyone, in a healthy or non-healthy way. It's important to understand this in order to provide students with healthy ways to experience fulfillment of all of these needs in a healthy way during the learning process.

Needs of the spirit are relevant to meet only if an individual has evolved both physically and

psychologically to value the fulfillment that comes from self-actualization. Brain development and cognitive development need to reach level that can support such needs. (See table 8)

Gender differences in motivation

In gender, it is important to understand that there are fundamental differences between male and female brain. The differences are physical by design and function. This results in differences in behavior and preferences.

Brain differences

	Women	Men
Grey Matter	More: Thinking	Less
White Matter	Less	More: Doing
Larger areas	Language centers, Hippocampus	Spatial Centers, Amygdala, 2.5 times more Sex Drive (Hypothalamus)
Language Centers	Larger: 20,000 words	Smaller: 7,000 words
Output from Limbic System	Frontal Lobes	Brain Stem
Sensory Acuity	High	Lower—likes loud noises (explosions etc)
Listening	Use Both Hemispheres	Left Hemisphere
Spatial planning	Left Hemisphere	Use Both Hemispheres

Table 6: brain differences in men and women.

According to Brizendine (2006) and Travis (2011), the male brain is 9% larger than the female brain; even after considering relative body size difference. From the above chart, we can see that women have more grey matter(input fibers) and men have more white matter(output fibers). Emotional response is also different because of the brain structure and functioning. The differences in the brains are found even in infants and unborn children. Studies suggest that the structural and behavioral differences are not due to social conditioning, but rather are inborn gender specific.

Behavior differences

	Women	Men
Stress response	Tend or Befriend	Fight or Flight
Friendships	Based on talking, a few close friends.	Based in Doing, many friends
Competition	Destroys friendships	Builds friendships
Sex hormones	Estrogen: People Oriented	Testosterone: Task Oriented
Eyes	More P cells (smaller, in fovea): details, color, texture	More M cells (larger, over the whole eye): location, direction and speed

Table 7: Gender-specific behavioral differences (Travis, 2011)

One of the biggest differences is single tasking and multitasking (Kelly, 1999). Men are clearly single taskers and are happy when doing the task at hand keeping the sequence of tasks. Women, on the other hand can multitask meaning that they can think about, talk about and do multiple things at the time by difference in their brain structure. Although there is usually only one thing at the time that women do, they can be aware and shift between more topics and tasks than men.

Stress reactions are different for men and women, because the amount of each hormone is different. Women excrete more oxytocin that lead to more “tend or befriend” reaction, resulting in more talking. If a woman is under stress, let her talk it out. Men excrete more testosterone and cortisone than oxytocin leading to fight or flight reaction, and less talking, more doing. If a man is stressed, let him be quiet and do work.

Also, social behavior and ways of working differ due to estrogen driving women and testosterone driving men. This makes women more social and men more task oriented. This leads to differences in how both genders react to competition. Men are competitive and women tend to help each other more.

These are important to know as they influence motivation in parallel to developmental differences.

Developmental differences

In general, girls are 1-2 years ahead of boys during the school years in their brain and cognitive development. Although there are differences, on average, we can expect a person to follow the developmental stages correlated to the brain maturation in the table below:

<u>Age</u>	<u>Brain Maturation</u>	<u>Cognitive Development (Piaget)</u>	<u>Primary Focus of Motivators</u>	
0-2	Neural Exuberance and Myelination of Sensory and Motor Areas (Behavior/senses)	Sensori-motor	Biological	Senses, hunger, thirst, arousal
2-7	Maximum Number of Connections (desire)	Pre-operations	Behavioral	Towards pleasure/avoid pain
7-11	Corpus callosum myelinates and pruning begins around age 10 (mind)	Concrete Operations	Social	Role models, or group pressure
11-18	Prefrontal connections begin to myelinate at age 12, and pruning finishes at age 18 (Intellect)	Formal Operations	Cognitive	Attention, meaning, cognitive dis-equilibrium, curiosity
18-25	Prefrontal myelination finishes (Feeling and intuition)	Post-Formal Operations	Affective	Feel good/bad, threat to security, meaning in life
25	Experience continues to shape brain circuits throughout one's life span. (Individual Ego)	Post-Formal Operations	Conative	Goals, control of life, will
	Techniques such as meditation practices are needed to promote post-symbolic experiences (Universal Ego)	Post-Formal Operations	Spiritual	Understand purpose of life

Table 8: Brain development and cognitive development.

As seen in this table, rows show age groups listed in column 1, and related brain development (column 2) and cognitive development (column 3) Piaget(1955) and the resulting primary focuses or motivators (column 4). Our assumption is that motivators are developed as brain and cognitive abilities develop. At each stage of new motivation development, old motivators will continue to function in the background, similarly as in brain and cognitive development. This correlation is presented in the hypothesis and tested in this research.

It is quite well established that the brain development is underlying the cognitive development (Travis 2011).

Physiological conditions for learning

For one to learn well, physical and environmental situation needs to be suitable. Lack of suitable physiological state or environment, mental state might get on the way of being motivated. Some of the relevant findings are (Jensen 1, Renate Caine 2):

- Select the time of the day that is most conducive to learning to be motivated. Usually mornings are the best for learning. Most drowsiness is expected to be 12 hours from middle of the night's sleep. Also, detail memory works best in the morning. You may have your own patterns for inspiration, recognize and use them. Dunn (2007) found that 30% people learn best in the morning hours, 30% learn best in the afternoon, 30% learns best in the evening. Only 10% can learn any time.
- For intense learning, content, lectures etc, limit time to 25 minutes and 5-10 minutes for children and adolescents. After such period, elaborate with mind mapping, paired sharing, or model building. Downtime is also important to keep motivation: breaks, walk, stretch, cleanup etc.
- Use the natural curiosity to motivate your learning. Align learning with the personal goals.
- Time and multiple exposure to knowledge is important for learning. This in order make sense out of information that we take in. Ideal division of time for learning something is:
 - 5% Pre-exposure (overview)
 - 45% Acquisition (lectures / focused reading etc)
 - 45% Elaboration / processing (mind maps, paired sharing)
 - 5% downtime
- Fear and stress reduces cognitive abilities and weakens immune system
- Keep hydrated to stay alert and motivated
- Eat healthy and make sure you get all nutrients you need (omega fats, vitamins, proteins)
- Have enough air (ET) and full spectrum or natural light in the learning space.
- Observe your emotions and make sure they are conducive to being motivated for learning. Use positive emotions to cement your learning.
- Exercise keeps body producing alert and motivated state for learning, keeping the brain healthy and reward circuits happy.
- Rewards and punishments are de-motivating. Never use them. Use the intrinsic motivators instead.

Hypothesis

If brain development underlies cognitive development and motivation, then children at different levels of brain development on 1st, 3/4th, 7/8th and 12th grades – would exhibit different levels of primary motivators.

Parallel to this correlation, motivation is influenced by gender and physical conditions for learning.

Method

This section describes subjects and procedures for data acquisition and analysis.

Subjects

The school participating in this study was a private school, located in a rural area in Iowa. Participants in this study were children in grades 1, 4, 8, and 12. Classes were single gender and mixed. The table below shows different grade, gender, age range and subject matter of the classes observed:

Grade level	Gender	Age range	Subject matter
7-8	Boys	13-14	English
7-8	Girls	13-14	English
12	Girls	18-19	SCI
3-4	Boys	10-11	Social Studies
1-2	Girls	7-8	Writing / Art
12	Boys	18-19	Physics
12	Boys	18-19	Economics
7-8	Boys	13-14	English
7-8	Girls	13-14	English

Table 8: Study subject groups

Procedures

Data is collected qualitatively and analyzed by correlating behavioral patterns observed in class and adult behavior in relation to the students' learning motivation. Data was collected using non-influential “fly on the wall” -methodology. Intention was to not affect the objects of observation, “the subjects” by the act of observation. In practice I sat with other M.A. Education students in the school classes (table 8) and made notes. After class was over, we shared information and thus added to each others' observations. Observation notes are summarized in the results area and analysis is discussed in the discussion section.

Results

Results are discussed in segments of age groups in order to identify behavioral motivators based on age group's brain and cognitive development. Gender, environment and other factors are also controlled for finding significant motivators.

1st-2nd grade

In the class, first graders are eagerly exploring nearly anything that's presented to them in this class. Natural curiosity is guiding their eagerness to learn. Stories in the class captured their attention. They are expressive in art and happy to experiment with the new writing skill. Background music seems to help focus and stay motivated and keeping learning process more fun and joyful. Keeping class playful seems to increase motivation in the class. There is much more freedom in motion in this class than in upper grades. Although topic of the class was writing, drawing was acceptable. I talked to teacher outside the class and she said that it's nearly interchangeable at this stage. Some children can write, some just draw. Intention was in writing, however.

Observation of the 1st / 2nd grade class was very brief, but significant because behavior and motivators at this stage is very different from other stages observed.

3rd-4th grades

In this class (all boys), boys are surprisingly calmly sitting in their seats. Topic of the class is to find states with Native American names. Presenting their finding showed discipline: the one speaking was standing and others were sitting. It was made comfortable (safe environment) by asking to tell ones that you are "pretty sure" about. Also asking class mates to add to their lists from what the others say seemed to improve motivation. When teacher said that there are 37 states with Native American names, that increased motivation in the class noticeably. Boys were working in teams and were curious to explore the names. Class did not go beyond simple fun facts. Although boys were a bit restless in the teams, they were focused on the task and very obedient to the teacher's requests.

For the fun of observers, we noticed how small the chairs and desks were when sitting in the back of the class.

7th-8th grades

In these gender separate classes, teachers were teaching using projects. In language class, they took journalist's job description and started to produce a TV show. In mathematics class, they took rocket scientist's job description and learned mathematics while building and eventually launching a rocket.

Male language teacher told that for him to do the job, he needs to establish the alpha male presence right away. Although he may be nice and fun teacher, he needs to give them an impression that he could lose it at any time. This creates respect and makes kids at that age do what is necessary.

In his class, they started with two minute of free form writing. He explained that this is a classroom management technique. Although there is a suggested topic, they can write about anything

they want, given it's appropriate and well written. This practice seemed to calm down the class and focus them on something they are interested in. The tone of the class was very different after the exercise, so I agree with the teacher's intention regarding this exercise.

In the boys' class, boys were glad to share the writing results. They also seemed very focused on their project and keen on their topics. Boys liked working in their own, on the task.

Teacher pointed out that one of the girls had parents divorcing or something like that going on at home and that is taking away her focus from the class. Even for girls' class, there was significant amount of disturbance in the class. Because it was a combined 7th and 8th grade class, some of the girls seemed more focused on the project and some seemed more distracted by their hormones and tendency to socialize. Although girls seem to work well in teams, a lot of their social chatter did not seem to be related to the project.

In the girls mathematics class, all girls came in with their homework done, and they spent much more time experimenting with the instrument they built. Girls naturally get into teams and do the measurements as a team.

In boys' mathematics class, on the other hand, only a few boys came in with homework done. The rest had an excuse or no excuse at all. The female teacher confirmed that this is typical of boys at this age. Boys worked more independently even in a team and sharing with a buddy seemed to work better than team dynamic.

Teacher explained that she needs to love the children for the class to work. My observation showed a female version of alpha male in discipline keeping. "If you are not on time, I will not be happy" was one expression.

Mathematics and language teachers both explained that they find that the project based teaching works great for this age group. It's a way to combine harmoniously sweet 7th graders and bullying 8th graders in class. It also teaches real-world skills and self-evaluation. The job descriptions and evaluations are from real-world and children live up to the expectations. Grade is given quantitatively from results (such as how high rocket flies) and not from qualitative opinion of the teacher.

All topics of learning were interesting skills and knowledge. How to do, calculate or know this or that. Interest once again was the guiding light in each project. Teachers pointed out that at this age they need things to be very concrete. Thus all learning was simple and personally tangible.

12th grade

12th graders are seem to be more interested in larger concepts. Girls in their SCI class were talking in more general terms:

- Why is everyone in the movement interested in digestion, although it seems quite personal matter
- How is using pesticides similar to warfare
- Universal principles from fractals video – order is present everywhere etc.

Thinking is now beyond simple tasks and specific knowledge. It's about social phenomena, larger topics, universal principles and their applicability in general, instead of for specific tasks. Boys still need to be kept on task to be motivated, and competition can be useful to motivate boys, but not girls.

Hormonal disturbance is still noticeable. Girls class calmed down and focused with pulse diagnosis. After that girls were noticeably talking a lot over each other and over teacher. Teacher does not seem to be bothered by it and manages to redirect the class.

In boys' class, more individual nature of boys is noticeable. There is chatter, and it's often off topic. Teacher is helping one student at the time. Motivation seems to be on their personally chosen topic, but the class is more restless than 7-8 grade class.

From shared observation notes, slightly conflicting information comes out. Although girls are more biologically advanced than boys, girls seem to participate less in presence of boys in co-ed class than in single gender class. Boys seem to be inspired to perform more. However, boys report in discussion that it's hard to focus on subject matter when girls are around. More data could explain and clarify the pattern.

The most demotivating experience was in economics class. Boys were expecting their usual teacher to explain the class material, but was faced with substitute teacher who just asked them to read a long copy of a book. Many boys had hard time focusing, understanding the material or even getting through the material. Classroom was also very hot, which might have added to the uncomfortable and demotivating learning experience. Teacher told me and a fellow observer that he was trying to keep them disciplined, quiet and reading the material. It did not seem to work very well and boys formed a group at the door waiting for the bell to ring.

Observation summary							
Grade level	Gender	Age range	Motivators	Demotivators	Concrete / abstract	Simple / complex	Rules / breaking
1-2	Girls	7-8	Natural experimentation and expression. Arts, learning simple schemas like alphabet		Here and now concrete	everything is simple and now	Make up rules.
3-4	Boys	10-11	Rules, Curiosity, simple schemas like state names		Concrete	simple concepts	Enforce concrete adult rules.
7-8		13-14	Authority + friendliness/love. Own personal interest. Common projects. Concrete study.	Hormones-> restlessness, distractions, trouble at home. Age difference between 7 th (sweet) and 8 th grade (bullies).	Hands on concrete tests.	Simple abstract concepts.	Break all rules. Listen to authority.
	Girls		Helping each other, teams, allow processing	Excess processing prevents results			
	Boys		Tasks, focused work, competition				
12		18-19	Larger social issues		Abstract concepts.	Abstract concepts. Society and universal.	Integrated. Follow but question society's rules.
	Girls		Personal experience, generalized knowledge				
	Boys		Own selected projects, presence of girls	Hot temperature, control, keeping quiet, reading, lack of discussion			

Table 9: Summary of results – motivators and demotivating factors in age and gender groups.

Discussion

From the results we can identify motivators for each observed age group and gender. In table 9 we identify motivators that can be used as tools for improving learning results and experience. Table also shows ineffective extrinsic motivators to be avoided (12th grade boys) and unavoidable demotivators that needs to be worked around(7th, 8th and 12th grade).

The differences in concrete/abstract and simple/complex is very clear in the age groups, although slightly different than expected from the literature review. All grades appreciate things that are concrete and simple, however, the ability to handle abstraction and complexity grows over the years. For instance, 1st graders draw and write a bit, 3rd graders can write and work with concepts, 7th graders can write papers and explore their interest area and finally 12th graders can apply their knowledge to societal and universal level. Confirming the cognitive development as function of brain development is important for motivation, because it's important to keep the learning within the range of cognitive abilities to keep the children motivated. If classes are too simple, they get bored and if they are too complex, they won't be able to understand it.

For motivation, behavior toward rules is important to understand. Pre-formal 1st graders come up with creative rules, 3rd graders (concrete op) enforce adult rules and 7th graders (formal op) break spontaneously all rules. 12th graders (post-formal op) seemed more integrated in their rule following and rebellion. This sets a different tone for leveraging extrinsic and intrinsic motivation. For instance, 7th graders should be guided to their interest, because they won't follow rules set by others.

For the demotivating experiences, we can conclude that they will force unhealthy expression of needs of EGO(love/connection, significance, certainty, variety). With proper extrinsic motivation (safe environment, understanding, loving, guiding) and intrinsic motivation (learner's own interest) needs of the Ego are met in a healthy way and not in a rebellious way. This opens up possibilities for growth needs of the soul (growth and contribution) to come to expression.

Correlation between maturation/development and primary motivation

In terms of the development of primary motivation in correlation with the brain and cognitive development, we can analyze in the following way (table 8):

- 1st - 2nd Graders are motivated by learning new behavior.
- 3rd - 4th Graders are motivated by social conditions, classroom and teacher as a role model.
- 7th - 8th Graders are motivated by cognitive search for personal meaning, curiosity to experiment with rules, and cognitive dis-equilibrium from heavy growth during this time.
- 12th graders are motivated by meaning in life and meaning of concepts in society and larger concepts.

There are some overlap in development of motivating layers, which suggests that evolution is not completely linear, but all layers of our existence develop more or less simultaneously. It is noticeable, however, that higher motivations like goals and meaning of life are less obvious in younger children. However, teachers have successfully used goals (rocket launch and news broadcast) to motivate/inspire adult like behavior in 13-14 years old school children. This may suggest that motivational factors are not as strongly tied into brain and cognitive development as we have expected.

Significance

Overall, the findings support the global model on the parts that they investigated. The amount of data is significant enough to validate assumptions, but the amount of data is insufficient for drawing global conclusions. Further research can validate globality of the findings and validation of areas of the hypothesis not measured in this research.

Other considerations

In co-ed schools, we can argue that effects are there, but less because students get used to other gender being in the class. This argument is open to research.

Further research suggestions

Because Moral and Ego development require experience in addition to maturation, it suggests that experience and moral/ego development influence motivation. This would support findings, where later motivators are found earlier in age than brain and cognitive development suggests. Teacher's participation as student's pre-frontal cortex may have influence on the student's motivation on higher level. These are questions open for research.

Conclusion

In conclusion, result data supports the hypothesis and confirms that motivation develops in connection with brain and cognitive development. Many teaching tools can be derived from the data to support effective and pleasurable learning and teaching experience in different age groups for both genders.

However, data also suggests that there are other factors than those considered in this study that influence motivation and can bring in motivators that are expected only at higher cognitive development levels. Experience, moral and ego development may be influences as well as teaching methodology. These are open for further research, as well as parts of the hypothesis that this study's data did not address.

This research also opens field for further research in other age groups. In addition same methods of observation can be used to identify motivators in work places and professional education.

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