

Letter of Professional Interest

“I can honestly say I had never seen a professor who cared more for his students and how they do, as well as what they learn.”

“Thank you, thank you, thank you! Mr. V, thank you for putting up with all of us this summer!! I feel much more prepared for the MCAT. And I loved the demonstrations! Thanks for putting all the time + effort!”

“Professor V, You designed this class so that those who put in the effort would succeed, so I gave it my all and sure enough. I want to say thank you for creating such a conducive learning environment for me to succeed. I hadn't taken a physics class since my freshman year in high school, so I was very nervous going into your class. I did not expect this course to become my favorite science course so far at BU. Physics is a hard subject, but you explained everything well and made sure we, as a class, had the tools necessary to succeed with enough hard work on our end.”

Above are some of many of the nice words said about me by my former students (for more examples please click on the following link, you may be surprised; <http://www.teachology.xyz/evvv.html>).

I believe, such a feedback is one of the greatest rewards any teacher can have.

Three times since my university graduation, I had to re-start my professional career from a square one. This feedback is one of the proudest achievements of my professional life.

Dear Colleagues,

I hope your view of a teacher is similar to mine, i.e. **a teacher is a person who is good at teaching.**

A good teacher is a teacher who can teach not only, but also *beyond* memorizing and repeating various – even very complicated – patterns (that is essentially no different from training animals doing tricks; what current AI does: <https://teachologyforall.blogspot.com/2017/04/vc.html>); i.e. a good teacher is a teacher who can teach *how to create a solution to a brand-new problem* (what only HI can do – so far; and what I teach my students, no matter what specific subject I teach at the time).

“I have a very particular set of skills, which I have acquired over a long career”. My student evaluations are the result of my professional experience in the field of education.

I have a deep knowledge of the main subject I teach (M.S. in Theoretical Physics), as well as augmented subjects (math, logic, problem solving, human psychology, methods for teaching); I am an expert in teaching methodology and teacher preparation (PhD in Education); I have a deep knowledge of HI (Human Intelligence; have some publications on the matter; <http://www.teachology.xyz/lc.htm>); I have an extensive and successful tutoring, teaching and research experience (in the field of education since 1989); I believe, all this makes me a *teach-smith* (so to speak; <http://gomars.xyz/teachsmith.html>).

I have a successful experience in designing and teaching courses for middle school, high school, college and university students, and active teachers. Recently, based on my professional experience and expertise, I also have formed a novel approach to designing science courses. I have a clear vision of the structure of an effective on-site or online course (the latter should be more than a standard combination of “talking heads”, hyperlinked texts, screen simulations, and chat rooms).

A joke “those who cannot do – teach; those who cannot teach – teach teachers” is definitely not about me.

I could have become a physicist. To prove it to myself, in 2010 (years after graduating with M.S. in theoretical physics, but have never had done physics before) I read some papers on high temperature super conductivity, and then wrote mine own, which was published in a peer reviewed specialized magazine (<http://www.sciencedirect.com/science/article/pii/S0921453410006179>).

And, I teach teachers not because I cannot teach physics to students – on the contrary, my student feedback tells me that I am a good physics teacher; I teach teachers because I am good at teaching physics, and I have professional experience I would love to share. A large portion of my experience in the field of teacher professional development was summarized as a chapter in a book (<http://www.teachology.xyz/pd.htm>).

There is, though, the seed of truth in the joke. It is just a fact that *when someone is good at doing something, it does not necessarily mean that the one can also clearly explain what the one does, and why the one is good at it.*

My professional goal is very simple – I want to maximize my professional output.

I would be happy to join the team of instructors or course designers and use all my professional knowledge and skills to participate in creating, development, approbation, and installment of the most advanced and effective on-site and online courses (naturally, starting from physics).

Sincerely,

Dr. Valentin Voroshilov

Below is:

1. A short version of the description my professional experience
(also at: <http://www.teachology.xyz/vv.htm>)
2. My resume, which offers the full description of my professional experience
(or follow to: <http://teachology.xyz/mathhealth/rezume.htm>).
3. My general teaching statement (my teaching philosophy; or follow to this link: <https://teachologyforall.blogspot.com/2017/11/philosophy.html>).
4. [What is so special about physics?](#)

Three times since my university graduation, I had to re-start my professional career from a square one.

After receiving my MS diploma in theoretical physics, I went on the path of becoming a physicist. However, when the Russian economy collapsed, in order to feed my family, I turned to tutoring, and later to teaching middle and high school students, and then college and university students, and then teachers. At the time, schools were some of few places where the government sometimes paid some money. Soon I understood that students liked my teaching, and I liked teaching students, and I started my second career – as an educator.

I joined a team of innovative teachers, administrators, researchers, and consultants. As the result, in addition to teaching, I also entered the field of teacher professional development, and educational consulting, and got my PhD in Education (specialization in andragogy, concentration in teacher professional development). However, I did not like the changes in the political atmosphere. In 2001 a miracle happened – I won a Green Card.

When I moved in the U.S. I started my third career from a square one (my first job was a janitor at a supermarket). Since no one knew me, and I knew no one, and I spoke just very basic English, the journey to reestablishing myself as an educator was not quick and easy. Today I teach, I write, I do research.

I am proud of my current achievements, but I am looking forward to make the next step in my professional journey (hopefully, the last one).

I have been involved in many collaborative projects which had led to development of new curricula, new course content, efficient tools for managing teaching activities and learning experiences, facilitating teacher professional development, running professional development workshops for teachers and administrators.

I started my teaching career as a tutor. Tutoring may be very helpful for gaining a deep understanding of numerous reasons for different students to have various difficulties with getting a good understanding of math and physics.

Some tutors would help a student to do the homework, and then a student would come back with a new homework, and then again, and again. For me it felt like cheating. I wanted to teach my students how to do their homework on their own. My goal was to help a student to reach that level of understanding so he or she would not need me anymore. It may have looked counterproductive – money-wise. But in reality, it worked for me very well, because parents of my students told about me to other parents, and I had plenty of clients.

Tutoring helped me to initiate the development my teaching toolbox tailored to students with different background. People usually are eager to talk about gifted students, and how to help talented students to realize their potential. Struggling students do not often attract the same attention as gifted ones. Tutoring is like having a clinical practice. All good students are good due to mostly the same reason (a good background), but when a student struggles there might be numerous possible causes for that.

Teaching and tutoring physics, algebra, geometry, trigonometry, problem solving, logic helped me acquire an integrative view on various difficulties students may have and effective approaches to guide students through those difficulties. My Doctoral work was focused on techniques for igniting and supporting school teachers' sustainable desire to grow professionally, and on methods for helping teachers with their continues professional development (teaching teachers about teaching requires deep and wide understanding of learning, teaching, and of the teaching subject).

From 1992 to 2000 I was a member of so called “Moscow – Perm Socratic group” – a collaboration of educators dedicated to promoting the Socratic Method of teaching (<http://www.teachology.xyz/6LT.html#sm>).

I have a long and successful experience in teaching various mathematics and physics courses, course for pre-service and in-service teachers and school administrators. Since 1988 I have been teaching Mathematics and Physics to all possible categories of students (i.e. to middle- and high- school students, 2-year and 4-year college students, university students, to students with learning difficulties, and to school teachers). Since 1993 I have been teaching various curses for in-service teachers (in parallel with teaching math and physics).

For a number of years, I had been working at a regional institution for teacher professional development, providing various courses and training to teachers and school administrators. Individually and as a member of a team I was consulting and auditing individual teachers, schools, and school districts regarding educational policies, teaching technologies, learning outcomes, and quality of education in general. Alone and with my colleagues, I was traveling to towns and villages of the Perm Region to meet with teachers and administrators and helping them with adjusting teaching and administrative strategies and techniques in order to achieve better learning outcomes of their students; including preparing strategic plans for systemic development of a school, a district and a regional education system.

My administrative experience involves running a department of computerization at Perm Institute for Continues Teacher Education, working as an assistant to the President of Faculty Assembly, and later running the Center for Development of the School System of City of Perm, which was an analytical branch of the City Department of Education (my last position before moving to the U.S.).

In 2000 I was hired by the Perm State (a.k.a. Region, a.k.a. Oblast') department of Education as a consultant to help draft the “Program of the Development of the State Educational System for the period from 2001 to 2005”. This was one of the highest levels of the recognition of me as a professional educator and a consultant.

After I moved in the U.S. and re-entered the field of education, I have been teaching Boston University PY105/106 Elementary Physics courses, as well as College Mathematics, Physics and Problem solving at ITT Technical Institute (Norwood, MA), Wentworth Institute of Technology, Bridgewater State University, BU High School Academy.

During the years of my teaching practice I have developed numerous math and physics middle-, and high-school and college curricula, syllabi and lesson plans; problem sets, worksheets and hands-on activities. I have an experience in developing websites and using such ones as webct, moodle, blackboard, webassign, masteringphysics, wileyplus; creating new demonstrations, filming movies and posting them online, using Java applets and audience responds systems (eInstruction, Turning Technologies); developing laboratory experiments and writing manuals. I have been and am using different teaching strategies, including different media to motivate students to learn and to help students to master a subject.

I firmly believe in a scientific approach to teaching and to research on teaching. A teacher should be able to state specific goals, list the assumptions, formulate the criteria of a success, and establish measuring tools and procedures, and a researcher should be able to do the same as well. I am also convinced that contemporary technologies allow bringing teaching to a new level (<https://teachologyforall.blogspot.com/2017/11/pilt.html>).

My personal teaching experience always has been entangled with my research and consulting practices, and this entanglement represents the most helpful asset I have and use when working with students, colleagues, teachers, and administrators, because I usually know what students, colleagues, teachers and administrators may want or need, what obstacles they may encounter and need to overcome, and how to help them to do that.

Dr. Valentin Voroshilov

Physics Department / Boston University
Physics Department / Bridgewater State University

Education:

PhD in Education: “Managerial and Pedagogical Conditions for Acquiring by School Teachers the Methods of Designing Individual Professional Activities”.

Moscow Academic Institute for Innovations in Education; Moscow, Russia, 2000

M.S. in Theoretical Physics: “Homogeneous Relaxation in Weakly Non-ideal Bose Gas”

Minor in Education: Methods for Teaching Physics at a Middle and High school

Perm State University; Perm, Russia: 1985

PROFESSIONAL EXPERIENCE

Boston University, Boston, MA; Physics Department: 03/2007 - present time

Lecture Enhancement Coordinator (Physics Department Demonstration Facility Director)

Responsibilities: Cooperating with the faculty on using existing and developing new physics demonstrations and helping faculty with implementing contemporary teaching research-based techniques into the teaching practice.

Boston University, Boston, MA; Physics Department: 09/2007 - present time

Lecturer (PY105/PY106 courses):

Responsibilities: Curriculum development; developing and editing lecture notes, homework assignments, laboratory manuals, exams; lecturing, overseeing work of teaching fellows and learning assistants.

Bridgewater State University, MA; 2010 - present time

Visiting Lecturer: Algebra Based Physics.

European Journal of Physics; 2013 – present time

an official reviewer, manuscriptcentral.com

Wentworth Institute of Technology, MA; 2008 - 2014

Adjunct Lecturer: Algebra Based Physics.

Boston University, Boston, MA; Physics Department: 08/2012 – 08/2013

PDGK12 program/ Program Manager:

Responsibilities: Organizing and guiding teaching fellows – participants in GK12 project – on the use of physics demonstrations in Boston schools.

Boston University, Boston, MA; Physics Department: 08/2012 – 08/2013

BU ERC Lecturer:

Responsibilities: Curriculum development for and leading workshops “Physics - Demystified” for BU students.

BU Academy, MA; 2009 - 2012

Substitute Lecturer: Elementary Physics

ITT Technical Institute, Norwood, MA; 06/2004 – 2011

Adjunct Physics Instructor:

Responsibilities: Teaching Physics, College Math I and II, Problem Solving

Boston University, Boston, MA; Physics Department and School of Education: 09/2006 – 06/2007

Adjunct Instructor

Responsibilities: Teaching Physics to in-service high school teachers

Boston University, Boston, MA; Physics Department: 09/2004 – 03/2007

Lab Tech Coordinator

Responsibilities: Coordinating a preparation and carrying out of undergraduate teaching labs; managing the equipment; developing new teaching labs; consulting TFs

Boys and Girls Club of Boston, Roxbury Clubhouse, Boston, MA; 07/2004 – 11/2004

Teacher’s Assistant, Math and Science tutor:

Responsibilities: Tutoring in Math and Science to Club Members

Wentworth Institute of Technology, Boston MA: 01/2004 – 05/2004

Physics Laboratory Instructor: Department of Applied Mathematics and Sciences.

Responsibilities: Guiding students through a variety of Physics I and Physics II laboratory work

Tutor: Academic Resource Center. 01/2004 – 05/2004

Responsibilities: Tutoring students in Mathematics (Algebra, Geometry, Trigonometry, Calculus) and Physics

Various professional positions in Boston area: 05/2002 – 07/2004

Center for Development of City School System, Perm, Russia: 2000 – 2002

Interim Director

Responsibilities, including but not limited to:

Developing strategy and plans for the Center (in coordination with the Department of Education of the City of Perm)

Establishing long term and short term goals for the Center and for the individual employees

Observing, guiding, coordinating, evaluating the performance of the Center employees

Analyzing individual reports, preparing and presenting the reports on the outcomes of the Center’s activities

Managing everyday workflow of the Center

Institute for Continuous Education, Perm, Russia: 1993 - 2000

Associate Professor: Department of Teachers' Skill Development. (1993 – 1995 as an invited team member, 1995 -1997 as an adjunct, 1997 – 2000 as a fulltime professor, assistant to the President of Faculty Assembly, and director of a department of computerization)

Responsibilities:

Taught a wide spectrum of courses to school teachers and principals of the city of Perm and Perm region

Examined teachers' curricula

Evaluated of the quality of teaching in physics and mathematics

Courses developed and taught included:

Methods for Problem Solving in Mathematics and Physics

Using Mathematics in High School Physics Courses

Modeling of Mental Processes of Students while Problem Solving

Methods for Preparing Educational Tests

Planning Effective Teaching Activities

Introduction to Educational Policies

Director (1998 – 2000 in parallel with professorship): Department of computerization and information technologies.

Assistant to the President of Faculty Assembly (1998 – 2000 in parallel with professorship)

Perm State Technical University, Perm, Russia: 1988 - 1997

Assistant Professor: Physics Department.

Responsibilities:

Teaching a wide spectrum of courses to undergraduate students

Training students in Math to prepare them to study Physics

Developing physics and math curricula

Developing educational aids for students

Courses developed and taught included:

Mechanics; Thermodynamics; Electrostatics; Magnetism; Optics; Atomic and Nuclear Physics

Fundamentals of Quantum Mechanics; Algebra, Geometry, Trigonometry, Pre-Calculus, Calculus

Methodological development included:

Curricula in Physics for Undergraduate Students; Midterm and Final Physics Exams;

Collection and compilation of Physics Problems and solutions for Undergraduate Students

Perm State University, Perm, Russia: 1985 - 1988

Hardware Engineer: Department of Computerized Calculations:

Responsibilities: All kinds of a technical support

Middle and High Schools, the City of Perm, Russia: 1991 – 2001

Teacher/Tutor:

Teaching a wide spectrum of courses to students

Developing curricula and midterm/final tests for courses taught

Training students to Math/Physics competitions

Developing and testing learning tools for students with learning disabilities

Courses developed and taught included:

Algebra; Geometry; Trigonometry; Fundamentals of Probability Theory; Physics

Methodological development included:

High School Curriculum in Physics with Elements of University-level Physics

Math Curriculum for High School Students in Physics Classes

Introductory Lectures on Basic Quantum Phenomena for High School Students

Midterm and final physics exams

Areas of expertise:

A) administrative practices related to running a unit of an administrative structure, such as a department, or an institution, including but not limited to:

1. strategic and tactical planning
2. observing, guiding, coordinating, evaluating the performance of employees
3. analyzing individual reports, preparing and presenting cumulative
4. managing everyday workflow

B) consulting on developing teaching practices at different levels (individual teachers, teams of teachers, schools, school districts)

C) auditing teaching practices of individual teachers, teams of teachers, schools, school districts

D) public relations – representing the team of developers to different groups of prospective clients (teachers, administrations of different levels)

E) analytical practices:

1. developing and employing various analytical tools – surveys, interviews, tests
2. conducting analysis and presenting reports

F) developing and teaching various courses for pre-service and in-service teachers, including but not limited to:

1. philosophy of education
2. role of teaching in human practices
3. curriculum development and lesson plan preparation
4. assessing learning outcomes of students
5. classroom management with and without differentiation
6. how to become an effective teacher (the role of self-reflection in professional development)

G) developing and teaching various Math and Physics courses for undergraduate students (non-physics majors, including pre-service and in-service teachers):

1. writing a syllabus (structuring the course, establishing learning paths)
2. writing lecture notes and composing assessment tools (problem sets, quizzes, surveys)
3. developing problem solving strategies and guiding techniques
4. lecturing, guiding, tutoring students (including teachers in service)
5. developing, testing, performing physics demonstrations and laboratory experiments
6. video and audio capturing, editing, posting, streaming

H) teaching creative courses as such “Lateral thinking”, “Problem solving strategies”

I) as a faculty member of a research university: facilitating, monitoring, consulting faculty on developing curriculum, preparing lectures, incorporating various teaching activities into a course, analyzing the learning outcomes of students.

J) using and consulting on using online teaching instruments (blackboard, webassign, mastering physics, etc.) and personal response system

SELECTED CONFERENCES AND PUBLICATIONS

(more at <http://www.teachology.xyz/lc.htm> and <http://teachology.xyz/mathhealth/papers.htm>)

“Becoming a STEM Teacher: a crash course for people entering the profession”// ebook (Sept., 2016)

“Learning aides for students taking physics”// Phys. Educ. 50 (2015) 694-698, <http://stacks.iop.org/0031-9120/50/694> (October, 2015)

“What does “thinking as a physicist” mean?” // <http://www.teachology.xyz/sp.htm> (Mar. 2015)

An actual level of difficulty of test problems and its subjective perception by students // Poster, 2009 AAPT Winter Meeting, Chicago, Feb. 15 (2009).

On a Definition of Work // The Physics Teacher, Val. 46, May 2008, p. 260.

On “Putting Physics First” // “Interactions”, March/April 2007, p. 6 -7;

“Constructing Learning Aids for Teaching Algebra Based Physics” // poster at 2006 APPT Summer Meeting, July 2006.

“Classification of Educational Self-Determination of Students” // in journal “School Principal”, Moscow, Russia, 2001.

In this short essay, I will try to summarize my view on what is teaching, what is learning, and why learning physics is so important to everyone.

What is teaching?

Below is the quote from Google search on: “what is teaching” (the top answer):

teach·ing

/ˈtēCHiNG/ 

noun

1. the occupation, profession, or work of a teacher.
2. ideas or principles taught by an authority.

The second meaning of “teaching” is transparent: “teaching is a synonym for philosophy”. But the first description does not really say much what teaching is. “Teaching is what a teacher does”.

Everyone wants to be healthy and successful and no one wants to be ill and poor. The only difference is how we want to achieve our success. There are people who use other people as a tool for climbing the social ladder. I would not recommend people like that going into teaching. Children feel when they are being used and always find the way to escape – one way or another. Anyone who wants to be a teacher (or an educator of some sort), should do it to help children to succeed in their life, and they will return the success.

Teaching is an important human practice. Many people think that teaching is simply telling students “do as I say”. This very approach is built in our DNA. Our parents used this approach when teaching us. Animals use this approach when teaching cubs, pups, baby birds (they rather use the “do as I do” version, which is also very popular among humans).

If teaching was indeed merely “do as I do” or “do as I say” practice, then of course everyone could do it! Teaching would not be much different from training animals (“a stick and a carrot” would do the trick).

Clearly, teaching is something more complicated than just “do as I say”. Not everyone can become a good teacher. Everyone can cook at home, or drive a car. But not everyone can become a successful chef or a racecar driver. And when we say this out loud, it does not sound controversial – because it’s obvious! Yes, we know that some people are a better fit for some practices than others, and some people are not a good fit for some practices. In particular, some people are just not fit to be teachers (which is not their fault), and one of the goals of every teacher preparation program should be identifying those people and helping them to find another professional path.

So, what is teaching, or, what does it mean to be a teacher?

I think that the answer to this question forms a fundamental basis for the whole professional philosophy of a teacher and for the practice built on that philosophy. One of the first indicators of a true teacher is that he or she has a certain answer to this question. I also believe that there is no single correct answer to this question. I believe that every teacher should search for and find his or her own answer (although the answers might sound very similarly).

In this essay, I want to share my answer to the question “what is teaching?”.

To me, teaching is guiding students through a specifically designed set of learning experiences (a.k.a. student activities) to help them to develop or advance desired skills and knowledge – this is my formal definition of teaching (hence, a teacher is a person who teaches in accordance with this definition; this link

leads to short statements about teaching which I call “Laws of TeachOlogy”; <http://www.teachology.xyz/6LT.html>).

A teacher might not be the one who designs the whole set of student activities, but should have a deep understanding of the reasons for the activities and measures of the success or failure of the activities.

We all know the old saying that one can bring a horse to water but one cannot make it drink. Well, a teacher cannot make a student learn unless that student wants to learn. Unfortunately, too often students start to learn only to avoid some kind of punishment. This kind of teaching might happen when a teacher does not care much about students, but just functioning to avoid being fired (mimicking/faking teaching). On another hand, a teacher might be very forceful on students (“It is for your own good”) to become being praised. **I believe, no matter what a teacher does, students should not have any psychological damage (like, “feeling stupid”).**

Teachers - like doctors – should take “a Hippocratic Oath” of a Teacher and promise “never do harm to anyone”, because there is always something more important in teaching than merely transmitting knowledge or training skills. A true teacher knows the limits.

Ideally, parents should be the first true teachers. The best gift a parent can give to a child is good habits and love for learning. The same is true for a teacher. Look at infants and little children – they always try things and want to learn something new! Now look at school graduates – so many of them do not want to learn anything new anymore (or cannot learn anything new, which is even worse). If children have lost their curiosity and desire to learn, that only means they did not have a true teacher in their life.

A true teacher is not the one who just loves teaching (“do as I say”), but the one who also loves learning. The art of teaching is based on love for education, and passion for sharing this love (and also on the science of learning).

Every student has his or her own learning style. Every classroom is different from another. Teaching constantly presents challenges: students do not act the way a teacher expects, parents or officials put pressure on a teacher. If a person cannot withstand challenges, that person should not go into the business of education in any form; she/he is not going to be a good teacher, or administrator or a researcher in the field.

No one is perfect. Everyone makes mistakes (the difference is what we do after we made it). Mistakes are an inherent part of our life. Mistakes are inevitable and unavoidable. Especially when people learn something new. A teacher should understand that students will be making mistakes. Learning is based on continually overcoming mistakes and learning from them. If a student did not learn something, which he or she was supposed to learn, chances are that it was because a teacher made a mistake. A true teacher never stops learning (mostly because no matter how good we are there is always a room for improvement: new students are different from the former ones, world changes, a new year is never the same as the previous one). And a true teacher is always open about mistakes he or she has done, even (especially!) if it happens in front of a class.

To summarize, what does make a teacher to be The Teacher (or a Teach-Smith, so to speak: <http://www.gomars.xyz/teachsmith.html>)?

Patience, love of learning, understanding and accepting personal limits, genuinely caring for students (they intuitively feel if for the teacher they are just pawns in his/her game for personal success), constant professional development – including, but not limited to – having deeper knowledge of the content of the subject he or she teaches, deeper understanding of the fundamentals of the knowledge development within a specific science (each school subject is a projection or a simplification of a certain science), deeper understanding of the fundamentals of the knowledge development in general, understating of human behavior in general and behavior of a child, understanding of the fundamentals of human learning and teaching. From a procedural point of view, the simplest model of teaching is “teaching = motivating + demonstrating + instructing + explaining + assessing”, hence a teacher should have personal qualities, knowledge and skills which will allow to be able to motivate, demonstrate, instruct, explain, and assess (within the limits placed by “do no harm” rule).

A true teacher is not always the one whose professional description says so. A teacher is a person about whom other people say that they have learned something important from that person.

There is one controversy I would also like to address. Many people (including policy makers, parents, business representatives) think that to be a good teacher one just needs to know the content. But, that is not true. The content knowledge is one of many components of a good teacher, and not the most important one. Firstly, I have met people who had excellent content knowledge but were terrible teachers. I had professors who were at the top of the achievement list in academia, but who could not teach at all (they were very interesting storytellers, though). Clearly, they knew how to do difficult science and they did it. But they could not explain what they did, and why. Secondly, content knowledge is just a result of a certain amount of effort. Any reasonable person who spends a reasonable amount of time can obtain content knowledge in the amount sufficient to teaching at a reasonable level. Personal qualities like willingness to learn till the first day of the retirement (at least), patience, etc. are also very important for becoming a true teacher. A teacher is - first - a person, and - second - a knowledge storage, a skill presenter, a guide, a trainer.

What is learning?

A dictionary tells that learning is:

- * the acquisition of knowledge or skills through experience, study, or by being taught.
- * knowledge acquired through experience, study, or being taught.

For a teacher, this definition may be a starting point for reaching a deeper understanding of how people learn.

The first fundamental notion is that learning is a basic need, like food, or oxygen. There is a “slight” difference, though. With no food or oxygen, a person ceases the biological existence (a.k.a. dies).

Without learning a person ceases the social existence (the reason for all dictators to micromanage education - they are scared of free thinking which comes with true education). Learning - as a process and as a result - is solely responsible for the prosperity of a society (even if the prosperity still is very uneven).

Secondly, learning is a process; it has phases, it has stages (that is why a college does not accept middle school graduates). Learning stages might differ in length and difficulty, depend on many parameters (subjective like age, race, brain development of a student; contextual – what science is this subject about; social – culture, traditions, economics), but they are as objective as stages in the seasons we observe every year. The existence of these stages results in the existence of the specific patterns of learning, which must be reflected in the specific patterns of teaching.

We cannot jump from a spring right into a winter; similarly, we cannot jump into learning quadratic equations right after learning the addition within a hundred (the normal process of giving a birth requires 9 months and should go through well-established phases - from an embryo to a baby: the process of “giving a birth” to an educated person– from having no knowledge and skills to having them - also has specific stages). If despite our best efforts a student did not learn how to solve a quadratic equation, it means that his/her learning path had missed in the past some of the important stages (assuming that students’ learnability is adequate).

Thirdly, learning is a result, it is an achievement. There are many achievements in our life, which – kind of - just happen; learning how to walk, learning how to talk.

Achievements like that happen usually in a natural way, they do not normally require special prolonged management, do not have to be controlled, assessed, regularly measured, at least if everything happens as expected.

However, reading and writing, adding and subtracting, solving equations, etc. are skills; and to learn those skills a special and longitudinal effort is required, and hence, these skills have to be assessed.

What needs to be assessed, how, when and by whom, however, are some of the most controversial questions of the contemporary research on education.

True learning never happens by just watching and listening (i.e. by merely attending lectures), it happens by doing. One can observe every cycling tour; interview every famous racer, that will definitely help the one to understand the theory of biking, but to learn how to ride a bicycle one has to ride a bicycle.

One can watch for hours other people swimming, but if one wants to learn how to swim, the one has to get yourself into water and start trying. In the latter case, it would help having around someone who could explain what one does wrong and how to correct it (a friend screaming “you can do it, you can do it” would not be much of a help).

Active lectures help to boost motivation, develop vocabulary, give a perception that things are not as hard as they seem. Reading (and watching, and listening) also helps to form a vocabulary, to strengthen some relationships between the current knowledge and the upcoming one, to ignite curiosity, to boost imagination, to reinforce self-discipline, to advance mental capacities.

However, skills are only formed by doing.

For example, if the only exercise students had been doing for 12 years is squats, they will not be good at push-ups and pull-ups. If we want students to develop a certain skill, we have to give them an opportunity to practice that skill (ideally – as long as they need to master it).

Our brain is acting in a way similar to how our regular muscles act. Memorization is a mental activity very much different from creating new images, searching for new meanings, describing new phenomena, or developing new approach to solving a problem (during different mental activities a brain does a different work). Hence, if for 12 years in a school students only have been memorizing facts, it is not reasonable to expect from the graduates an ability to think critically, or to be creative.

Thinking critically is a specific mental activity, which requires comprehensive methodology, meticulous planning, detailed procedures, and designated time (much more time than just memorizing and retrieving facts).

Our brain is a powerful pattern recognition machine. As soon as it recognizes the task, it retrieves from the memory the sequence of the actions, which has to be performed to succeed. Of course, we assume that that particular brain is capable of storing and retrieving the information and governing the actions required for fulfilling the task (otherwise we have to discuss a case of learning disabilities). If a brain does not recognize the task, we have two options: (a) the task is the same but due to some features it is camouflaged as a different one; (b) the task is different and is really new for the brain and the brain does not have the solution (at least in full) in its storage.

Every teacher has to teach students to two different practices: (a) how to perform specific tasks (the set of those tasks should be specified by a curriculum); (b) how to create a solution to a problem which has not been solved in the past (by that person); the latter practice, in turn, requires a practice in making a conclusion regarding the familiarity of the given assignment - is it the same as one from the past (a task) or different (a problem)? Development of that skill also requires specific practice.

Teaching thinking critically (a.k.a. creatively) means teaching how to create solutions, invent actions/procedures which have not been presented/trained before.

In general, the answer to the question “what is learning?” depends on the interpretation of who is asking this question. For example, one can believe that learning is ...

1. memorizing facts and excelling in performing certain task (actions).

Or

2. obtaining knowledge and developing skills which will allow to create (a.k.a. “construct” – for those who loves constructivism, as I do) solutions to problems which have never been solved by the person in the past.

Or

3. from a procedural point of view, the simplest model of learning is

Learning = goal making + memorizing + reiterating/practicing + thinking/analyzing + self-assessing (reflecting on the actions done during the problem-solving process).

My personal definition of learning is a combination of all the three above.

I believe that teaching how to think critically, teaching how to create solutions to new problems is the most important goal and the most difficult task of the contemporary education. If a person cannot solve any new (for that person) problem, it is hard to expect this person would generate some knowledge (or product, or business) new to the society. However, if a person can solve problems which he or she has not solved in the past, there is at least a chance that that person would give us something absolutely new and unexpected (good or bad – that is a different conversation). We should keep in mind, though, that critical thinking cannot be learned without a solid foundation in facts and skills.

What is so special about Physics?

It has become a common place to say that American schools need to attract more students into STEM related fields (<https://teachologyforall.blogspot.com/2017/02/nostudents.html>).

I believe that physics represents a door into STEM education (<https://teachologyforall.blogspot.com/2017/01/door.html>). If students get confidence in physics class, they will feel confident in any science. Physics is one of the oldest and most developed sciences, hence it has a very clear logic and a straightforward learning methodology. Also, nowadays physics or physics based approaches can be found far beyond physics itself, for example, in medicine, in business and finance, even in sport (more at: <https://teachologyforall.blogspot.com/2016/12/onphysics.html>).

What changes does education reform need?

Education needs its own “Manhattan Project”, or “Apollo Program”, which would reexamine the well-established paradigms, and would guide a broad search for new connections and correlations; which would combine newly presented advances in artificial intelligence with neuroscience to study and analyze multi-layered universe of individual, group, and institutional learning and teaching; which would bring in education newly developed technologies, including AI, virtual reality, augmented reality, top level robotics.

This type of a program can be initiated via institutionalizing a collaboration between various professional and scientific groups by establishing a specific institution –an Institute for Learning and Teaching (the name is tentative, of course).

Within this Institute, professionals from various universities, intuitions, and companies would be able to join their effort and expertise.

<https://teachologyforall.blogspot.com/2017/11/pilt.html>

Sincerely,

Dr. Valentin Voroshilov

<http://www.gomars.xyz/vv.htm>