

Why would you want to teach physics?

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Just in case - you know what I look like



A few words about me

1977-1982 - BS and EDM from Moscow
State Pedagogical University, Physics
Department



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1982-1995 - Moscow South West School,
physics teacher (physics 7-11; astronomy
11)



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1995-1997 - Rutgers Physics Department

1997- Rutgers
Graduate School
of Education



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Why did I become a physics teacher?

My personal experiences as a student

My personal experience as a daughter
of a physicist

What was most surprising when I was teaching?

Relationships with my students

Time in class (flow state, Mihaly Csikszentmihalyi - remember this name!)

Why did I stop being a teacher after 13 years and became a teacher educator?

It is all about impact...

1 teacher = $75 \times 20 = 1500$ people

Teacher educator = $10 \times 20 \times 1500 = 300,000$ people

If just two of those teachers become professors - we get to a million...

Five reasons to teach physics

- You can actually learn physics.
- You do creative work every day, every minute, every second.
- You can affect lives of at least a 1500 people.
- You will not age and can potentially experience emotional high every day.
- You have flexible hours in the afternoon, a long summer break, and good benefits in some states (although this is changing rapidly now).

Another good reason - you can go places and associate with cool people



FERMI LAB

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AAPT meetings

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Five reasons not to teach physics

- You need to get up early every day.
- You need to work at home after working at school.
- You need to learn all the time.
- You need to be able to cope with extreme stress.
- You might not make as much as you would if you went to industry.

What does it take to become a good teacher?

- Altruism (selfless concerns for the being of others)
- Passion, patience, and empathy (students, parents, administration)
- Deep knowledge of the content and process of physics (including history)
- Knowledge of your students (books, shows, games)
- Organizational skills (when, what and how)
- Hard work (weekend? What weekend.....?)

Ways to become a physics teacher

It all depends on the state were you live

Possible paths

Traditional certificate

Alt. route

Nothing

Teaching certificate through the school of education

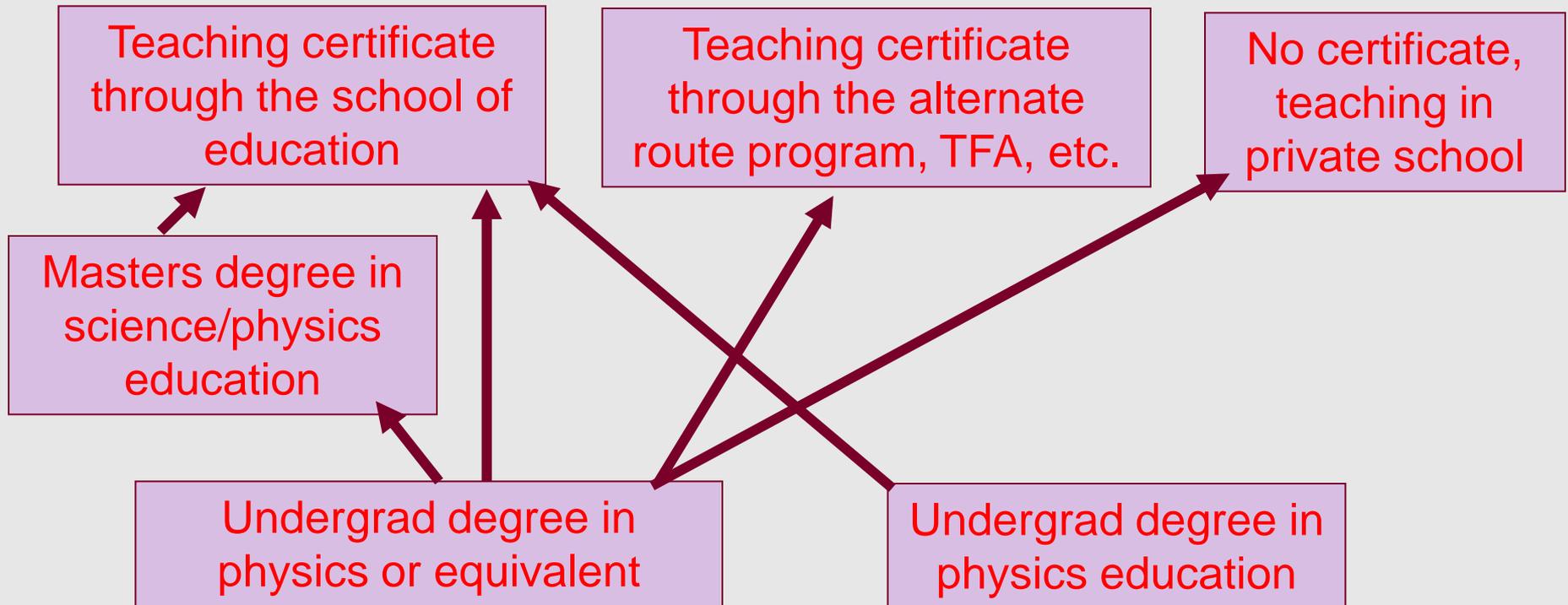
Teaching certificate through the alternate route program, TFA, etc.

No certificate, teaching in private school

Masters degree in science/physics education

Undergrad degree in physics or equivalent

Undergrad degree in physics education



Why would you want a traditional path?

- Traditional path: course work and student teaching before you resume full responsibility of a teacher. You are better prepared to start.
- You do student teaching before taking a job.
- You have peers who went through the program with you.
- You have instructors who taught you.
- You have materials (lesson and unit plans) you created or learned with during the program.

What to do to decide which path to take?

- Check your state requirements for certification. Check the liberal arts requirements as well as major requirements.
- Check your state employment situation - talk to those who are teachers: do the schools hire alternate route people? Does the salary depend on the education level? Does the state support Physics First movement?
- Find the agencies/people, etc. who are responsible for teacher preparation at your institution. Explore all your options before you make the decision.
- Think of what age group and in what environment you would like to teach: middle school, high school, urban, suburban, etc. It is all important for making decisions.
- **Note: many people come to teaching after having been in research, industry, etc.**

Demand for physics teachers

Each year, **500** physics teachers leave the profession while only **300** enter the workforce

Only about **1/3** of the current physics teachers have either a major or a minor in physics.

The growing and critical need for qualified STEM teachers has been called **a national security issue.**

A first year physics teacher

- Being a physics teacher is great because **every single day is different, and every single year provides new challenges to face.** But what's even better is that you can actually SEE yourself getting better at being a physics teacher, not many people see the successes in their own job (saving the company money, seeing the end result of your hard work), however as a physics teacher you can. You can see their understanding grow and improve as your own knowledge of teaching and your own skills grow.
- **Being a physics teacher allows you to make a true difference in a student's life.** Especially in high school when they are deciding what they want to be, what they enjoy, what to study in college, you can make their decision lean in one direction or another. You can show them what true science is, the art of observation, questioning, and thinking. You can help them learn to learn on their own, so that they will always have a teacher at their disposal: themselves. If a student is deciding whether to go into engineering or business, perhaps you can persuade them to go into engineering... or even business! Either way it's good, because if you gave them a positive experience that helped them make their own decision to get into what they want, even if it isn't science, you've made a huge and wonderful difference in somebody's life.
- **Being a physics teacher allows the students to change you.** Too often when I was in industry, I felt like a machine, always doing the same thing, never growing, but here the students always surprise you, change you, make you better. However much you give to them, if you know how to look, you receive twice in return.

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Typical day of a physics teacher

- My typical day starts of **waking up around 5-5:30 in the morning** depending on how many times I hit the snooze button! I get to school, make photocopies of quizzes or handouts that I need for the day, and then begin classes. During my prep periods, if I'm well prepared and do not need to grade/setup labs, I usually wander the school and visit other classrooms (art/engineering/etc) where I can find other cool teachers and students to hang out with. I then usually paint, draw, or keep my own creative spirit up by just acting like a kid again. I also make myself available to other students whom need help with class. Being a physics teacher is great because I know a ton about chemistry and other sciences, and also about math. I've become a source of help for all students with any kind of work, they've come to respect me and trust me in such a short amount of time just because I'm willing to help them in my own spare time. This in turn makes them realize how valuable knowledge is, and how it can help people.
- **I have a total of 4 classes per day, with a 5th lab period some days**, they go mostly smoothly, aside from my 9th period class which is the last period and also full of seniors. It's a very challenging class to teach, especially as a first year teacher, but also never let the students get you down, as their decisions are their own, it is your job to provide the opportunity to learn, and theirs to take it. **When the class goes badly, I try to reflect on what I can change and correct, if it goes well, I give myself a pat on the back and feel good about myself.**
- I then **go home and grade and create new lessons** for tomorrow. It's very difficult the first year, but I can already see it getting easier for me next year!

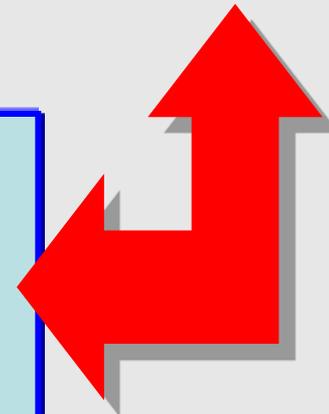
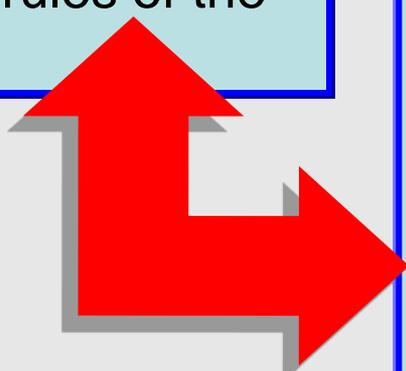
What should a physics teacher know?

Subject matter
(concepts, rules,
problem solving)
Methods of acquiring
knowledge: How do
we know what we
know? What are
accepted rules of the
game?

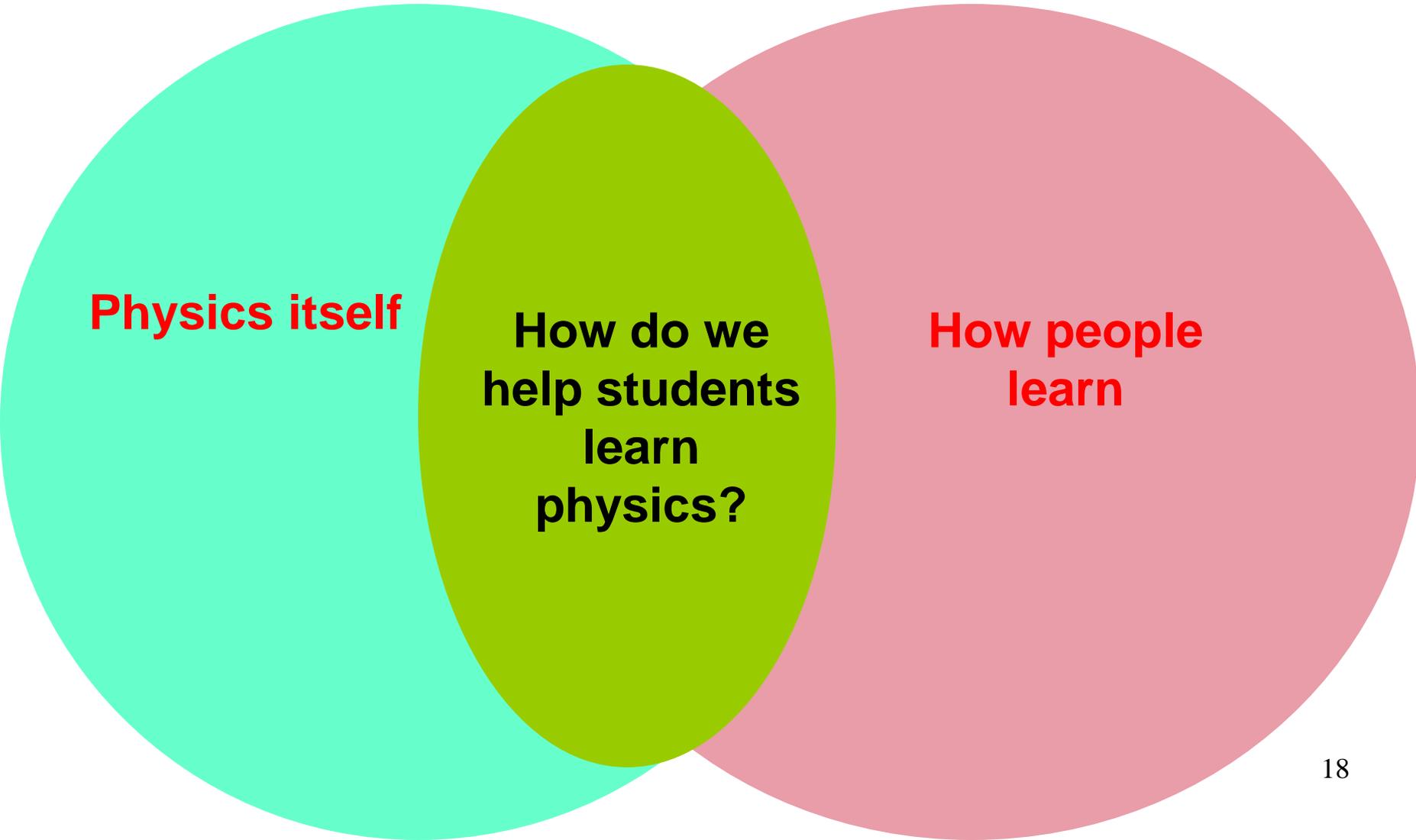
**Anything
else?**

How people learn
How people work in groups
How do we motivate them?

What should students learn in a
physics course?
What ideas do they already
have?
How can we help them best?
How can we assess them?
What resources are available?
How to structure the curriculum ?



Summary: important to think about when you take any course



Physics itself

**How do we
help students
learn
physics?**

**How people
learn**

In 2001 Rutgers Graduate School of Education became the only place in the US where there is a logically connected sequence of multiple methods courses at the masters level where PHYSICS future teachers learn how to teach PHYSICS.

Rutgers Physics Teacher Program

Ed.M. + certification

Year/ semester	Required Coursework (45 credits)	
	General Education	Physics PCK and physics
1/Fall	1. Educational psychology 2. Ind. and cult. diversity	1. Development of ideas in physical science
1/Spring		1. Teaching physical science. 2. Technology in science education. 3. Upper level physics elective
1/Summer	1. Assessment (2 credits)	1. Research internship in X-ray astrophysics
2/Fall	1. Classroom management (1 credit)	1. Teaching internship seminar (physics). 2. Internship (9 credits)
2/Spring	1. Intro to Special Ed. 2. Teacher as a professional	1. Multiple representations in physical science

E. Etkina, E. Pedagogical content knowledge and preparation of high school physics teachers. *Physical Review Special Topics Physics Education Research*, **6**, 020110 (2010)

Year/ semester	Coursework		Clinical practice	
	General Education	Physics PCK and physics	As a student	As a teacher
1/Fall	1. Ed Psych 2. Diversity	1. Development of ideas in physical science	Microteaching	TA in a reformed course
1/Spring		1. Teaching physical science 2. Technology 3. Elective	Plan multiple lessons and one whole unit, microteaching.	
1/Summer	1. Assessment	1. Research internship in X- ray astrophysics	X-ray research in a HS summer program.	TA in summer courses
2/Fall	1. Classroom management	1. Seminar 2. St. Teaching	Observe, reflect write lesson and unit plans.	Be a high school physics teacher.
2/Spring	1. Teacher as a professional. 2. Inclusion	1. Multiple representations in physical science	Plan multiple lessons and one whole unit; teach a lesson.	Work as an instructor in reformed recitations or labs.

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2/Spring	1. Teacher as a professional. 2. Inclusion	1. Multiple representations in physical science	Plan multiple lessons and one whole unit; teach a lesson.	Work as an instructor in reformed recitations or labs.
After graduation	Web-based discussions, meetings twice a month at the GSE, curr, dev.		Work as a high school physics/physical science teacher and reflect on experiences.	

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Thank You!

Questions?

You can always e-mail me at
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