„Albert Einstein – he was a little bit gifted…“

An Interview Study concerning Students‘ Mindsets in Physics

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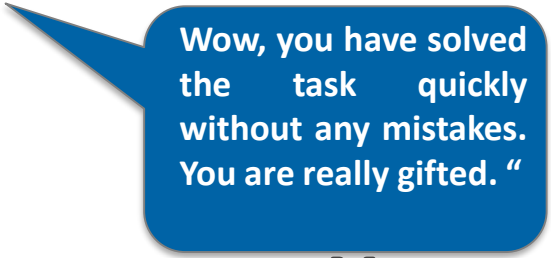
Background

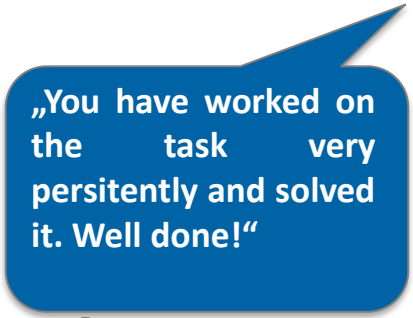
Mindset Assessment

tinyurl.com/PER-mindsets

…a story of two students…



Mary

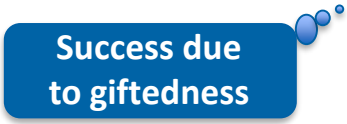


Anna

…a story of two students…

	Success due to giftedness	Success due to persistence
	Mary	**Anna**
…Challenges	avoid it	embrace it
…Obstacles	give up easily	keep it up
…Effort	is fruitless	is neccessary
…Criticism	ignore it	appreciate it
…Success of Others	as a threat	as a lesson

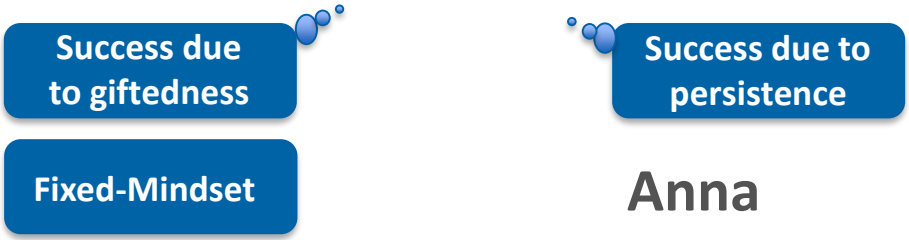
C. S. Dweck (2006): Mindset: The New Psychology of Success



Mary

Anna

C. S. Dweck (2006): Mindset: The New Psychology of Success



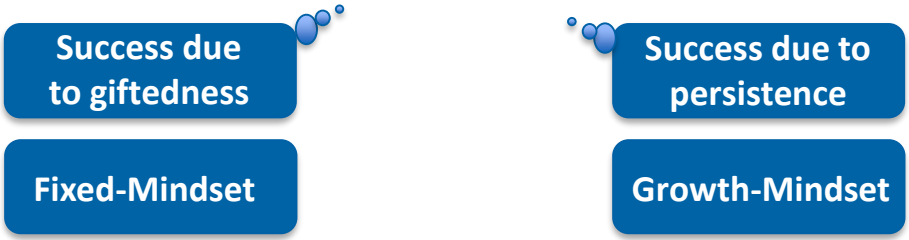
Fixed-Mindset:

intelligence is static,

leads to a desire to look smart

- As a result, these students may plateau early and achieve less than their full potential.

C. S. Dweck (2006): Mindset: The New Psychology of Success



Growth-Mindset:

intelligence can be developed,

leads to a desire to learn

- As a result these students reach even higher levels of achievement.

Background

praise for giftedness can promote a Fixed-Mindset

praise for persistance can promote a Growth-Mindset

students learn to embrace challenges from which to acchive growth

z.B. Cimpian, Arce, Markman & Dweck (2007); Mueller & Dweck (1998); Kamins & Dweck (1999)

Background

gender-specific differences:

boys are more likley to have a Growth-Mindset

girls are more likely to have a Fixed-Mindset

Dweck, Davidson, Nelson & Enna (1978);
Gunderson, Gripshover, Romero, Dweck, Goldin-Meadow & Levine (2011)

Background

gender-specific differences:

within the Fixed-Mindest
boys perform better than girls

within the Growth-Mindset
boys and girls perform equally

Grant & Dweck (2003)

Background

succesfull interventions to teach a Growth-Mindset

positive effects on achievement gaps between boys and girls

Dar-Nimrod & Heine (2007); Good, Aronson & Inzlicht (2003)

positive effects on achivement levels of Middle-School- und College-Students

Aronson, Fried & Good (2002); Blackwell, Trzesniewski & Dweck (2007)

Background

“Similar experiments have not yet been carried out in physics.“

Aguilar, Walton & Wieman (2014)

Interview Study

research questions:

Does the characterization according to Dweck's theory of Fixed- and Growth-Mindsets apply to students with regard to physics?

Interview Study

research questions:

By means of which criteria can Fixed- and Growth-Mindsets be separated?

Can Fixed- and Growth-Mindsets be separated accurately, or are there mixed forms?

Interview Study

qualitative content analysis (Mayring 2015)

1. data collection

2. data preparation

3. data evaluation

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… Have a look at the interview-guideline!

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N=12 middle-school students, Darmstadt 2017

Interview Study

qualitative content analysis (Mayring 2015)

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… Have a look at the interview-guideline!

N=12 middle-school students, Darmstadt 2017

(4 female, 8 male) from 3 different schools

Interview Study

qualitative content analysis (Mayring 2015)

1. data collection

2. data preparation

3. data evaluation

… Have a look at the interview-guideline!

N=12 middle-school students, Darmstadt 2017

→ each interview took about 15 minutes

Interview Study

qualitative content analysis (Mayring 2015)

1. data collection
2. **data preparation**
3. data evaluation

Interview Study

qualitative content analysis (Mayring 2015)

1. data collection

2. data preparation

3. data evaluation

- **transcribe the whole interview**
- **paraphrase relevant statements**
- **generalize these statements**

Interview Study

qualitative content analysis (Mayring 2015)

1. data collection

2. data preparation

3. data evaluation

Example: Transcription

„Mhm. (.) Ich glaube es geht immer mit dem Interesse zu. Wenn man sich für Physik interessiert, dann hat man Spaß und ich glaub dann beherrscht man das auch ziemlich gut. Aber wenn man wirklich kein Interesse für das Fach hat, dann (…)“

Interview Study

qualitative content analysis (Mayring 2015)

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Example: Transcription

„Mhm. (.) I think interest is always involved. If you are interested in physics it is fun and I think that in this case you are usually quite good at it. But if you are really not interested, then (…)“

Interview Study

qualitative content analysis (Mayring 2015)

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Example: Paraphrasing

If you are interested in physics it is fun and you are better at it.

Interview Study

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Example: Generalization

Interest improves performance.

Interview Study

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Interview Study

qualitative content analysis (Mayring 2015)

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inductive creation of categories: sorting of the generalized statements according to content

Interview Study

qualitative content analysis (Mayring 2015)

1. data collection

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inductive creation of categories: sorting of the generalized statements according to content

→ created categories

Interview Study

qualitative content analysis (Mayring 2015)

1. data collection
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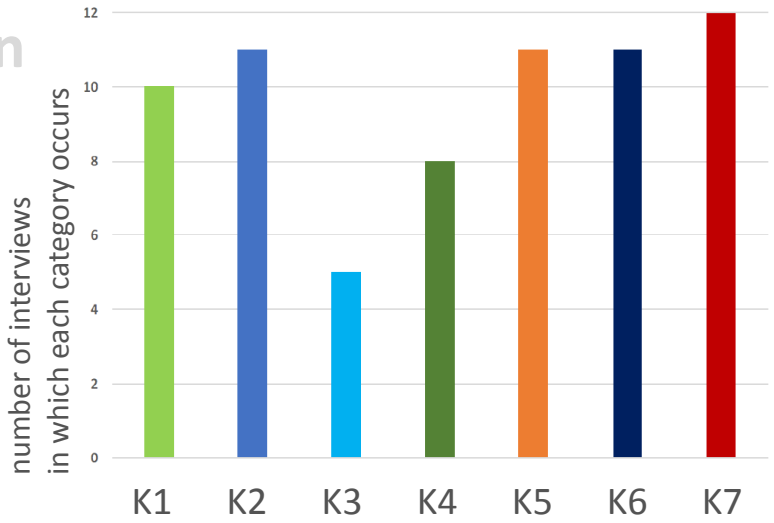
3. **data evaluation**



Interview Study

qualitative content analysis (Mayring 2015)

1. data collection

2. data preparation

3. data evaluation

allocation of the categories to one mindset

group work phase 1

Interview Study

qualitative content analysis (Mayring 2015)

1. data collection

2. data preparation

3. data evaluation

analyzation of each interview in terms of occurring categories and allocated mindset

group work phase 2

Interview Study

ET_w

- Fixed-Mindset
- Growth-Mindset

K2	a)	There is an innate gift for physics.	133-134	
	b)	If you have a talent for physics, you do not have to study a lot.	130-139	
	c)	If you are gifted, you learn and understand physics faster.	150-153	
K3	a)	Studying can only improve performance within certain limits.	70-71	
	b)	Just by practicing you can not understand new things in physics as quickly as with a talent.	179-183	
K5	a)	Interest improves performance. If you are interested in physics, you can learn it. Without interest you can not learn physics.	33-35 91-92 201-203	
K6	a)	It is hard to learn physics if you do not understand it.	30-31	
K7	b)	Successful physicists need talent.	49-50	

Interview Study

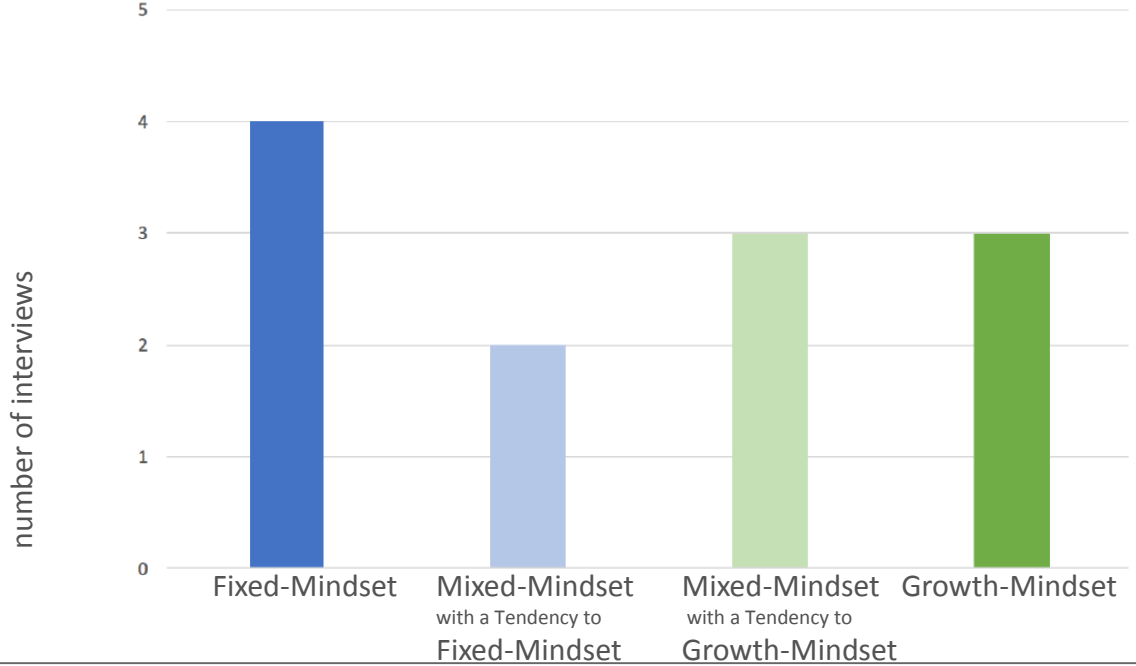
DP_m

- Fixed-Mindset
- Growth-Mindset

K1	c)	To understand physics you have to study.	70-74	
K2	b)	If someone has a talent, he learns faster.	109-111	
	c)	If you discover something new, you have a talent. You can only study what has been discovered already.	139-141	
K4	a)	Everyone can learn everything in physics.	81-83	
	b)	One can compensate giftedness by practicing.	118-120	
	c)	Without aptitude, you have to practice more, but you can learn physics just as well.	115-117	
K5	a)	Interest improves performance.	24-27	
	e)	If someone is interested in the subject, talent can arise.	152-155	
K7	b)	Einstein had a talent.	126	

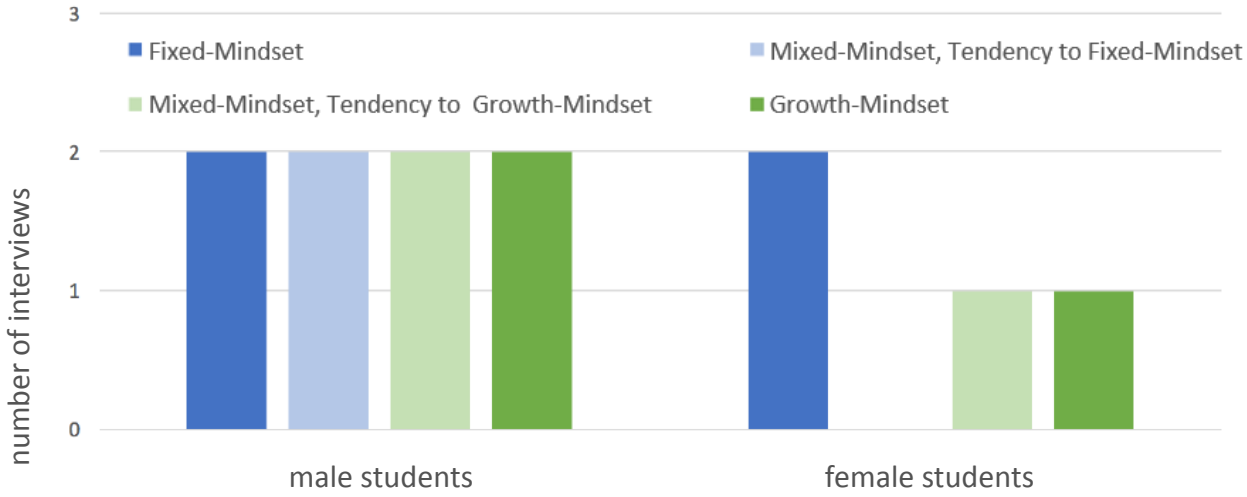
Interview Study

Analyzation of the 12 student-interviews



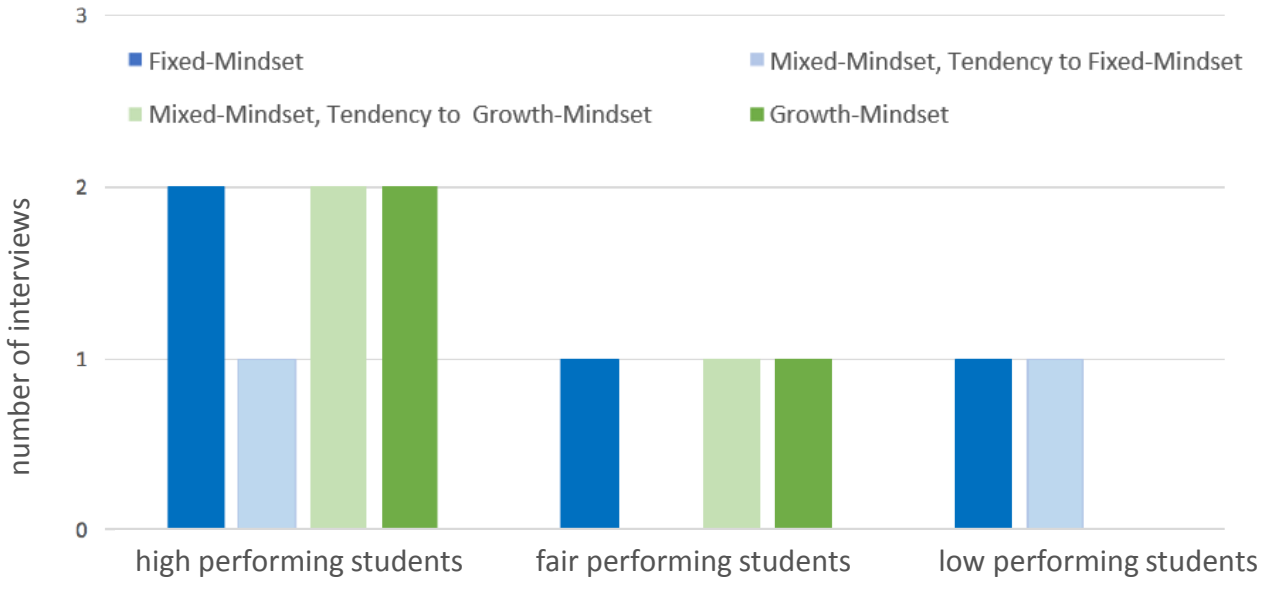
Interview Study

Analyzation of the 12 student-interviews



Interview Study

Analyzation of the 12 student-interviews



Interview Study

Conclusion:

Does the characterization according to Dweck's theory of Fixed- and Growth-Mindsets apply to students with regard to physics?

We are confident that we can apply the concept of Fixed- and Growth-Mindsets to students' beliefs about learning physics.

Interview Study

Conclusion:

By means of which criteria can Fixed- and Growth-Mindsets be separated?

To what reasons is success in physics attributed?

giftedness? persistence?

Does interest determine success in physics? Is it inherited or acquired?

Does understanding determine success in physics? Is it inherited or acquired?

Interview Study

Conclusion:

Can Fixed- and Growth-Mindsets be separated accurately, or are there mixed forms?

Nevertheless, not only two distinct mindsets have been revealed but also mixed forms with a tendency to either the Fixed- or the Growth-Mindset.

Interview Study

Conclusion:

We might see a higher probability for a Fixed-Mindset among low-achieving students.

Interview Study

Conclusion:

Clearly more interviews are neccessary to confirm this first impression.

Esspecially the influence of „interest“ and „understanding“ to learn physics according to students‘ perception has to be assessed explicitly.

Interview Study

Conclusion:

We are currently analyzing another interview study carried out with students in Vienna, as well as an interview study with physics teachers from the region of Darmstadt.

We are currently also working on an adaptation of students‘ statements to items for a paper-pencil test concerning mindsets.

Selected Quotations:

„Albert Einstein, der war dafür geboren. Ich denke schon [man braucht eine Begabung…] Also wenn ich übe, kann ich vielleicht besser werden, aber nie auf dem Level von jemandem, der seit Kind die Begabung hat.“

Albert Einstein, he was born for it. Yes, I think [you need a talent ...] So when I practice, I may get better, but never to the level of someone who has had the talent since childhood.

KaEr21m
Jgst. 07

Selected Quotations:

„Albert Einstein – der war schon so ein bisschen begabt, aber natürlich hat er auch gelernt. Wenn er Physik nicht gelernt hätte, würde er es ja gar nicht können. Wenn man sehr viel lernt, dann kann man es auch schaffen sehr gut zu werden.“

Albert Einstein - he was a little bit gifted, but of course he also studied. If he had not studied physics, he would not have been able to do it. If you revise a lot, you can succeed getting excellent.

AsEr30m

Jgst. 07

Discussion

„I have no special aptitude,

I am only passionately curious.“

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