

# MAYBE MINDSET MATTERS?

HOW THEORIES OF INTELLIGENCE AFFECT LEARNING  
APPROACHES AND OUTCOMES

Presentation delivered by Oliver Lovell to the University of Tasmania's  
Centre for University Pathways and Partnerships. 19 June 2014.

# Today's presentation



- An activity!
- What's the challenge?
- A general theory of motivation
- What is Mindset?
- Does Mindset matter? (Study 1)
- Can we change Mindset? (Study 2)
- Conclusions

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# Activity



- Head to <http://tiny.cc/olliessurvey> and fill out the survey!

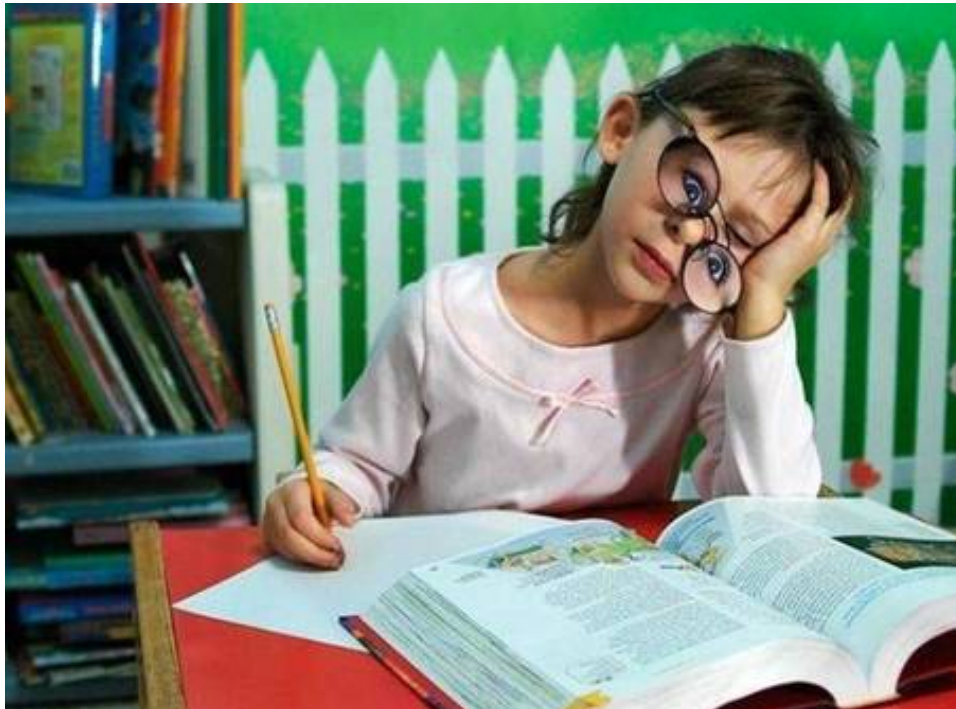
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# The Challenge

- How do we get from here



- To here?



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# A general theory of motivation

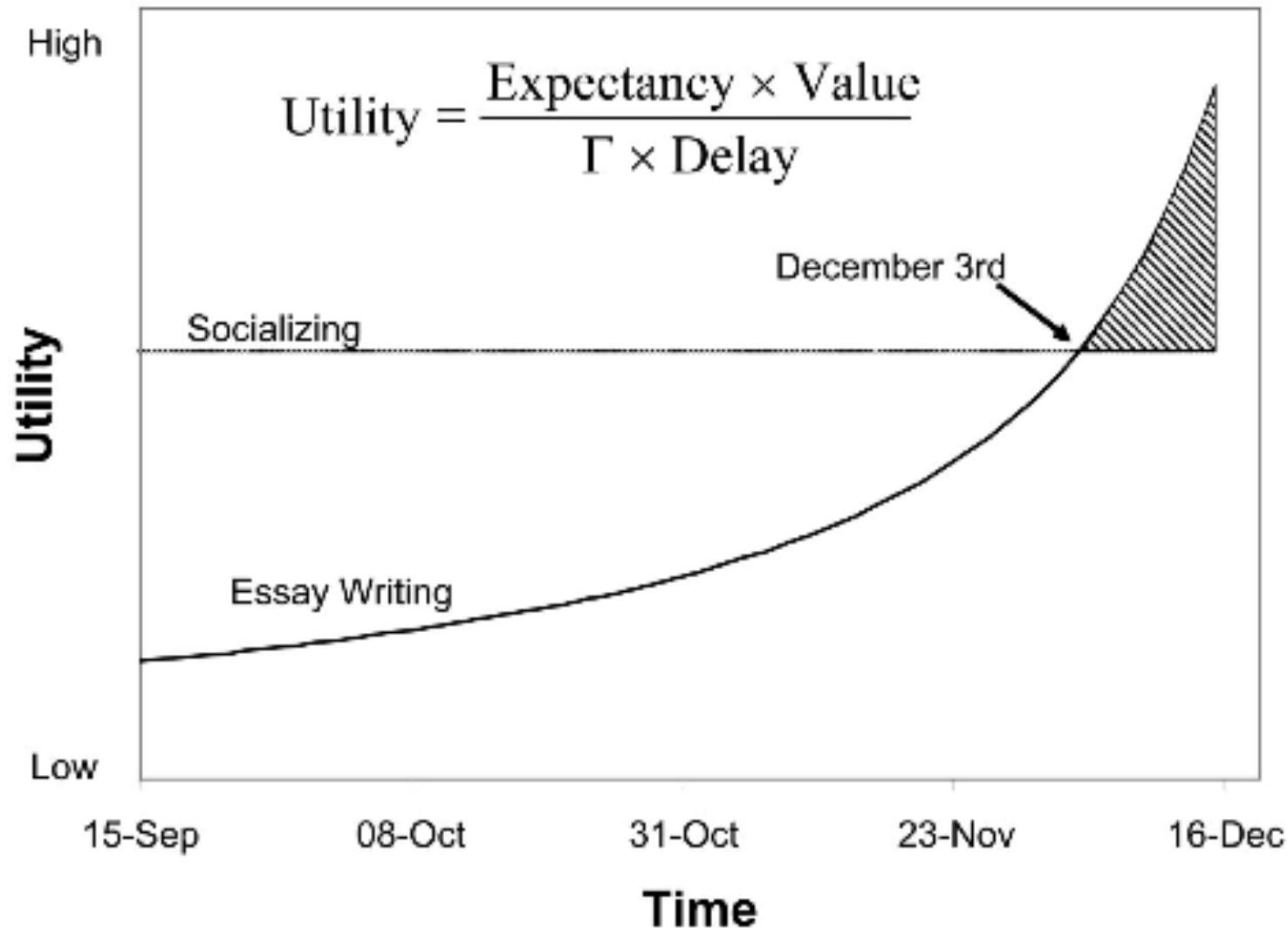


## □ The procrastination equation!

$$Motivation = \frac{Expectancy \times Value}{Impulsiveness \times Delay}$$



# Motivation threshold



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# Mindsets



- **Fixed Mindset:** Abilities such as intelligence or talent are fixed traits
- **Growth Mindset:** Abilities can be developed through dedication and hard work – brains and talent are just the starting point

# What does Mindset relate to?

## □ The procrastination equation!

$$\textit{Motivation} = \frac{\textit{Expectancy} \times \textit{Value}}{\textit{Impulsiveness} \times \textit{Delay}}$$

# Why **should** it make a difference?



## □ Expectancy

- ▣ Fixed: No matter how hard I try I'll still be bad at maths
  - Vs.
- ▣ Growth: If I work hard I have a good chance of achieving

## □ Value

- ▣ Fixed: Getting this right doesn't mean anything anyway, it's just a grade that won't effect my life at all
  - Vs.
- ▣ Growth: Working hard and achieving will improve my intelligence and abilities

# And these students have different goals

- Growth Mindset → learning goals: 'it is very important to me to feel that my coursework offers me real challenges' → Asks questions when they don't understand
- Fixed Mindset → performance goals: 'When I take a course in school, it is very important for me to validate that I am smarter than other students' → Lies to make you think that they understand when they don't!

Grant, H., Dweck, C.S. (2003). Clarifying achievement goals and their impact. *Journal of Personality and Social Psychology*, 85, 541–53.

<http://ih.constantcontact.com/fs186/1102478511107/img/83.jpg?a=1112657926033>

# And these students have different goals

- Goal-oriented

- Fixed ability



offers  
they

take a

s' → Lies

understand when they don't!

Grant, H., Dweck, C.S. (2003). Clarifying achievement goals and their impact. *Journal of Personality and Social Psychology*, 85, 541–53.

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# Does Mindset Matter?



- #edupaper: “Why do beliefs about intelligence influence learning success? A social cognitive neuroscience model”-Mangels et. al (2006)...

**YES!**

- Primarily because it influences attention and time taken for information encoding...

# The Experiment



25



22



475/40%



✓

✗



Mangels, J. (2006). Why do beliefs about intelligence influence learning success? A social cognitive neuroscience model. *Social Cognitive and Affective Neuroscience*, [online] 1(2), pp.75-86. Available at: <http://dx.doi.org/10.1093/scan/nsi013> [Accessed 17 Jun. 2014].

# The Experiment (in words)

- 22 fixed mindset and 25 incremental mindset students (18-35, right handed, english speaking, clear vision, hearing, not crazy, etc)
  - ▣ Categorized as Growth or Fixed theorists through likert Qs, eg: “You have a certain amount of intelligence and you can’t do much to change it”
- Pool of 475 general knowledge questions, all correct answers 3-8 letters long, algorithm used so that students received approx 40% accuracy overall
- Students were presented (by a computer) with a question and they typed in their response (or xxx) and rated their level of confidence (1 through 7)
- Following answer submission screen was blank for 2 seconds, crosshair appeared for 2.5 seconds then students were given *performance-relevant feedback* ie: correct or incorrect
- Following this crosshair appeared for another 2.5 seconds then *learning-relevant feedback* appeared for 2 seconds, ie: the correct answer.

Mangels, J. (2006). Why do beliefs about intelligence influence learning success? A social cognitive neuroscience model. *Social Cognitive and Affective Neuroscience*, [online] 1(2), pp.75-86. Available at: <http://dx.doi.org/10.1093/scan/nsi013> [Accessed 17 Jun. 2014].

# AND LOOK AT THEIR BRAIN WAVES!!!



[http://www.neuroscan.com/images/products/quick\\_caps\\_1\\_gal.jpg?0.4261539574887017](http://www.neuroscan.com/images/products/quick_caps_1_gal.jpg?0.4261539574887017)

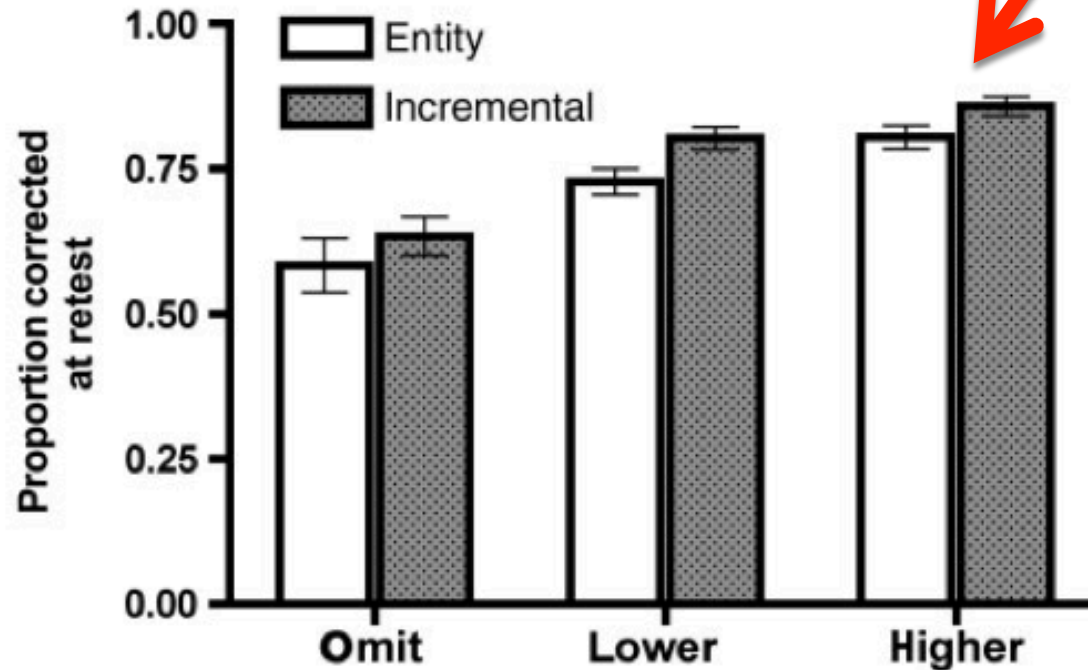
# But then...



[http://seemasodha.com/wp-content/uploads/2013/11/jack\\_in\\_the\\_box\\_1.jpg](http://seemasodha.com/wp-content/uploads/2013/11/jack_in_the_box_1.jpg)

# Results

The “Hyper Correction” effect  
(Butterfield & Metcalfe, 2001)



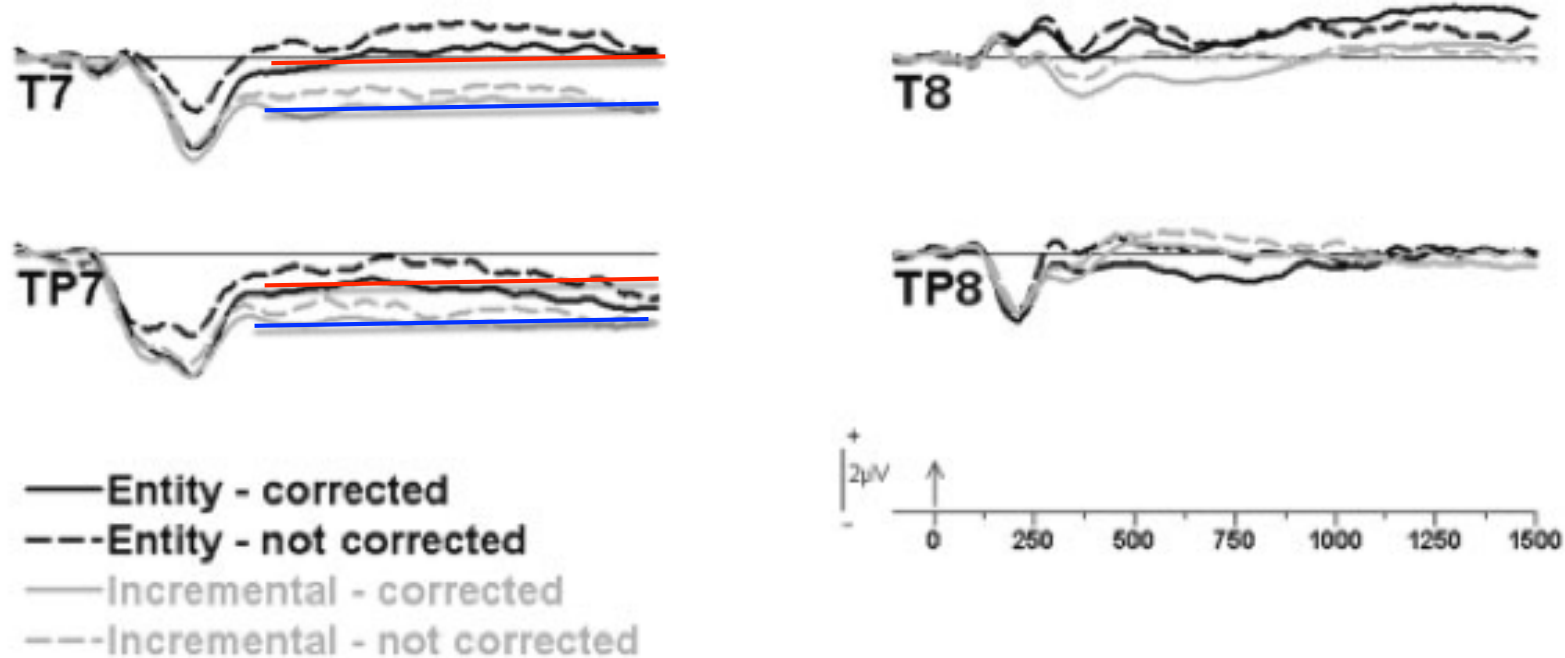
**Fig. 1** Proportion of errors of each confidence type (omits, lower confidence, higher confidence) that were corrected at retest, as a function of theory of intelligence (entity, incremental). Error bars in this and all subsequent figures represent the standard error of the mean (SEM).

Mangels, J. (2006). Why do beliefs about intelligence influence learning success? A social cognitive neuroscience model. *Social Cognitive and Affective Neuroscience*, [online] 1(2), pp.79 . Available at: <http://dx.doi.org/10.1093/scan/nsi013> [Accessed 17 Jun. 2014].

Butterfield, B., Metcalfe, J. (2001). Errors committed with high confidence are hypercorrected. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 27, 1491–94.

# Brain Waves...

“There is now substantial evidence accruing that negative-going potentials ...(associated with)... enhance episodic memory for that item”



**Fig. 4** ERPs to learning-relevant feedback. Grand mean waveforms at temporal sites as a function of theory of intelligence (entity, incremental) and subsequent memory performance (corrected, not corrected).

Mangels, J. (2006). Why do beliefs about intelligence influence learning success? A social cognitive neuroscience model. *Social Cognitive and Affective Neuroscience*, [online] 1(2), pp. 82. Available at: <http://dx.doi.org/10.1093/scan/nsl013> [Accessed 17 Jun. 2014].

# WHAT???



**=People with a Growth Mindset  
concentrated harder when the  
correct answer came up!**

Mangels, J. (2006). Why do beliefs about intelligence influence learning success? A social cognitive neuroscience model. *Social Cognitive and Affective Neuroscience*, [online] 1(2), pp. 82. Available at: <http://dx.doi.org/10.1093/scan/nsl013> [Accessed 17 Jun. 2014].



# Which means

□ Less of this...



I'm over  
Here!

**Correct Answer**

[http://i.telegraph.co.uk/multimedia/archive/01647/teenage\\_daydreamin\\_1647428a.jpg](http://i.telegraph.co.uk/multimedia/archive/01647/teenage_daydreamin_1647428a.jpg)  
<http://www.doncrowther.com/wp-content/uploads/StayFocused.jpg>  
<http://www.clker.com/cliparts/L/3/n/h/7/l/correct-answer-bold2-hi.png>

□ More of THIS!



# In more words...

- “From 250 to 500ms, both entity and incremental theorists evidenced a memory-related left inferior temporal negativity, although this activity was enhanced for incremental theorists overall.”
- “There is now substantial evidence accruing that negative-going potentials over inferior temporal sites index activation of semantic representations that subsequently enhance episodic memory for that item”

Mangels, J. (2006). Why do beliefs about intelligence influence learning success? A social cognitive neuroscience model. *Social Cognitive and Affective Neuroscience*, [online] 1(2), pp. 84. Available at: <http://dx.doi.org/10.1093/scan/nsl013> [Accessed 17 Jun. 2014].

# And if that isn't enough...

- 'Relative to (fixed mindset individuals), (growth mindset individuals) have been found,
  - (a) to **focus more on learning goals** (goals aimed at increasing their ability) versus performance goals (goals aimed at documenting their ability; see e.g., Dweck & Leggett, 1988);
  - (b) to **believe in the utility of effort** versus the futility of effort given difficulty or low ability (e.g., Hong, Chiu, Dweck, Lin, & Wan, 1999);
  - (c) to **make low-effort, mastery-oriented attributions** for failure (e.g., Henderson & Dweck, 1990); and
  - (d) to **display mastery-oriented strategies (effort escalation or strategy change)** versus helpless strategies (effort withdrawal or strategy perseveration) in the face of setbacks (e.g., Robins & Pals, 2002)'

The above is a direct quote (my emphasis added) from: Blackwell, L., Trzesniewski, K. and Dweck, C. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child development*, 78(1), pp.247.

# Maybe Mindset Matters!



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So... can we change mindset?



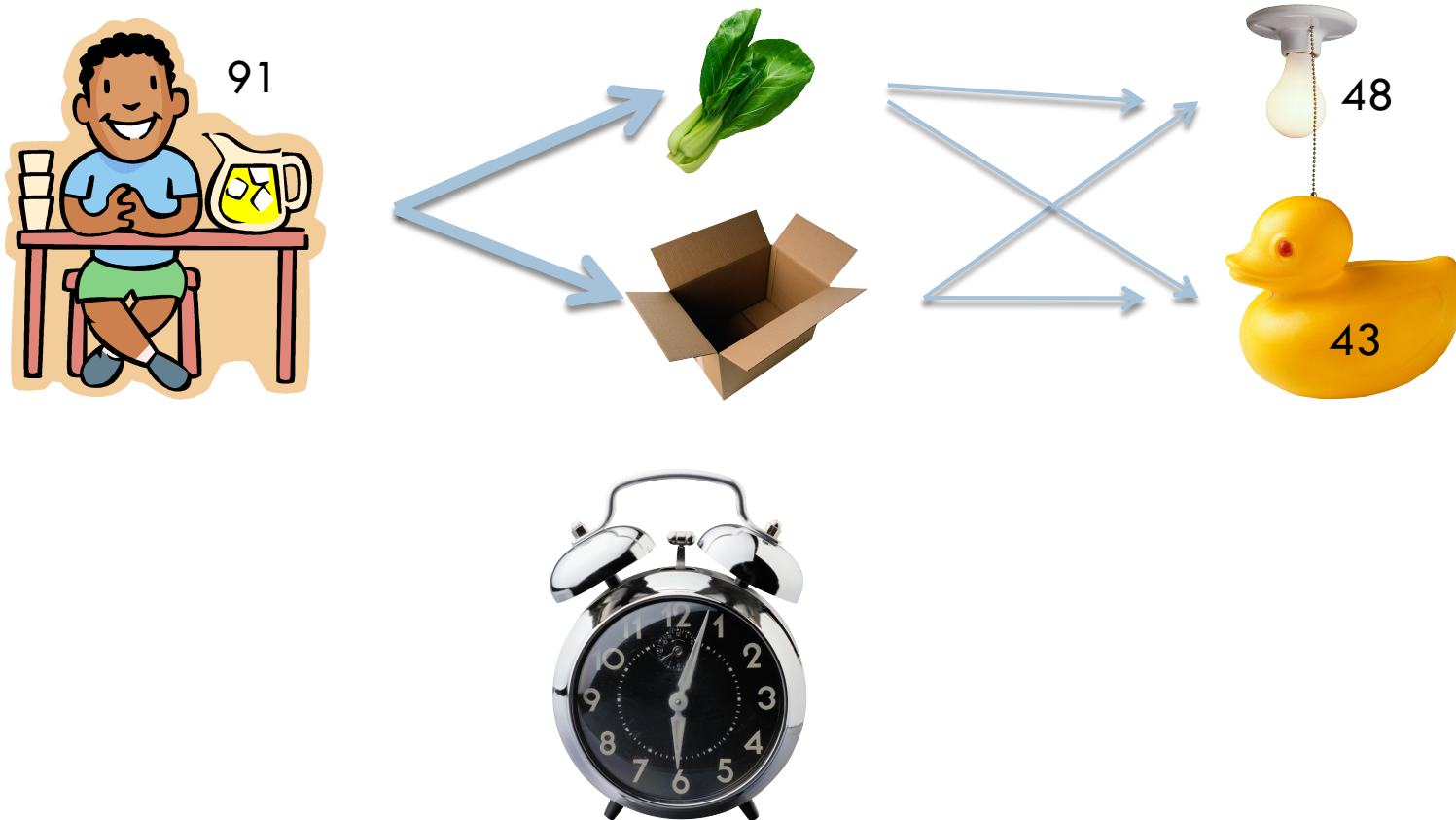
**Apparently so!**

# Here's who says so



- #edupaper: “Implicit Theories of Intelligence Predict Achievement Across an Adolescent Transition: A Longitudinal Study and an Intervention ”-Mangels et. Al (2006)...

# The Experiment



Blackwell, L., Trzesniewski, K. and Dweck, C. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child development*, 78(1), pp.246-263.



# The Experiment

- 99 students from a NY high school (49 females, 52% African American, 45% Latino, 3% White and Asian). They were in the 35<sup>th</sup> percentile nationally for mathematics results (relatively low-achieving)
- All participated in a questionnaire (to determine mindset) then were given an opportunity to participate in an 'intervention'
- 95 of the 99 volunteered to participate and 91 of these subsequently participated
- These 91 were split with 48 in the experimental intervention (attempting to promote a growth mindset) and 43 in the 'control' intervention (in which they ran academically similar sessions that did in contrast made no mention of growth mindsets or the justifications for one)
- Intervention was 8 X 25 minute sessions over 8 weeks, split into 8 modules. Here's what the modules covered

Blackwell, L., Trzesniewski, K. and Dweck, C. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child development*, 78(1), pp.246-263.

# Module 1: Brain Structure and Function

ALL students learnt that the brain...

- consists of different regions that control different functions
- Has a left and right hemisphere
- Is connected to the body through the spinal cord
- sends messages travel between nerve cells as electrical and chemical signals
- etc

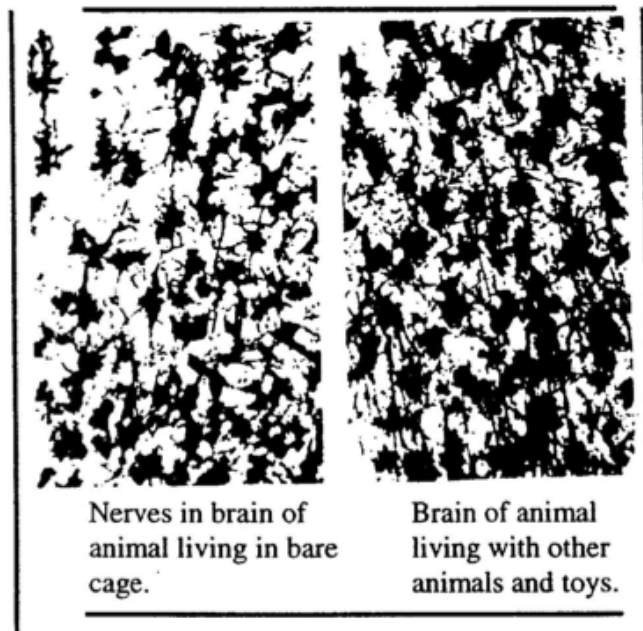
Blackwell, L., Trzesniewski, K. and Dweck, C. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child development*, 78(1), pp.262.

# Module 2: Theory Intervention/Memory

## Unit

### Experimental Group: Theory Intervention

- Read aloud an (age appropriate) article entitled 'You Can Grow Your Intelligence'



Concluded that learning makes you smarter

### Control Group: Memory Unit

- Read an academically similar (theory of intelligence neutral) article on memory and how it is thought that memory works, included
  - How to “chunk” information
  - Tricks of how to remember grocery lists
  - Mnemonic strategies

Image: Blackwell, L. You Can Grow Your Intelligence, the actual document used in the intervention..

Blackwell, L., Trzesniewski, K. and Dweck, C. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child development*, 78(1), pp.262.

# Module 2: Theory Intervention/Memory

## Unit (in words)

### Experimental Group: Theory Intervention

- Read aloud an (age appropriate) article entitled ‘You Can Grow Your Intelligence’
  - ▣ This described how brain growth occurs through strengthening of connections between neurons
  - ▣ Cited scientific research that mental activity results in measurable physical changes in the brain
  - ▣ Broadly likened the brain to other muscles that strengthen with exercise
  - ▣ Concluded that learning makes you smarter

### Control Group: Memory Unit

- Read an academically similar (theory of intelligence neutral) article on memory and how it is thought that memory works, included
  - How to “chunk” information
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Blackwell, L., Trzesniewski, K. and Dweck, C. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child development*, 78(1), pp.262.

# Module 3: Stereotypes; Study Skills

## ALL students

- Students were shown pictures of people and had to guess at their profession
- Mentors (running the workshop) then revealed the true occupations of the pictured individuals
- Discussion followed on how stereotyping oneself and others can limit ambitions
- Second half of module (week 6) was focused on study skills
  - ▣ Goal setting, time management tips, strategies for studying, remembering, understanding and organizing material

Blackwell, L., Trzesniewski, K. and Dweck, C. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child development*, 78(1), pp.262.

# Module 4: Discussions

## Experimental Group:

- Students re-capped what they had learned
- Students reflected upon 1 thing that they had learned well (from whole life) and discussed how they had gone about it
  - Emphasis was put on how mistakes were made in (and necessary to) the process of learning
- Session concluded with ‘everything you learn makes you smarter, and, being smart is a choice
- Next session (8) talked about how stereotyping is limiting. Concluded with “everything is hard before it is easy”

## Control Group: Memory Unit

- Students (session 7) discussed how they were going with their subjects and shared study tips
- Session 8: Re-cap of memory strategies and discussion of the mental abilities of different animals

Blackwell, L., Trzesniewski, K. and Dweck, C. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child development*, 78(1), pp.263.

# Results

- All students underwent a test to determine whether the intervention had changed Mindset, it was concluded that the theory of intelligence message had been successfully communicated. (from 4.36 to 4.95 for intervention group and from 4.62 to 4.68 for control group, on a 7 point scale. A statistically significant result)
- Teachers (unaware of who was in the control and who was in the intervention group) reported to experimenters 17 of the 91 students showed improved motivation (of which 13 were in the intervention group), a statistically significant result.
- This graph demonstrates grades over 3 time periods and the effect of the intervention (note: only students  $>1$  SD either side of the mean are included in this graph)

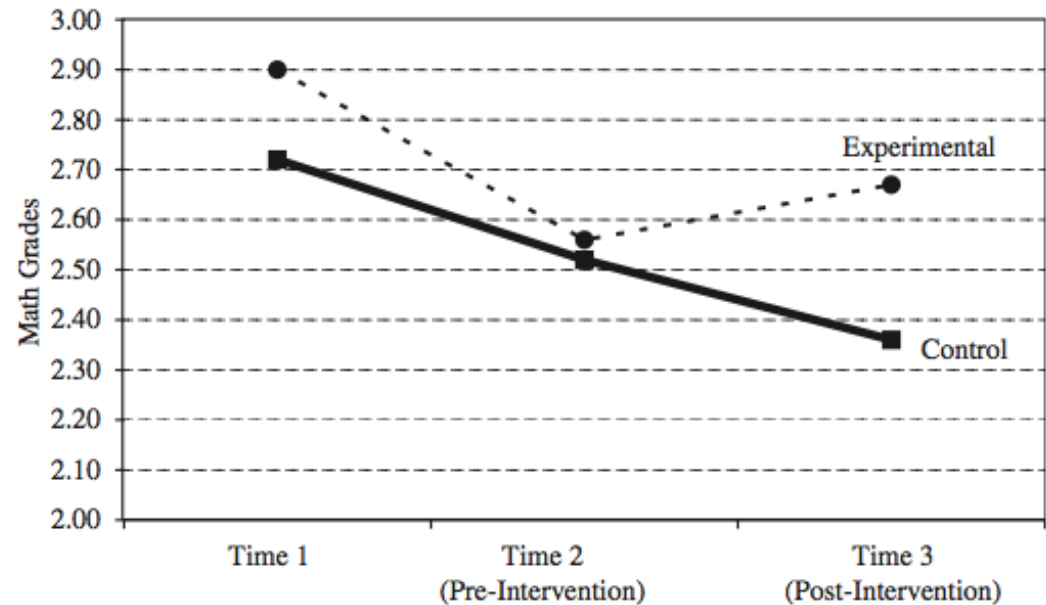


Figure 3. Predicted math grades by experimental condition.

Blackwell, L., Trzesniewski, K. and Dweck, C. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child development*, 78(1), pp.246-263.

# And if that isn't enough...

- ▣ “Aronson, Fried, and Good (2002) taught an incremental theory to college students, and compared them with two control groups: one a no-treatment group; and one taught a version of the “multiple intelligences” model of ability (Gardner, 1983). **Students in the incremental theory training group subsequently earned higher grades**, controlling for SAT scores, than did their counter-parts”
- ▣ “Aronson, and Inzlicht (2003) also found that an **incremental theory intervention led to significant improvement in adolescents’ achievement test scores** compared with a control group.”

The above is a direct quote (my emphasis added) from: Blackwell, L., Trzesniewski, K. and Dweck, C. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child development*, 78(1), pp.247-248.



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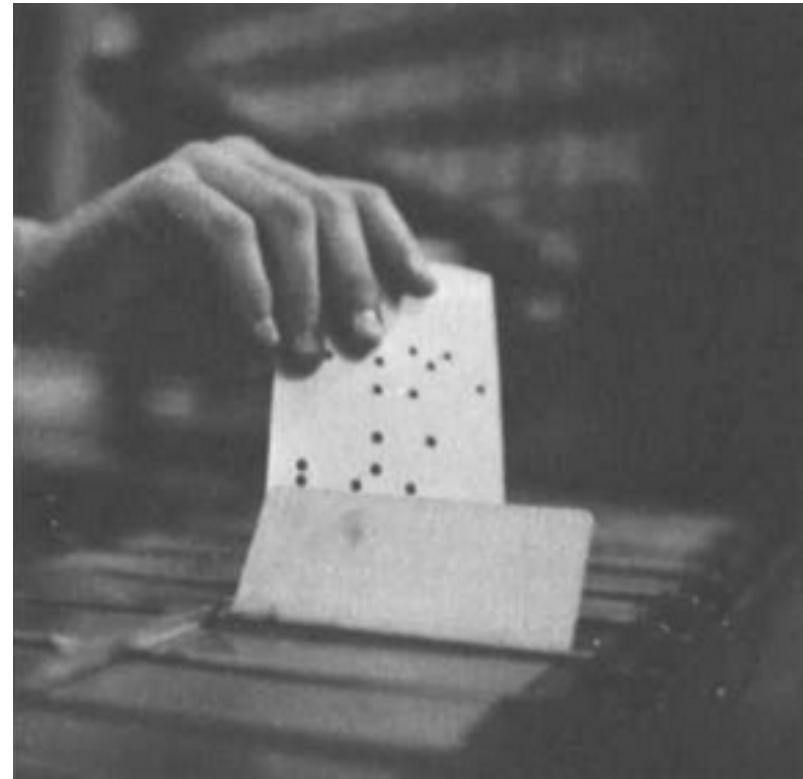


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# A Story ...the power of expectations



Herman Hollerith's 1890 tabulating machine



Images: <http://www.columbia.edu/cu/computinghistory/census-tabulator.html>

Story: Shell, G. (2014). Springboard. 1st ed. Pp. 173

# So, what Mindset was the group?



- Red=Fixed Mindset
- Orange=Slightly Fixed Mindset
- Yellow=Undecided
- Light Blue=Slightly Growth Oriented Mindset
- Dark Blue=Growth Mindset

<http://tiny.cc/mindsetsurveyresults>

Do we or should we address mindset in  
our programs?

