Achievement Emotions: Functions, Origins, and Implications for Practice

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Invited Talk, Berlin Interdisciplinary Education Research Network (BIEN), Berlin, February 2017
Focus on achievement anxiety

- Achievement anxiety: Pervasive problem in modern society

- Educational + occupational careers, life chances are made contingent on individual achievement

  - Avoidance of failure of critical importance

  - Fear of failure: One of the most frequently experienced emotions in achievement settings

    (e.g., when attending class, taking tests and exams; in evaluative job situations; in competitive sports; Pekrun et al., 2002; Zeidner, 1998)
Focus on achievement anxiety

- Detrimental effects
  - Well-being and health
  - Motivation and cognitive performance on complex + difficult tasks
  - Achievement outcomes in academic settings, on the job, in sports

→ Achievement anxiety is an important emotion
Relevance recognized early

- Scientific investigation since the 1930s (Stengel, 1936; Brown, 1938)
  Multitude of theories (psychoanalytic, behavioristic, cognitive etc.)
  > 1,000 empirical studies

- Cumulative knowledge
  - Frequency, phenomenology, components
  - Measurement
  - Antecedents, development
  - Effects
  - Intervention (therapy)
Should we go in there anyway?
„Ich trinke Jägermeister, weil ich eine Fünf in Mathe habe.“
On average, students feel bored 32% of classroom instruction time.

Csikszentmihalyi & Larson, 1987
ESM Study
<table>
<thead>
<tr>
<th>Emotion</th>
<th>Number of Studies</th>
<th>Research Tradition</th>
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</thead>
<tbody>
<tr>
<td>Joy / Enjoyment</td>
<td>61</td>
<td>Mood research</td>
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<tr>
<td>Enthusiasm</td>
<td>16</td>
<td>Teacher enthusiasm</td>
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<td>Admiration</td>
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<td>Sadness</td>
<td>15</td>
<td>Mood research</td>
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<tr>
<td>Anger</td>
<td>64</td>
<td>Type A personality</td>
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<tr>
<td>Anxiety</td>
<td>&gt; 1,000</td>
<td>Test anxiety</td>
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<tr>
<td>Hopelessness</td>
<td>14</td>
<td>Attributional</td>
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<tr>
<td>Shame / Guilt</td>
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<td></td>
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<tr>
<td>Disappointment</td>
<td>2</td>
<td>Job monotony</td>
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<tr>
<td>Boredom</td>
<td>43</td>
<td></td>
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<tr>
<td>Envy</td>
<td>6</td>
<td>Attributional</td>
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<tr>
<td>Contempt</td>
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<tr>
<td>Surprise</td>
<td>7</td>
<td>Attributional</td>
</tr>
</tbody>
</table>
1. Exploratory Analysis
   - Occurrence, structures, phenomenology

2. Assessment
   - Achievement Emotions Questionnaire (AEQ)

3. Functions
   - Learning and achievement
   - Psychological well-being, health

4. Origins, Development, Differences
   - Control-value theory of achievement emotions

5. Intervention
   - Design of achievement settings (e.g., learning environments)
Exploratory Analysis
Samples

University and K-12 students

Instruments

Semi-structured interviews + questionnaires, video-stimulated recall, psychophysiological analysis

Example: Semi-structured interview

1. Retrieval of well-remembered academic situation from autobiographical memory; or situational self-report
2. Description of situation
3. Question: How did you feel in this situation, which emotions did you experience?
   → Open answers

Pekrun, Goetz, Titz, & Perry, Educational Psychologist, 2002
EXPLORATORY ANALYSIS
Emotions in Achievement Settings at University: Frequencies

- Enjoyment: 13.7%
- Hope: 9.2%
- Interest: 6.9%
- Relief: 8.0%
- Satisfaction: 5.4%
- Pride: 3.0%
- Anger: 18.8%
- Anxiety: 21.6%
- Hopelessness: 1.2%
- Boredom: 1.1%
- Dissatisfaction: 4.1%
- Disappointment: 4.5%
- Shame / Guilt: 1.2%
- Other: 21.6%

N = 56 Students
415 Emotion episodes
(class, studying, exams)

Pekrun et al., Educational Psychologist, 2002
EXPLORATORY ANALYSIS

Emotions in University Exams: Frequencies

- Joy
- Hope
- Feeling of Security
- Relief
- Pride
- Anger
- Anxiety
- Hopelessness
- Dissatisfaction
- Shame / Guilt
- Surprise
- Other

Pekrun et al., Educational Psychologist, 2002
EXPLORATORY ANALYSIS

Test Emotions: Examples

Joy

“When I was asked this question (...) I thought to myself, “super, I know that(...)“, and I was happy“ (S 12)

“(…) this makes you feel enthusiastic (...) it’s kind of a hidden joy (...) of course, you can’t show it this way, they would think you’re crazy“ (S 8/6)

Hope

“And then my hope was he would continue asking questions on this subject, since this is material ... I feel I know“ (S 8/3)

Relief

(At the beginning of the exam) “... I thought, that’s a question I can answer, that’s straightforward ... (...). And I was sure I could say something about it. This was kind of a relief ...“ (S 4/1)
EXPLORATORY ANALYSIS

Test Emotions: Examples

Anxiety

“(…) I thought to myself, oh my god, again, one of the things you didn’t prepare for, I didn’t learn this stuff, and I got panicky (…)“ (S 24/1)

“I am sitting there, getting anxious, thought to myself, “I don’t know that“ (…) and, I don’t know, blackout, probably (…). I was no longer concentrating. I couldn’t listen any longer (…). I only kept thinking, ‘let’s hope there’ll be some questions I can answer“ (S 9/2)

Anger

“(…) he then kept asking questions on this material. I almost became desparare (…). I got a bit irritated then (…). Because I thought, why the hell is he asking for all these details, when I prepared for something else (…)“ (S 9/3)

“I was angry because I knew „achievement“ is a topic I know something about, but due to my disorientation, I won’t be able to sell it the way I could“ (S 26/1)

Pekrun et al., Educational Psychologist, 2002
EXPLORATORY ANALYSIS

Test Emotions: Examples

Shame

“I don’t like to let myself be embarrassed, but I really thought, if I don’t manage to say *anything* about Piaget, nobody could help me any longer (…) I mean, this really is a bit embarrassing“ (S 26/6)

Resignation

“(…) this thought of resignation (…). I noticed, it doesn’t go well, and then I even felt freed, because the expectations were gone“ (S 15/4)
“Yeah ... There weren‘t too many feelings during the exam. Just anxiety, disappointment, fright, hope. In one critical situation, enjoyment. Those were the main feelings“ (S 7/24)
EXPLORATORY ANALYSIS

Conclusions

(1) Emotional diversity

Students experience a variety of emotions in academic achievement settings

(2) Anxiety: Frequent – but explains < 20% of emotions reported

→ Reductionist approaches inappropriate

(3) Evidence on phenomenology, components, functions
Exploratory Analysis:

Which Emotions are Experienced in Achievement Settings?

ASSESSMENT
Emotions = Systems of interrelated psychological processes:

1. **Affective** (e.g., uneasy, nervous feelings)
2. **Cognitive** (e.g., worries)
3. **Physiological** (e.g., peripheral activation)
4. **Expressive** (e.g., anxious facial expression)
5. **Motivational** (e.g., avoidance motivation)
ASSESSMENT
Ways to Assess Emotions

1. **Self-report** (Questionnaires, interviews)
   
   Example: *Achievement Emotions Questionnaire, AEQ*
   (Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011)

2. **Implicit assessment** (e.g., IAT, IPANAT)

3. **Neuro-imaging** (EEG, fMRI, PET)

4. **Peripheral physiological analysis**
   (Heart rate, galvanic skin response etc.)

5. **Behavioral observation:**
   **Facial and postural expression** (e.g., FACS)
<table>
<thead>
<tr>
<th>Class</th>
<th>Learning</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enjoyment (10)</td>
<td>Enjoyment (10)</td>
<td>Enjoyment (10)</td>
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<tr>
<td>Hope (8)</td>
<td>Hope (6)</td>
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<td>Pride (9)</td>
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<td>Anger (9)</td>
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<td>Anxiety (12)</td>
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<td>Shame (11)</td>
<td>Shame (11)</td>
<td>Shame (10)</td>
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<tr>
<td>Hopelessness (10)</td>
<td>Hopelessness (11)</td>
<td>Hopelessness (11)</td>
</tr>
<tr>
<td>Boredom (11)</td>
<td>Boredom (11)</td>
<td>----</td>
</tr>
</tbody>
</table>

*Subscales for affective, cognitive, motivational, physiolog. components in each scale*

*Pekrun et al., Contemporary Educational Psychology, 2011*
Sample item: “I enjoy acquiring new knowledge in this course”
Sample item: “The day before an exam I am very nervous”
Sample item: “During the exam I feel hopeless”
## ASSESSMENT

**AEQ: Reliabilities (Alpha)**

<table>
<thead>
<tr>
<th>Emotion</th>
<th>Class-related Emotions</th>
<th>Learning-related Emotions</th>
<th>Test Emotions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enjoyment</td>
<td>.85</td>
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<td>Pride</td>
<td>.82</td>
<td>.75</td>
<td>.86</td>
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<tr>
<td>Relief</td>
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<td>---</td>
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<tr>
<td>Anger</td>
<td>.86</td>
<td>.86</td>
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<td>.90</td>
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<td>Boredom</td>
<td>.93</td>
<td>.92</td>
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</tr>
</tbody>
</table>
ASSESSMENT

AEQ: Internal Validity – Relations Between Emotions

C = class, L = learning, T = test. Jo = enjoyment, Ho = hope, Pr = pride, Re=relief, An = anger, Ax = anxiety, Sh = shame, Hl = hopelessness, Bo = boredom.

Pekrun et al., Contemporary Educational Psychology, 2011
### ASSESSMENT

**AEQ: Internal Validity – Relations Between Emotions**

<table>
<thead>
<tr>
<th>Model</th>
<th>$X^2$</th>
<th>$df$</th>
<th>$CFI$</th>
<th>$RMSEA$</th>
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<td>1-Factor Model</td>
<td>5,647</td>
<td>252</td>
<td>.81</td>
<td>.250</td>
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<tr>
<td>8-Emotions Model</td>
<td>2,349</td>
<td>217</td>
<td>.92</td>
<td>.170</td>
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<tr>
<td>3-Settings Model</td>
<td>5,866</td>
<td>249</td>
<td>.83</td>
<td>.257</td>
</tr>
<tr>
<td>Two-Facet Model (Emotions x Settings)</td>
<td>370</td>
<td>134</td>
<td>.99</td>
<td>.072</td>
</tr>
</tbody>
</table>
AEQ: reliable + valid

Versions of the AEQ
- Trait vs. state scales
- Domain-specific + age-specific versions
  
  *Achievement Emotions Questionnaire-Mathematics (AEQ-M)*
  
  *Achievement Emotions Questionnaire-Language (AEQ-L)*
  
  *Elementary School AEQ*

Translations
- Chinese, Korean, Spanish, French, German, Swedish, Italian, Greek, etc.
FUNCTIONS FOR LEARNING AND PERFORMANCE
<table>
<thead>
<tr>
<th></th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Activating</strong></td>
<td>Enjoyment</td>
<td>Anger</td>
</tr>
<tr>
<td></td>
<td>Hope</td>
<td>Anxiety</td>
</tr>
<tr>
<td></td>
<td>Pride</td>
<td>Shame</td>
</tr>
<tr>
<td><strong>Deactivating</strong></td>
<td>Relief</td>
<td>Hopelessness</td>
</tr>
<tr>
<td></td>
<td>Relaxation</td>
<td>Boredom</td>
</tr>
</tbody>
</table>

Pekrun, Educational Psychology Review, 2006
FUNCTIONS FOR LEARNING AND PERFORMANCE

Mediating Mechanisms

Positive Emotions
- Activating (e.g., Joy, Pride)
- Deactivating (e.g., Relaxation)

Negative Emotions
- Activating (e.g., Anger, Anxiety)
- Deactivating (e.g., Boredom)

Cognitive Resources
- Irrelevant Thinking
- Flow

Motivation
- Intrinsic
- Extrinsic

Regulation + Strategies
- Self vs. External Regulation
- Flexible vs. Rigid Strategies

Learning + Performance

Pekrun & Linnenbrink-Garcia, 2012
Positive activating emotions:  Positive
(e.g., joy, hope, pride)

Positive deactivating emotions:  Variable
(e.g., relief, relaxation)

Negative activating emotions:  Variable
(e.g., anger, anxiety, shame)

Negative deactivating emotions:  Negative
(e.g., hopelessness, boredom)
MECHANISM I:
COGNITIVE RESOURCES
Emotions focus attention on object of emotion

→ (1) Emotions consume cognitive resources
   - positive emotions
   - negative emotions
   → Reduction of resources available for task performance
     = revision of Resource Allocation Model (H. Ellis, 1988)

→ (2) Exception: Task-related positive emotions
   (e.g., enjoyment of learning)
   → focus attention on task
   → promote task concentration and flow
EEG Experiments

(1) Emotion induction (IAPS)

(2) Dual-task paradigm
   - Task 1: Emotion
   - Task 2: Oddball task

(3) Assessment of resource consumption: Event-related potentials, P300

Field Studies (quantitative, qualitative)
CONDITION: NEGATIVE BLUE / NEUTRAL GREEN
+- 12 Microvolt / -100 -1100 ms
CONDITION: POSITIVE RED / NEUTRAL GREEN
+- 12 Microvolt / -100 -1100 ms
## EMOTIONS AND COGNITIVE RESOURCES

Field Studies: Correlations

<table>
<thead>
<tr>
<th></th>
<th>Task-irrelevant thinking</th>
<th>Flow</th>
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<tbody>
<tr>
<td>Enjoyment</td>
<td>-.38</td>
<td>.52</td>
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<tr>
<td>Pride</td>
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<tr>
<td>Shame</td>
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<td>-.08</td>
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<td>Hopelessness</td>
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<td>-.18</td>
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<tr>
<td>Boredom</td>
<td>.46</td>
<td>-.30</td>
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</tbody>
</table>

*Note.* University students, learning-related emotions.  
$p < .01$ for $r > .17$.  

*Pekrun et al., Contemporary Educational Psychology, 2011*
MECHANISM II: MOTIVATION
### EMOTIONS AND MOTIVATION

Field Studies: Correlations

<table>
<thead>
<tr>
<th></th>
<th>Intrinsic Motivation</th>
<th>Effort</th>
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<tr>
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<tr>
<td>Boredom</td>
<td>-.35</td>
<td>-.50</td>
</tr>
</tbody>
</table>

*Note.* University students, learning-related emotions.  
*p < .01 for r > .17.*

*Pekrun et al., Contemporary Educational Psychology, 2011*
Question: What has this feeling motivated you to do?
What would you have liked to do?

“The boredom caused a feeling of dissatisfaction and lack of motivation to finish the task ...” (136)
“You are bored, lose the motivation to read everything carefully ” (142)
“I’d rather leave and postpone the task ” (136)
“... could no longer sit in my chair, just wanted to get away “ (250)

“I drifted away mentally and no longer listened to the presenter ... “ (421)
“I thought of something else, day-dreamed “ (256)

“... tiredness, bad posture, yawning ” (164)

Pekrun, Goetz et al., Journal of Educational Psychology, 2010
EMOTIONS AND MOTIVATION

Qualitative Interviews: *Anxiety*

“I’d rather have avoided the exam” (16)

“... no motivation anymore” (504)

“I just wanted it to be over ...” (40)

“This feeling has prompted me to pray. The days before even to weep. I just wanted it to be over or that I didn't have to do it in the first place ... I'd rather have done anything else instead of sitting there and studying ... “ (515)

“I want to pass it ... I don't want to fail the exam” (427)

“I have to manage to finish it” (485)

“I wanted to do on the test as well as possible” (276)

“... it has motivated me to see the exam as a challenge” (513)

“... you would rather run away, but on the other hand, you want to fulfill your obligations, overall really ambiguous feelings” (281)
EMOTIONS AND MOTIVATION

Anxiety + Motivation to Learn: *Intraindividual Correlations*

Mean Correlation $r = -0.01$
MECHANISM III: SELF-REGULATION + STRATEGY USE
### EMOTIONS AND LEARNING STRATEGIES

#### Correlations

<table>
<thead>
<tr>
<th></th>
<th>Elaboration</th>
<th>Rehearsal</th>
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<tbody>
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<td>Boredom</td>
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<td>-.06</td>
</tr>
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</table>

*Note.* University students, learning-related emotions.

$p < .01$ for $r > .17$.  

*Pekrun et al., Contemporary Educational Psychology, 2011*
## EMOTIONS AND REGULATION OF LEARNING

### Correlations

<table>
<thead>
<tr>
<th></th>
<th>Self-regulation</th>
<th>External regulation</th>
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<tr>
<td>Enjoyment</td>
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<td>.17</td>
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*Note.* University students, learning-related emotions.  
*p < .01 for r > .17.*

*Pekrun et al., Contemporary Educational Psychology, 2011*
EMOTIONS AND ACADEMIC ACHIEVEMENT
## EMOTIONS AND ACHIEVEMENT

Mid-studies Exams at University

<table>
<thead>
<tr>
<th></th>
<th>Study 1 Learning-related emotions</th>
<th>Study 2 Test-related emotions</th>
</tr>
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<tbody>
<tr>
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<td>Boredom</td>
<td>-.36</td>
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*Note. p < .01 for \( r > .17 / .16 \) in Studies 1 / 2.*
### PALMA Study (Mathematics): Correlations

<table>
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<tr>
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<th>Grade Level</th>
<th></th>
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<td>6</td>
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<td>-.37</td>
<td>-.39</td>
<td>-.39</td>
<td>-.45</td>
</tr>
</tbody>
</table>

*Note. p < .001 for all coefficients.*
EMOTIONS AND ACHIEVEMENT
Reciprocal Relations

Positive Emotions
- Activating (e.g., Joy, Pride)
- Deactivating (e.g., Relaxation)

Negative Emotions
- Activating (e.g., Anger, Anxiety)
- Deactivating (e.g., Boredom)

Cognitive Resources
- Irrelevant Thinking
- Flow

Motivation
- Intrinsic
- Extrinsic

Regulation + Strategies
- Self- vs. External Regulation
- Flexible vs. Rigid Strategies

Learning + Performance: Success vs. Failure

Pekrun, Educational Psychology Review, 2006
EMOTIONS AND ACHIEVEMENT

Boredom and Test Performance in University Courses

CFI = .931, RMSEA = .050. * p < .05. ** p < .01.

Pekrun, Hall, Goetz, & Perry, Journal of Educational Psychology, 2014
STUDY 2

Reciprocal Effects: Cross-Lagged Modeling

CFI = .944. RMSEA = .054. $p < .01$ for all coefficients.

$N = 3,425$. Covariates: Gender, IQ, SES.

Pekrun et al., Child Development, 2017
STUDY 2

Reciprocal Effects: Cross-Lagged Modeling

CFI = .959. RMSEA = .046. p < .01 for all coefficients.
N = 3,425. Covariates: Gender, IQ, SES.
STUDY 2
Reciprocal Effects: Cross-Lagged Modeling

CFI = .962. RMSEA = .049. $p < .01$ for all coefficients.
$N = 3,425$. Covariates: Gender, IQ, SES.

Pekrun et al., Child Development, 2017
FUNCTIONS FOR LEARNING AND PERFORMANCE

Conclusions

(1) **Positive activating emotions (e.g., enjoyment):**
   → Positive effects

(2) **Negative deactivating emotions (e.g., boredom):**
   → Negative effects

(3) **Negative activating emotions (e.g., anxiety):**
   → Variable effects on mediating mechanisms
   → Negative effects on overall performance in most individuals

Emotions critically important for learning and achievement
ORIGINS:
THE CONTROL-VALUE THEORY OF ACHIEVEMENT EMOTIONS
Propositions of different theories on origins of emotions complementary rather than mutually exclusive

Aims of the control-value theory:

1. Integration of propositions
   (Expectancy-value theories, attributional theories, transactional stress model)

2. Addressing multiple achievement emotions
   (including outcome emotions + activity emotions)
Basic Propositions: Appraisal Antecedents

Implications

I. Domain specificity

II. Individual antecedents (e.g., gender, achievement goals)

III. Social environments as antecedents (e.g., learning environments; classroom composition)

IV. Reciprocal causation, emotion regulation, treatment

V. Relative universality

Pekrun, Educational Psychology Review, 2006
BASIC PROPOSITIONS:
APPRAISAL ANTECEDENTS
Many factors can contribute to arousal of emotions

- *Genetic dispositions*
- *Conditioning* (evaluative, traumatic)
- *Neurohormonal processes*
- *Facial + motor feedback*
- *Cognitive appraisals* (reflective, habitualized, schematic)
Phylogenetically old and constrained situations:
Primacy of biologically prepared emotion schemata, conditioning
(e.g., enjoyment of physiological need fulfilment; anxiety of falling when perceiving heights; Campos, Bertenthal, & Kermoian, 1992)

→ Appraisals less important

Settings shaped by cultural evolution:
Need to interpret situation, adapt to culturally defined demands

→ Appraisals necessary for adaptive thought, emotion, and action

Achievement settings, achievement emotions:
Appraisals likely of primary importance

Pekrun, Educational Psychology Review, 2006
Control Appraisals
- Causal expectancies
- Causal attributions
- Competence appraisals (e.g., self-concepts of ability)

Value Appraisals
- Intrinsic / extrinsic values of achievement activities + outcomes

Achievement Emotions
- Prospective Outcome Emotions
- Retrospective Outcome Emotions
- Activity emotions
Failure Possible?

Failure Harmful?

Prevention realizable?

Yes

Hopelessness

Anxiety

Relief

No

No Negative Emotion

No

No Negative Emotion

Uncertain – Lack of control
Achievement emotions = f (Control x Value)
(In the generation of emotions, control and value appraisals interact in multiplicative ways)

- e.g., Anxiety of failure
  High when control over performance lacking, failure possible and value of performance high; low when control is high, or value low, or both

- e.g., Enjoyment of learning
  High when subjective competence (i.e., control) and value of learning are high, low when competence or value or both are low
APPRAISALS: EXPERIMENTAL EVIDENCE
APPRAISAL ANTECEDEENTS
Control, Value, and Achievement Anxiety

- **Experimental manipulation of control and value**
  Dependent variable: Anxiety

  Study 1: Scenarios
  
  **Study 2: Test-taking**

  Study 3: Implicit measure of anxiety

- **Samples**

  High school students

*Pekrun, Lichtenfeld, & Maier, AERA 2009*
Experimental procedure: Nonverbal reasoning test

(1) Announcement of test
(2) Sample item  19, 16, 13, 10, 7, ?
                 a = 7, b = 4, c = 5, d = 9, e = 3
(3) Self-report anxiety  (AEQ achievement anxiety scale, α = .86)
(4) Covariates: Gender, affectivity  (assessed prior to experiment)

High vs. low value:  Math test counting towards final grade / number riddles, no assessment of performance, no consequences

High vs. low control:  Sample item easy / unsolvable
STUDY 2 – TEST-TAKING

Method

Dependent measure: Self-reported anxiety
(4-item version of AEQ Achievement Anxiety Scale, \( \alpha = .81 \))

„How do you feel?

- I am nervous because I could fail on these tasks
- I worry I could do poorly on these tasks
- ... “

Covariates

- Gender
- Positive and negative trait affectivity (PANAS)
Effects of Control and Value on Anxiety

Control: $F=4.51$, $p < .05$
Value: $F=8.71$, $p < .01$
Control x Value: $F=4.28$, $p < .01$
APPRAISALS:
CORRELATIONAL EVIDENCE
Field study of appraisals and achievement emotions
longitudinal, t1 / t2 = beginning / middle of schoolyear

Sample
N = 1,518 Secondary school students (grades 5 to 10)

Variables
- Perceived competence: Self-concept of ability (SDQ)
- Value: Perceived value of success + failure
- Achievement emotions (AEQ)
LATENT INTERACTION ANALYSIS

Competence, Value, and Achievement Emotions

SEM Latent Interaction Analysis (Mplus 7, LMS)

Becker-Kurz, Pekrun, Frenzel, Marsh, & Scherer (submitted)
LATENT INTERACTION ANALYSIS
Competence, Value, and Achievement Emotions

<table>
<thead>
<tr>
<th></th>
<th>Enjoyment</th>
<th>Pride</th>
<th>Anger</th>
<th>Anxiety</th>
<th>Shame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competence</td>
<td>.67**</td>
<td>.68**</td>
<td>-.50**</td>
<td>-.43**</td>
<td>-.40**</td>
</tr>
<tr>
<td>Value</td>
<td>.20**</td>
<td>.16**</td>
<td>.27**</td>
<td>.13**</td>
<td>.24**</td>
</tr>
<tr>
<td>Competence x Value</td>
<td>.11**</td>
<td>.05</td>
<td>-.13**</td>
<td>-.13**</td>
<td>-.13**</td>
</tr>
</tbody>
</table>

*Note. Time 1. SEM Latent interaction analysis, LMS (Mplus 7).

* p < .05. ** p < .001.
LATENT INTERACTION ANALYSIS

Competence, Value, and Achievement Emotions

Enjoyment (t1) vs. Competence (t1)

Value (t1): 2 SD
Value (t1): 1 SD
Value (t1): Mean
Value (t1): -1 SD
Value (t1): -2 SD

Becker-Kurz, Pekrun, Frenzel, Marsh, & Scherer (submitted)
LATENT INTERACTION ANALYSIS

Competence, Value, and Achievement Emotions

Anxiety (t1)

Value (t1): 2 SD
Value (t1): 1 SD
Value (t1): Mean
Value (t1): -1 SD
Value (t1): -2 SD

Competence (t1)
IMPLICATIONS 1.

DOMAIN SPECIFICITY
Traditional assumption:
Achievement emotions are trait-like personality constructs, generalized across situations
(e.g., test anxiety)

However:
Variables related to control and value: organized in domain-specific ways
(Self-concepts of ability, goals, interest, task values, etc.; Bong, 2001)

→ Achievement emotions domain-specific?
# Domain Specificity

## Emotions in Different Subjects: Latent Correlations (Grade 11)

<table>
<thead>
<tr>
<th>Domain</th>
<th>Enjoyment</th>
<th>Anxiety</th>
<th>Boredom</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>P</td>
<td>G</td>
</tr>
<tr>
<td>Math</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Physics</td>
<td>.54</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>German</td>
<td>.09</td>
<td>.10</td>
<td>--</td>
</tr>
<tr>
<td>English</td>
<td>-.15</td>
<td>.03</td>
<td>.03</td>
</tr>
</tbody>
</table>

*Note. N = 235. p < .01 for r > .17.*

Enjoyment / anxiety / boredom models: CFI = .99, .95, .97. RMSEA = .032, .059, .050.
(1) Students’ achievement emotions: Differentiation across domains

(2) Domain specificity increases with age

→ Conceptualize + measure achievement emotions in domain-specific ways

→ Teachers: Don’t infer from a student’s enjoyment, anxiety in subject A how s/he feels in subject B, or how s/he feels generally
IMPLICATIONS II.
INDIVIDUAL ANTECEDENTS
INDIVIDUAL ANTECEDENTS
Control-Value Theory

Individual Antecedents

Distal Antecedents
- Gender
- Goals
- Beliefs
- etc.

Proximal Antecedents
- Control + Value Appraisals

Emotion
- Achievement Emotions

Pekrun, Educational Psychology Review, 2006
INDIVIDUAL ANTECEDENTS

- GENDER -
GENDER DIFFERENCES

Emotions in Mathematics (PALMA)

- **Enjoyment**
- **Pride**
- **Anxiety**
- **Hopelessness**

**GENDER DIFFERENCES**

Emotions in Mathematics (PALMA)

- **Female**
- **Male**

**N = 2,053 students, grade 5**

- $0.23 < d < 0.30$
- $p < 0.01$ for all emotions

Frenzel et al., European J Psych Ed, 2007
<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Perceived competence</strong></td>
<td>3.31 (.80)</td>
<td>3.70 (.78)</td>
<td>.49 **</td>
</tr>
<tr>
<td><strong>Domain value of mathematics</strong></td>
<td>3.19 (1.04)</td>
<td>3.52 (1.03)</td>
<td>.31 **</td>
</tr>
<tr>
<td><strong>Achievement value</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In mathematics</td>
<td>3.88 (.83)</td>
<td>3.90 (.89)</td>
<td>.02 ns</td>
</tr>
</tbody>
</table>

*Note. N = 2,053 students, grade 5.*

**p < .01.
GENDER DIFFERENCES

Mediation by Control and Value

Gender

Perceived Competence

Enjoyment + Pride

Domain Value

Anxiety + Hopelessness

Achievement Value

.24**

.15**

ns

.38**

.59**

-.57**

-.09**

.22**

N = 2,053. CFI = .97, RMSEA = .062.

** p < .01.
IMPLICATIONS III.
ENVIRONMENTS AS ANTECEDENTS
ENVIRONMENTS AS ANTECEDENTS

- LEARNING ENVIRONMENT

IN CLASSROOMS -
LEARNING ENVIRONMENT

Control-Value Theory

Environment

Teacher emotions
Quality of instruction
Expectations + goal structures
Feedback on achievement

Appraisal

Control
Values

Emotion

Students’ achievement emotions
“Teaching … is almost scary … because I’ve come to realize that my emotions … can really dictate the mood of the class and almost how the kids are going to be that day … If I’m in a good mood, it can be a real positive class”

(Quote from an interview with a teacher, Sutton, 2004)
LEARNING ENVIRONMENT
LEARNING ENVIRONMENT
Teacher Enjoyment: Multi-Level SEM (Mplus)

Teacher Enjoyment

Teacher Enthusiasm

Student Enjoyment 7

Student Enjoyment 8

Shared environment: Teacher emotion + behavior

Shared student emotion (Class level)

N = 1,763 students, 71 classrooms. CFI = .99, RMSEA = .022. ** p < .01
ENVIRONMENTS AS ANTECEDENTS

- GROUP COMPOSITION -
GROUP COMPOSITION
Achievement and Emotion: Control-Value Theory

Individual achievement
Positive effect on positive emotions; negative effect on negative emotions

→ beneficial for individual emotion

Group-level achievement
Negative effect on positive emotions; positive effect on negative emotions

→ detrimental for individual emotion

Pekrun, Educational Psychology Review, 2006
GROUP COMPOSITION
Achievement and Emotion: Control-Value Theory

BFLP-Effect

Group-level Achievement

Individual Achievement

Enjoyment Pride

Anxiety Shame Hopelessness

Perceived Control

Pekrun, Educational Psychology Review, 2006
GROUP COMPOSITION

Achievement and Emotion: Control-Value Theory

Group-level Achievement

Individual Achievement

Enjoyment
Pride

Anxiety
Shame
Hopelessness

Pekrun, Educational Psychology Review, 2006
GROUP COMPOSITION
Achievement and Emotion: Multi-Level Analysis

![Diagram showing the relationship between class and individual achievement and emotions.]

Note. $N = 1,762$, $k = 78$ classrooms.

** $p < .01$.
GROUP COMPOSITION
Achievement and Emotion: Multi-Level Analysis

Class
Achievement 5

Individual
Achievement 5

BFLP-Effect

Enjoyment 6

Enjoyment 5

.14 **

-.13 **

.50 **

Pekrun et al., 2016
GROUP COMPOSITION

Achievement and Emotion: Multi-Level Analysis

Note. $N = 1,762$, $k = 78$ classrooms.
** $p < .01$.
GROUP COMPOSITION
Achievement and Emotion: Multi-Level Analysis

Class

Achievement 5

Anxiety 6

BFLP-Effect

Individual

Achievement 5

Anxiety 5

.14 **

-.20 **

.52 **

Pekrun et al., 2016
GROUP COMPOSITION
Achievement and Emotion: Multi-Level Analysis

Note. $N = 1,762$, $k = 78$ classrooms.
** $p < .01$.
GROUP COMPOSITION

Achievement and Emotion: Multi-Level Analysis

Class

Achievement 5

Hopelessness 6

Individual

Achievement 5

Hopelessness 5

BFLP-Effect

Pekrun et al., 2016
Class-level achievement 5

Student-level achievement 5

Academic self-concept 5

Enjoyment 6

-.30** (-.46**) to -.52**

.61**

.09* (.33**)

-.16**

.24**

* p < .05. ** p < .01.

Contextual mediated effect: -.16**
Student-level mediated effect: .24**

Pekrun et al., 2016
“Trust me — it’s better to be a little fish in a big pond.”
IMPLICATIONS IV.
RECI PROCAL CAUSATION AND EMOTION REGULATION
EMOTION REGULATION AND TREATMENT

Environment | Appraisal | Emotion | Performance
---|---|---|---
Cognitive Quality | Control | Achievement Emotions | Resources Motivation Strategies
Autonomy | Values | Temperament | Performance
Goal Structures, Expectations | Achievement Goals | | Competences
Feedback of Performance | | |

Design of Tasks + Environments | Appraisal-orient. Regulation | Emotion-orient. Regulation | Competence-or. Regulation
| Cognitive Treatment | | | Competence Training

Pekrun, Educational Psychology Review, 2006
IMPLICATIONS V.
RELATIVE UNIVERSALITY
Frequency distributions, process parameters (e.g., intensity), contents (reference objects):

can differ across individuals, domains, genders, cultures

Functional mechanisms linking appraisals, emotions, and behavior:

expected to be universal
Example: China and Germany

- *Mean levels*
  Chinese students more enjoyment, pride, anxiety, shame; less anger

- *Functional relations with appraisals, parental expectations, academic achievement*
  Structurally equivalent across cultures
Achievement Emotions in Mathematics:
China and Germany

p < .01 for all emotions

Frenzel et al., Journal of Cross-Cultural Psychology, 2007
## RELATIVE UNIVERSALITY

Culture: Equivalence of Functional Relations

<table>
<thead>
<tr>
<th>Appraisal</th>
<th>Enjoyment</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
<td>G</td>
<td>C</td>
<td>G</td>
<td>C</td>
</tr>
</tbody>
</table>

Perceived competence

<table>
<thead>
<tr>
<th>C</th>
<th>G</th>
<th>C</th>
<th>G</th>
<th>C</th>
<th>G</th>
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<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>.34</td>
<td>.31</td>
<td>.50</td>
<td>.37</td>
<td>-.38</td>
<td>-.33</td>
<td>-.60</td>
<td>-.55</td>
</tr>
</tbody>
</table>

Domain Value

| .53 | .60 | .12 | .34 | -.29 | -.43 | -.19 | -.18 | -.15 | .05 |

Achievement Value

| -.09 | -.10 | .19 | .12 | .05 | .22 | .22 | .27 | .27 | .12 |

*Note. Coefficients are standardized Betas. ** p < .01 for all Betas > .05.*
INTERVENTION:
DESIGN OF ACHIEVEMENT SETTINGS
How can we design achievement settings in „emotionally sound“ ways? (Astleitner, 2000)

➢ Previous research: Focus on individual treatment of test anxiety
   Variants: Relaxation training, systematic desensitization, cognitive-behavioral, etc.

➢ Psychotherapy of test anxiety:
   Among most successful types of therapy (effect sizes $d > 1$)

➢ Design of achievement settings targeting emotions:
   Little research (Glaeser-Zikuda et al., 2005)

Unanswered question
Treatment conditions

(1) Direct instruction
   - Teacher-centered

(2) Co-constructive learning
   - Group-based learning
   - Teacher scaffolds strategy use and group interaction

(3) Learning alone

Common core across conditions
Use of modelling tasks, cognitively activating

Schukaljow et al., Educational Studies in Mathematics, 2012
Length x
Calculate the length of line x

Schukaljow et al., Educational Studies in Mathematics, 2012
Playground
How long is the zipline?

The Traudt family is on vacation on a farm close to the Bavarian forest. On the farm is a playground for the two Traudt family daughters, Lina and Maria. The neatest thing on the playground is the zipline. The wire for the zipline is suspended between two posts and spans 10m when it's taut. When Lina reaches the middle of the zipline, the wire is pulled down 45 cm by her weight.
INTERVENTION

DISUM: Treatment Effects on Task Enjoyment

Time: $p < .001$
Time x Treatment: $p = .09$

Co-construction $d = .46$
Direct instruction $d = .20$
Learning alone $d = .17$

Schukaljow et al., Educational Studies in Mathematics, 2012
INTERVENTION

DISUM: Treatment Effects on Task Boredom

Time: $p < .001$

Time x Treatment: $p = .05$

Co-construction $d = .53$

Direct instruction $d = .31$

Learning alone $d = .33$

Schukaljow et al., Educational Studies in Mathematics, 2012
CONCLUSIONS
CONCLUSIONS

(1) Achievement emotions are critically important for learning + performance

- Emotions: affect cognitive resources, motivation, strategy use, self-regulation, performance outcomes in achievement settings

(2) Achievement emotions are critically important for students‘ physical health

(3) Emotions are important outcomes in and of themselves

- Emotions are core components of individual identity, personality development, and psychological well-being

Pekrun & Linnenbrink-Garcia, 2014
CONCLUSIONS

(4) Origins: Perceived control + value of primary importance
   - Implications for domain specificity, antecedents, emotion regulation, relative universality

(5) Implications for Practice
   - Evidence-based recommendations possible, but preliminary
     Attempts to reach firm conclusions:
     Would be premature for most emotions and domains
   - Exception: Test anxiety ( > 1.000 studies; effective intervention)
   - Emotions beyond test anxiety:
     - Lack of cumulative knowledge on functions + antecedents
     - Lack of intervention studies

Pekrun & Linnenbrink-Garcia, 2014
CONCLUSIONS

Progress in educational research on emotions in academic settings

But clearly: Need for more research in this field

(1) Studies on outcomes, antecedents, development of students‘ emotions (as well as teachers‘ emotions)
   - Achievement emotions
   - Topic emotions
   - Epistemic emotions  (e.g., surprise, curiosity, confusion)
   - Social emotions    (e.g., admiration, compassion, envy)

(2) Educational intervention studies targeting emotions
DOCTORAL & POSTDOCTORAL STUDENTS
COOPERATION PARTNERS
COOPERATION PARTNERS
Thank you very much for your attention