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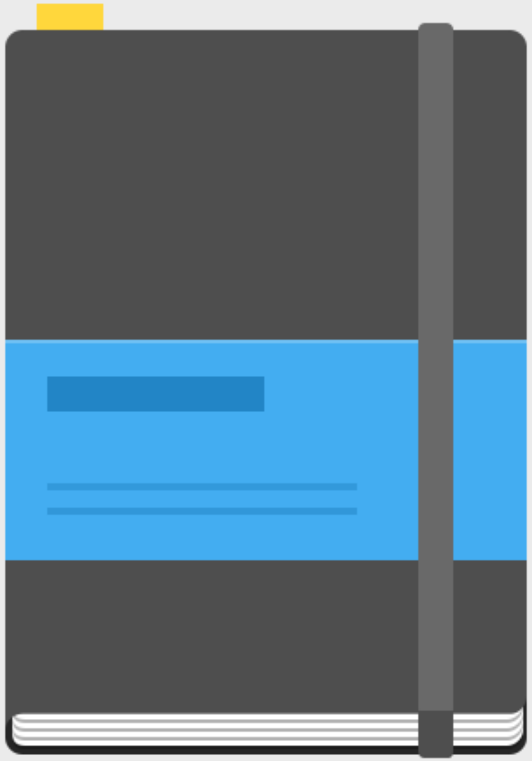
ASSESSING STUDENTS' EMOTIONAL STATES: AN APPROACH TO IDENTIFY LECTURES THAT PROVIDE AN ENHANCED LEARNING EXPERIENCE

David Munoz & Dr. Conrad Tucker

Engineering Design and Industrial Engineering

{dam395, ctucker4}@psu.edu

PRESENTATION OVERVIEW



- Background
- Motivation
- Methodology
- Case Study
- Results
- Conclusions
- Future Work

EMOTIONS IN THE CLASSROOM

LECTURES THAT ENHANCE LEARNING

need to understand levels of **engagement, delight, frustration** and **boredom**

relationship between student attitude and academic achievements

Shultz and Lanehart (2002)
Shultz and Pekrun (2007)
Sungh et al. (2002)

How can we identify lectures that offer an enhanced learning experience?

EMOTIONS IN THE CLASSROOM

Emotional State	Learning Gains Impact	References
Engagement/ Interest	Positive	[21,7]
Frustration	Negative	[25,9]
Boredom	Negative	[26]
Confusion	Positive	[9,25,27]
Delight	Positive	[9]

students **experience positive mental states while minimizing those mental states associated with negative connotations**.

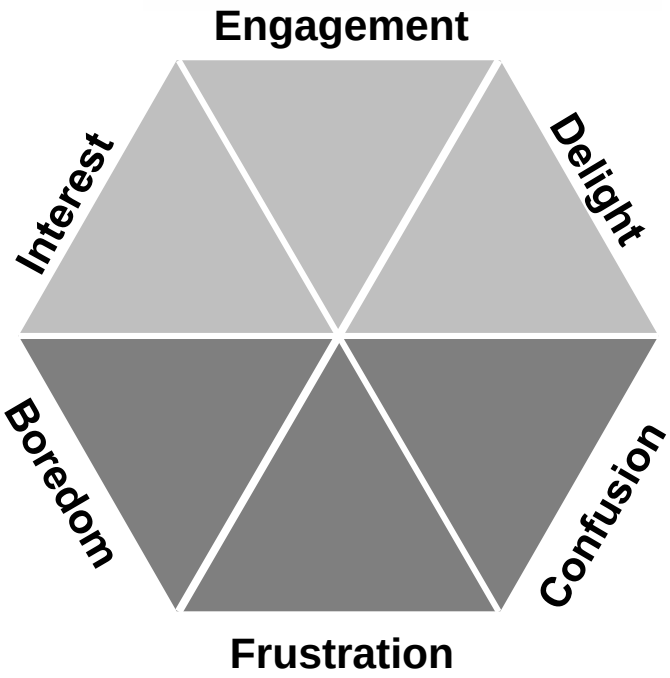
STUDENTS' UNDERSTANDING OF LECTURE MATERIAL

Existing Assessment Techniques

Data Mining Lectures

Limitations in understanding the root causes of poor students' performance

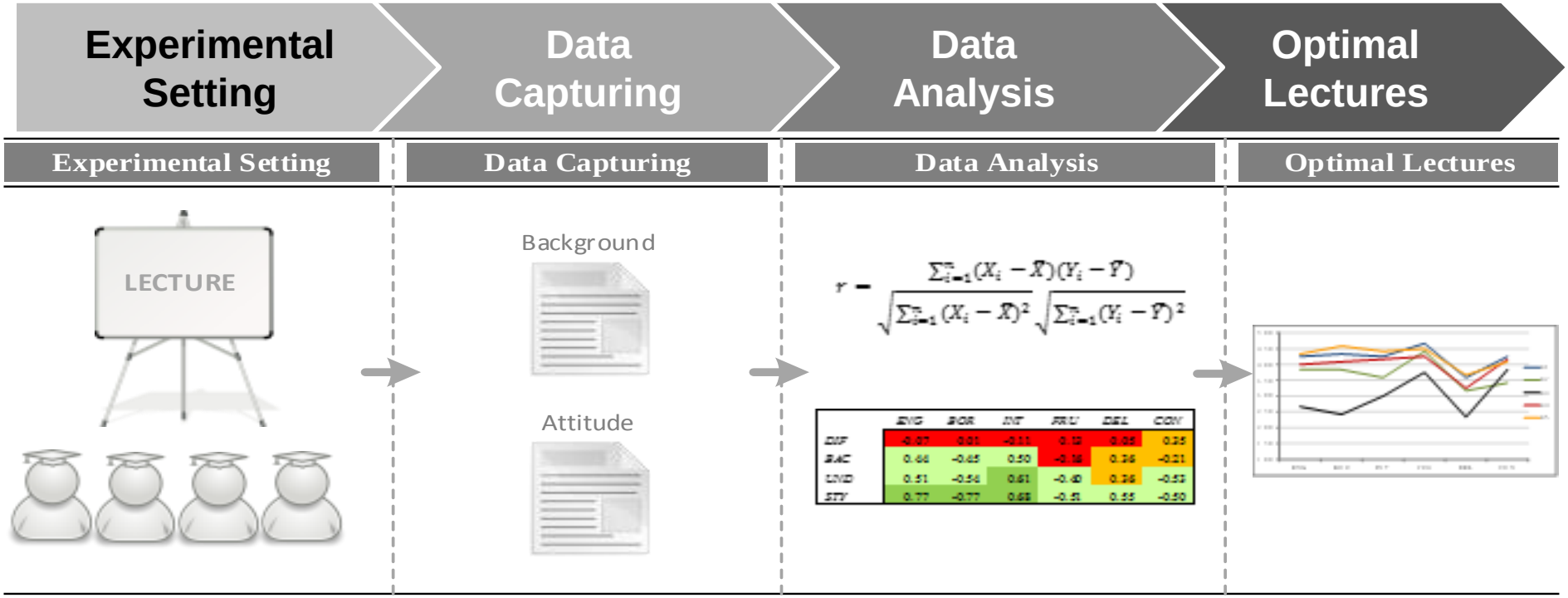
EMOTIONAL STATES AND LECTURES



Hypothesis: Students' emotional states are correlated with the lecture characteristics (lecture style and lecture content)

-towards individually customized learning

METHODOLOGY: QUANTIFYING STUDENTS EMOTIONAL STATES TOWARDS LECTURES



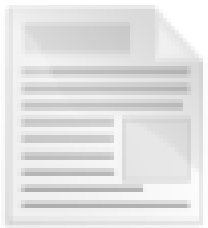
EXPERIMENTAL SETTING

- Students from various fields (degree, habits of study, class participation, interest and area of expertise)
- A Likert scale (1 to 5)
- Lecture composed by various lessons.
- Survey asking students about emotional states during lecture

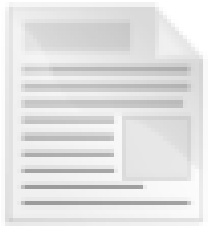
DATA CAPTURING

Forms

Background



Attitude



Background

- Degree sought
- Class level
- Habits of study
- Areas of interest
- Areas of expertise

Emotional states

Emotions

- Engagement
- Interest
- Delight
- Frustration
- Boredom
- Confusion

Perception

- Perceived difficulty
- Perceived
- understanding

DATA ANALYSIS

Correlation analysis from self-reported survey Variables

r	Type of relationship	Color Code
± [0.0 to 0.2]	Weak or no relationship	
± [0.2 to 0.4]	Weak relationship	
± [0.4 to 0.6]	Moderate relationship	
± [0.6 to 0.8]	Strong relationship	
± [0.8 to 1.0]	Very strong relationship	

$$r = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^{n}(X_i - \bar{X})^2}\sqrt{\sum_{i=1}^{n}(Y_i - \bar{Y})^2}}$$

n: Sample size

X_i: Value of $i-$ th observation from sample $X, i: 1$ to n

$\bar{X}$: Average value of all observations from sample X

Y_i: Value of $i-$th observation from sample $Y, i: 1$ to n

$\bar{Y}$: Average value of all observations from sample Y

RELATION TO LECTURE MATERIAL

Value path graphs

- Value paths range from 1 to 5
- Emotions categorized as negative will be normalized to have 5 as more desirable and 1 as less desirable
- Positive emotions and negative emotions are directly compared

CASE STUDY: EMOTIONAL STATES IN THE CLASSROOM

CASE STUDY

Experimental Setting → Data Capturing → Data Analysis → Optimal Lectures

Participants Selection

22 students from different fields

Lecture of five short video-lectures

5 – 7 minutes per video

Lecture Selection

10 video-lectures

List A (5 videos)

List B (5 videos)

The videos were retrieved from the "Big Think" channel in YouTube

RESULTS: CORRELATIONS AMONG EMOTIONAL STATES

Correlation Matrix

	ENG	*BOR*	*INT*	*FRU*	*DEL*	*CON*
ENG		-0.74	0.74	-0.45	0.61	-0.36
BOR	-0.74		-0.71	0.42	-0.54	0.54
INT	0.74	-0.71		-0.43	0.65	-0.38
FRU	-0.45	0.42	-0.43		-0.29	0.43
DEL	0.61	-0.54	0.65	-0.29		-0.27
CON	-0.36	0.54	-0.38	0.43	-0.27	

Emotional states included

Engagement (ENG)
Boredom (BOR)
Interest (INT)
Frustration (FRU)
Delight (DEL)
Confusion (CON)

Interesting insights

- **ENG is strongly positively associated to INT (0.74) and DEL (0.61),** which are usually defined as positive mental states.
- **ENG, is strongly negatively associated to BOR (-0.74)**, moderately negatively related to FRU (-0.45), and weakly negatively associated to CON (-0.36).
- In addition, CON is weakly (-0.36, -0.38, and -0.27) or moderately associated (0.54 and 0.43) to all other mental states.

RESULTS: EMOTIONAL STATES AND PERCEPTUAL FACTORS

Correlation Matrix

	ENG	*BOR*	*INT*	*FRU*	*DEL*	*CON*
DIF	-0.07	0.01	-0.11	0.13	0.05	0.35
BAC	0.44	-0.45	0.50	-0.16	0.36	-0.21
UND	0.51	-0.54	0.61	-0.40	0.36	-0.53
STY	0.77	-0.77	0.68	-0.51	0.55	-0.50

Perceptual factors included

- Perceived difficulty (DIF)
- Background (BAC)
- Understanding (UND)
- Teaching style (STY)

Interesting insights

- **The level of perceived difficulty was not significantly correlated with the reported emotional states** except for confusion in which a weak relationship was found (0.35).
- **Background of the student is not significantly associated to the frustration reported**. However, this statement cannot be generalizable for other settings in which more field-specific lectures are presented.
- Teaching style to engage students is correlated to all the emotions reported.

RESULTS: CORRELATIONS AMONG PERCEPTUAL FACTORS

Correlation Matrix

	DIF	*BAC*	*UND*	*STY*
DIF		0.06	-0.24	-0.01
BAC	0.06		0.27	0.32
UND	-0.24	0.27		0.53
STY	-0.01	0.32	0.53	

Perceptual factors included

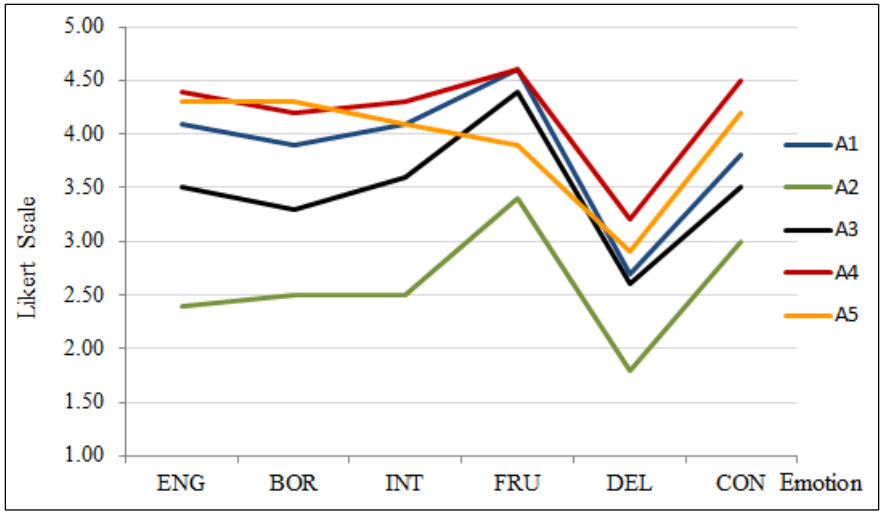
- Perceived difficulty (DIF)
- Background (BAC)
- Understanding (UND)
- Teaching style (STY)

Interesting insights

- The reported understanding level (UND) is moderately correlated with the perception of the ability of the speaker to engage the audience, STY (0.53).
- **Perceived difficulty (DIF) was not significantly correlated to neither background (BAC) nor speaker style (STY)**.

RESULTS: VALUE PATH GRAPHS

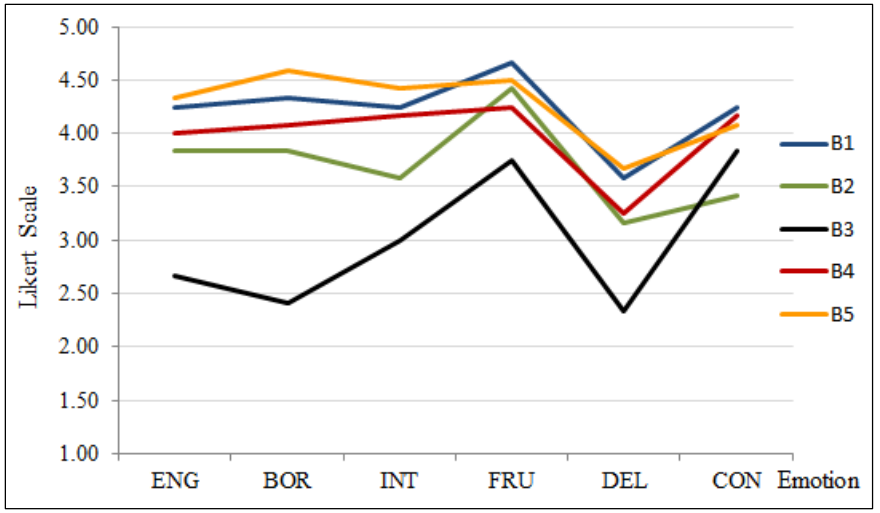
Value Path Graph (Set of lectures A)



Lectures **A4 and A5 are non-dominated** video-lectures.

A1, A2, and A3, are considered to be dominated video-lectures.

Value Path Graph (Set of lectures B)



Lectures **B1 and B5 are non-dominated** video-lectures.

B2, B3, and B4, are considered to be dominated video-lectures.

Lecture Analysis

Lecture Related Metrics

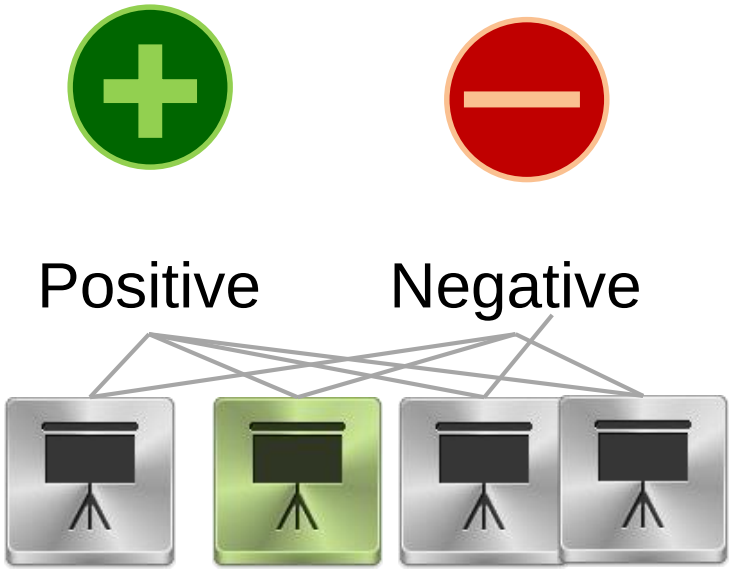
- Like/View (L/V)
- Like/Dislike (L/D)
- Subscriptions/View (S/V)
- Share/View (H/V)

Results and Insights

- The **ratio S/V** was **moderately correlated to ENG, BOR, INT, and FRU**, and weakly correlated to DEL and CON.

	ENG	*BOR*	*INT*	*FRU*	*DEL*	*CON*
L/V	-0.10	0.18	-0.06	-0.29	0.10	-0.09
L/D	0.35	-0.33	0.36	-0.25	0.32	-0.14
S/V	0.53	-0.53	0.55	-0.43	0.33	-0.25
H/V	0.08	0.00	0.13	-0.48	0.05	-0.04

CONCLUSIONS



- Engagement
- Interest
- Delight

→ Positively correlated ($r > 0.6$)

- Boredom
- Frustration
- Confusion

→ Positively correlated ($r > 0.4$)

Engagement and boredom are strongly negatively correlated ($r = -0.74$)

Confusion has the weakest correlations

FUTURE WORK

Current and future work

- Capture emotional states automatically (non-invasive sensors)

Potential applications

Identify factors influencing student's emotional states and early advice

Team matching

Evaluate teaching methods and lecture structure

Determine optimum length of a lecture or topic

Acknowledgement & References

Contributors:

- D.A.T.A. Lab: David Munoz , Conrad Tucker

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QUESTIONS