Doctoral School of Sociology and
Communication Science

THESIS SUMMARY

Lídia Vinczéné Fekete

Student Engagement and Emotions in Higher Education
Affective Patterns and Boredom
During Instructional Video Viewing

Supervisor:

Dr. Judit Gabriella Sass

Budapest, 2026

Corvinus University of Budapest
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I. RESEARCH BACKGROUND AND JUSTIFICATION OF THE TOPIC

Understanding student *engagement* is at the heart of identifying the factors that enable students to learn successfully while supporting their wellbeing, long-term satisfaction and development, with broader benefits for society. Engagement is defined as a dynamic state of active and focused involvement in learning, expressed through interconnected *behavioural*, *cognitive* and *emotional* dimensions (Fredricks, Blumenfeld and Paris 2004; Kahu 2024).

Over the past three decades, the *emotional dimension* of engagement has received growing attention. Research has revealed that achievement emotions are associated with attention, motivation, strategy use, persistence, performance and wellbeing. They also make a distinct contribution to performance beyond differences in gender, age, academic ability and personality traits (Pekrun 2006; Pekrun, Marsh, Elliot, et al. 2023). The pandemic intensified an emerging 'relational turn' in education, highlighting the importance of belonging, supportive teacher–student relationships, and the role of the wider social-emotional context in learning (Matthews, Lodge and Johnstone 2024; Kift 2024). *Boredom* is one of the most challenging aspects of academic experience(Goetz et al. 2024; Pekrun et al. 2014; Sharp, Hemmings and Kay 2016), particularly in asynchronous online environments, where maintaining attention, engagement, and a sense of connection can be more difficult (Dixson et al. 2017; Tze et al. 2017).

The review of literature relevant to the present thesis progressively revealed three interconnected *research gaps*. These gaps approach the same overarching problem from complementary perspectives and draw on different theoretical and methodological traditions. Together, they converge on the central question addressed by the thesis: *How are verbal and nonverbal teacher behaviours and instructional design features associated with learners' affective responses during learning, particularly in instructional videos?*

The first gap concerns learners' *affective experiences* during learning, with particular attention to *boredom*. Academic boredom is closely related to engagement and learning, yet important questions remain about how it develops over time, how it relates to attentional demand and disengagement, and how it differs from interest and other unpleasant affective states (Pekrun 2006; Tam, Van Tilburg and Chan 2023; Westgate and Wilson 2018). These questions create a need for further evidence on how boredom emerges and changes during ongoing learning activities.

A second unresolved issue concerns how learners' affective states can be measured, analysed and interpreted. Research on academic emotions still relies heavily on self-report measures (Goetz et al. 2024; Martarelli and Jost 2024), which provide essential access to learners' subjective experiences but offer limited temporal resolution. Reviews and methodological studies therefore increasingly call for complementary approaches that can capture the temporal dynamics of academic emotions and boredom, including physiological, behavioural, neurological and sensor- or computer-vision-based measures (Danckert et al. 2018; D'Mello, Dieterle and Duckworth 2017; Pekrun et al. 2023; Yadegaridehkordi et al. 2019). Automated measurement methods, such as facial expression analysis, can provide fine-grained and continuous data, but their analysis and psychological interpretation are still developing and remain methodologically demanding. Processing such data is time-intensive and often requires interdisciplinary expertise. There is therefore a need to test and refine analytical approaches in authentic learning contexts and to compare automated indicators systematically with learners' own accounts, examining where different measurement channels converge and diverge (Landmann 2023).

The third underexplored area concerns *instructional communication* and the *design of instructional videos*. Multimedia learning research provides a substantial evidence base for organising verbal and visual instructional material (Fyfield, Henderson and Phillips 2022; Mayer 2021). However, these principles have predominantly been developed around cognitive processing and include relatively few clearly

differentiated features representing the relational functions of teacher communication (Schrader, Kalyuga and Plass 2021). Instructional communication, in contrast, offers a rich conceptual vocabulary for rhetorical and relational teacher behaviours, but these variables do not constitute an integrated category system that can be readily operationalised to code instructional stimuli systematically (Mazer 2022; Mottet, Frymier and Beebe 2006). This suggests a need for a conceptual and operational bridge between observable multimedia-design features and their broader rhetorical and relational communication functions.

This three-part logic informed the formulation of the research questions and the subsequent research design of the empirical study:

RQ1: Which design features were associated with student boredom within the analysed segments of the observed instructional video?

RQ2: How do immediacy- and clarity-related design features co-occur with learners' affective response patterns during instructional video viewing, as indicated by automated facial expression analysis?

RQ3: To what extent do automated facial expression indicators align with interview- and self-report-based accounts of boredom and interest during instructional video viewing?

The analytic expectations followed a clear logic: features intended to support attention were expected to be associated with lower boredom; immediacy- and clarity-related features were expected to co-occur with more positive affective patterns; and the facial, questionnaire and interview data were expected to show some agreement, while also revealing meaningful differences.

The thesis is situated primarily within communication science, and more specifically *instructional communication*, while drawing strongly on findings from educational psychology, educational science and affective computing. Its broader epistemological

position is constructivist (Phillips 1995), treating learning-related experiences and meanings as dynamically constructed and context-dependent. Within communication science, the thesis adopts a relational approach to learning, viewing teaching and learning as a *transactional communication* process in which the communication of instructional content is accompanied by the development of interpersonal connection (Mottet, Frymier and Beebe 2006).

To address the research questions, the thesis combines theoretical perspectives operating at different explanatory levels. Control-Value Theory provides a broader framework for understanding academic emotions (Pekrun 2006), while the Meaning and Attention Components model provides a more specific account of boredom in terms of attention and perceived meaning (Westgate and Wilson 2018). The Cognitive Theory of Multimedia Learning provides the basis for identifying observable instructional design features (Mayer 2021), while Emotional Response Theory provides the primary communicative lens through the concepts of immediacy, clarity, and rhetorical-relational communication (Condit 2006; Mottet, Frymier and Beebe 2006; Mazer 2022).

Within this thesis, boredom is understood as a transient, aversive, multicomponent affective state involving attentional, motivational and behavioural processes (Eastwood et al. 2012; Westgate and Wilson 2018). Particular attention is given to its attentional and meaning-related components, its distinction from disengagement, and its relationship with interest and enjoyment.

The four-dimensional model in Figure 1 summarises the broader conceptual position adopted in the thesis. It connects rhetorical and relational traditions across instructional goals, teacher behaviour, learner appraisal and student needs, treating these dimensions as complementary rather than mutually exclusive orientations in instructional communication.

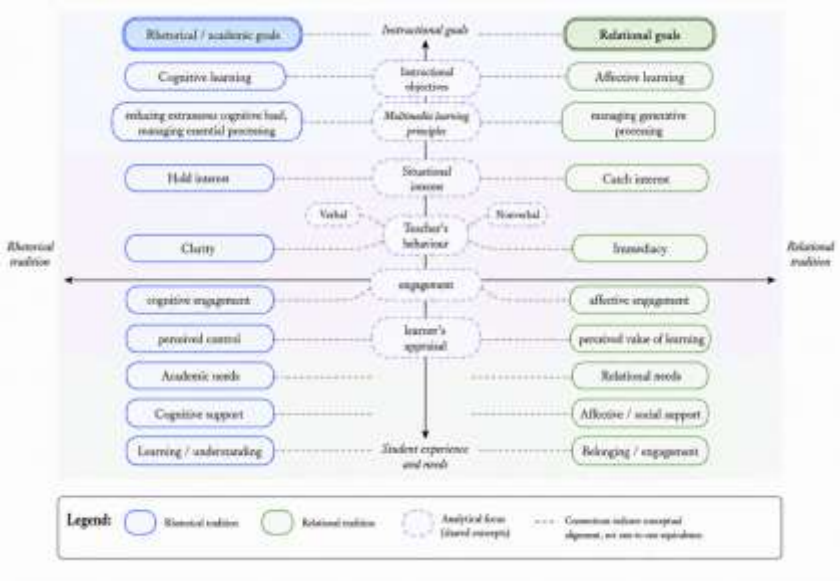


Figure 1. Four-dimensional conceptual model of rhetorical and relational traditions in instructional communication. Author's own conceptual synthesis based on Mayer (2021), Mazer (2022), Mottet, Frymier and Beebe (2006), and Pekrun (2006).

At the feature level, this rhetorical–relational logic was applied to the coded video features, which were organised as primarily clarity- or immediacy-related. The same structure later provided the organising logic for the heatmap in Figure 2. Figure 2. Figure 2. Figure 2.

The interpretation of the results did not aim to establish direct causal relationships. Rather, it sought patterns of association within a specific instructional video context and used the convergence and divergence of different data sources to support interpretation. This distinction is important throughout the thesis, particularly because FaceReader outputs are model-based classifications of facial activity rather than direct measurements of subjective emotional experience.

II. METHODS

The study used a multimodal design, with automated facial analysis as the primary data source and questionnaires and semi-structured interviews providing complementary perspectives on learners' experiences. Facial analysis provided temporally fine-grained data during video viewing, questionnaires captured self-reported affect and interest, and interviews supported the interpretation of specific moments after viewing. The three channels were therefore treated as complementary rather than interchangeable.

The initial sample included 55 Communication Science BA students aged 19–23. After data cleaning, the final dataset comprised 50 facial video recordings, 51 questionnaires and 44 semi-structured interviews. Participants watched a 22.4-minute instructional video while their facial activity was recorded, generating over one million temporally fine-grained data points. Questionnaire measures included the Student Interest Scale, PANAS and Verbal Teacher Immediacy Scales (Gorham 1988; Gyollai et al. 2011; Mazer 2012; Watson, Clark and Tellegen 1988), while semi-structured interviews explored participants' experiences of specific video segments.

The video was manually coded with one-second precision using a framework derived from multimedia learning and instructional communication. Coded features included instructor presence, humour, smile, personalisation, storytelling, signalling, visual elements, coherence, avoidance of redundancy, segmenting and examples (Fyfield, Henderson and Phillips 2022; Mayer 2021; Mazer 2022). These features were mapped according to their predominant communicative function as primarily relational/immediacy-related or rhetorical/clarity-related. The interview data were also systematically coded with an interview coding framework jointly developed and refined by two coders through negotiated agreement (O'Connor and Joffe 2020).

Facial expression analysis was conducted with Noldus FaceReader 9.1, which provided temporally fine-grained indicators of valence, arousal, neutral facial activity,

boredom, and FaceReader-labelled basic expressions. These outputs were treated as model-based classifications of facial activity rather than direct measures of subjectively experienced emotion (Barrett et al. 2019). Following an iterative analytical development, the final procedure aligned second-by-second facial data with second-by-second stimulus coding and compared feature-present and feature-absent periods within participants. Paired-samples t-tests or Wilcoxon signed-rank tests were applied depending on distributional assumptions, with Holm–Bonferroni correction for multiple comparisons. This transformed continuously changing facial data into comparable segment-level measures linked to precisely timed instructional features. The development of this workflow was informed by Landmann's (Landmann 2023) methodological review and by a targeted review of previous studies using FaceReader.

This segment-based analytical workflow is part of the thesis's methodological contribution. Cross-method comparisons were used not only to examine convergence but also to explore whether divergence among facial classifications, interviews, and questionnaires could reveal measurement limitations or theoretically informative differences between expressed, experienced, and remembered affect.

III. SCIENTIFIC RESULTS OF THE THESIS

The findings are summarised in the order of the research questions. The interpretation then draws together the empirical, theoretical, conceptual, methodological and practical contributions of the study.

1. Boredom as a dynamic learning-related state (RQ1)

Boredom was not evenly distributed throughout the video. High-boredom phases tended to occur around longer, visually static or less coherent sections, whereas phases without boredom peaks more often included attention-supporting features.

The instructor's face showed the strongest and most consistent association with lower FaceReader-labelled boredom, a pattern also supported by the interviews: 63% of

participants explicitly mentioned the visible instructor as supporting their attention. Segmenting also appeared relevant, as a prolonged, relatively unsegmented section co-occurred with a later high-boredom phase.

The temporal analyses showed that low-boredom phases generally became shorter as the video progressed, while individual boredom trajectories differed substantially. In the present context, these patterns suggest that boredom may develop over time and exhibit possible carryover rather than representing only a momentary response.

Boredom also co-occurred with participants' reported effort to sustain attention and, in some cases, with difficulty recalling the content of boring segments, suggesting that it was not limited to obvious underchallenge or inactivity. This pattern is compatible with the MAC account of attentional mismatch (Westgate and Wilson 2018), although the direction of the relationship cannot be established and warrants replication.

2. Instructional communication, multimedia features and affective patterns (RQ2)

The feature-level analysis showed a clear, broad pattern for immediacy-related cues. The instructor's face, humour, smile, and personalisation were associated with higher valence and arousal, and with a higher intensity of FaceReader-labelled 'happy' expressions. Several of these features were also associated with lower FaceReader-labelled levels of boredom, sadness and anger. Clarity-related features, including visual elements, coherence, avoidance of redundancy and examples, were also associated with higher arousal, valence or 'happy' indicators in several comparisons, although the pattern was less uniform. Signalling and segmenting showed more complex profiles.

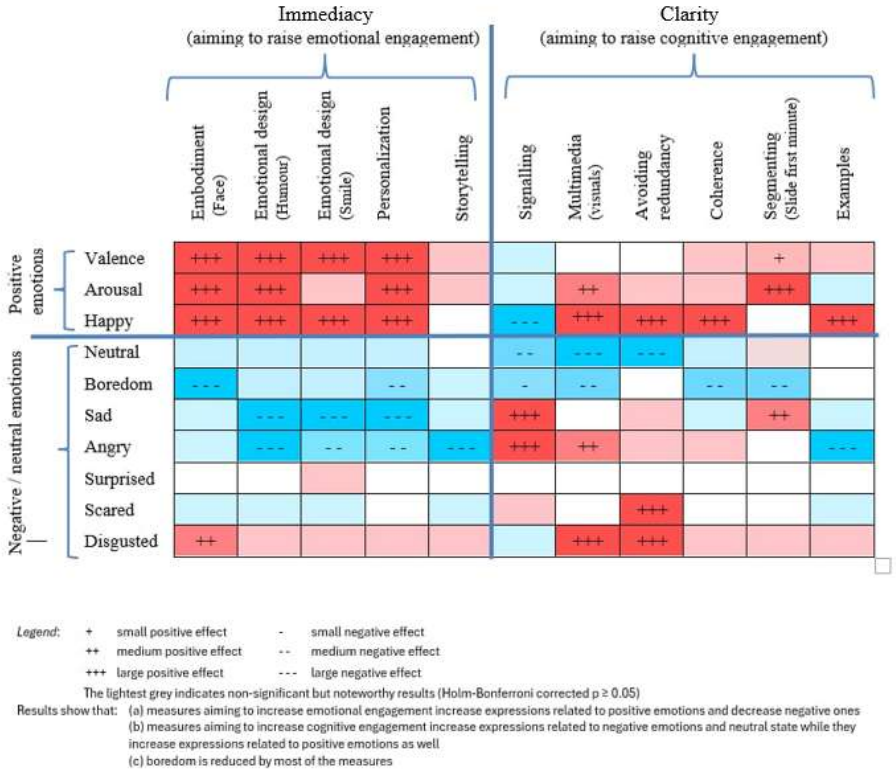


Figure 2. Summary heatmap of associations between FaceReader-labelled affective indicators and selected multimedia learning / instructional communication features. The feature groups follow the conceptual immediacy–clarity mapping developed in the thesis. Light shading denotes non-significant contrasts after Holm–Bonferroni correction.

The heatmap of Figure 2 provides an empirical extension of the conceptual mapping between multimedia learning features and instructional communication functions.

One pattern was *contrary to the initial expectations* and became central to the later interpretation. Several clarity-related features co-occurred not only with higher arousal and valence but also with greater intensity of FaceReader-labelled *negative* expressions, particularly sadness, anger, fear, and disgust. Some of these same features - especially signalling and visual representations - were described by students as

highly helpful for maintaining attention. This discrepancy, therefore, cannot be interpreted simply as evidence of a negative learning experience and is explored further in the discussion of RQ3.

3. Cross-method divergence and the interpretation of negative FaceReader-labelled expressions during learning (RQ3)

RQ3 examined the alignment between automated facial indicators and interview- and questionnaire-based accounts of boredom and interest. For boredom, the different measurement channels showed a relatively consistent pattern. Perhaps the most intriguing finding concerned other FaceReader-labelled negative expressions, particularly sadness, anger, disgust, and fear, which, in several cases, coincided with reported interest, sustained attention, or effort to remain engaged rather than with boredom or disengagement.

Several interpretations are possible, and their relevance depends on how the observed facial activity is understood in relation to the learner's reported experience and the instructional context. The thesis, therefore, treats these explanations as potentially complementary rather than mutually exclusive.

- *Facial movements have only a probabilistic relationship with internal mental states*, and facial action units may overlap across affective and cognitive states (D'Mello, Dieterle and Duckworth 2017; Barrett et al. 2019). For example, configurations classified as anger or sadness may also occur during concentration or interest (Ahn and Harley 2020; Hetland et al. 2019). FaceReader-labelled expressions should therefore not be interpreted as one-to-one indicators of subjective emotion.
- *Unpleasant affect during learning is not necessarily equivalent to disengagement.* Temporary confusion or frustration may occur during active engagement, particularly when learners are working through

difficulty (Arguel et al. 2019; Baker et al. 2010; D'Mello, Dieterle and Duckworth 2017).

- *Retrospective reports may differ from moment-to-moment facial activity* although the use of immediate, segment-referenced interviews reduced this temporal gap (Hetland et al. 2019). Some negative facial activity may also have reflected technical disturbances rather than the instructional content.

- Of these explanations, one appears particularly important for interpreting the present findings, as it concerns the relationship between two distinct states: *interest* and *enjoyment*. These two states may also move in partly opposite directions: conditions that foster interest, such as novelty and complexity, can sometimes coincide with lower enjoyment, while familiar and fluent experiences may support enjoyment more than interest (Westgate and Steidle 2020; Westgate and Wilson 2018). Interest is often supported by novelty and complexity and may involve greater cognitive effort, whereas enjoyment is more closely associated with fluent, familiar and immediately pleasant processing. Within the present context, this distinction may help explain why segments described by students as interesting were not always accompanied by more positively valenced facial displays. This interpretation does not exclude the other explanations outlined above, but it provides a particularly coherent account of the observed divergence and warrants replication in further learning contexts.

4. Contributions and implications

4.1. Research contribution

The thesis provides fine-grained empirical evidence on affective patterns during instructional video viewing by linking precisely timed video features with learners' moment-to-moment responses. It brings instructional communication and multimedia-

learning features into the same empirical analysis and extends a literature predominantly focused on cognitive outcomes by examining boredom, valence, arousal and FaceReader-labelled expressions as they unfold during learning (Fyfield, Henderson and Phillips 2022).

4.2. Theoretical contribution

The findings contribute to unresolved questions about boredom and unpleasant affect during learning. Within the present context, they support a dynamic view of boredom and further suggest that boredom should be distinguished from disengagement, while also suggesting that interest and pleasant affect should not be treated as equivalent. The divergence between FaceReader-labelled negative expressions and reported interest further indicates that unpleasant or negatively labelled affective activity may accompany ongoing engagement and therefore requires contextual interpretation (Baker et al. 2010; D'Mello et al. 2014; Hetland et al. 2019).

4.3. Conceptual contribution

The thesis develops a two-level conceptual bridge between instructional communication and multimedia learning. The four-dimensional model positions rhetorical and relational traditions within a shared framework, while the feature-level mapping connects observable instructional video features with primarily clarity- and immediacy-related communicative functions. This mapping was subsequently used to organise the empirical analysis represented in the heatmap. It therefore provides a way of analysing specific multimedia features while retaining their broader rhetorical and relational meaning, without assuming equivalence between the two theoretical traditions.

4.4. Methodological contribution

The methodological contribution lies in the development of a segment-based analytical approach linking temporally fine-grained facial data to precisely timed instructional features(D'Mello, Dieterle and Duckworth 2017; Grafsgaard 2014). This enabled short-lived video features to be related to within-participant changes in facial

activity rather than relying only on overall averages. A further contribution concerns multimodal interpretation, as divergence between automated classifications and learners' reports may itself be informative, particularly because these measures may capture different components or temporal aspects of affective experience (Hetland et al. 2019; Hirt et al. 2021).

4.5. Practical implications

The practical implications concern both instructional communication and instructional video design. Within the present context, instructor presence, humour and personalisation were associated with patterns suggesting that relational cues can remain relevant (or even more powerful) in asynchronous video, where immediate interaction is unavailable. Clarity-related features such as visual support, coherence, examples and appropriate segmentation were also associated with patterns relevant to attention and affective engagement.

These findings suggest that instructional videos may benefit from combining relational presence with clear, well-structured explanations rather than treating them as separate design goals. Periodic changes in presentation mode, visible instructor presence, meaningful examples and segmentation may help sustain attention across longer videos. The interviews also highlighted incoherence and redundancy as barriers to sustained attention: unnecessary information and mismatches between visual and spoken content were described as making the material harder to follow and potentially increasing cognitive load.

A further practical implication concerns the interpretation of learners' visible responses. Negatively valenced or FaceReader-labelled negative expressions should not automatically be treated as signs that learning has failed. Instructors and researchers may need to consider duration, task difficulty, context and learners' own accounts before interpreting such responses as disengagement (Keltner 2016; Mayer and Fiorella 2021).

Taken together, the findings point to the possibility of *designed relationality*: the intentional inclusion of relational cues in asynchronous instructional materials, even when immediate reciprocity is absent. Within the present context, visible instructor presence, personalisation and other immediacy-related features suggest that relational communication can be partly embedded in the design of a one-way instructional medium. This does not replace genuine interaction, but it may offer a way to preserve elements of connection alongside clarity and instructional structure.

4.6. Limitations and directions for future research

The findings should be interpreted within the study's limitations. The empirical analysis concerned one instructor, one instructional video and a relatively homogeneous student sample. Automated facial classifications are model-based and should not be treated as direct observations of experienced emotion. Technical disturbances also affected some viewing episodes. These limitations reinforce rather than weaken the rationale for multimodal interpretation: within the present context, convergence across methods was informative, but divergence was equally important for understanding what each measurement channel can and cannot show.

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V. PUBLICATIONS RELATED TO THE TOPIC

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