University of Tartu
Faculty of Social Sciences
Institute of Education
Curriculum: Educational Technology

Marharyta Martemianova

EPISTEMIC AND ACHIEVEMENT EMOTIONS IN INFORMAL LEARNING: STUDENT EXPERIENCES AND TEACHER ROLES

MA thesis

Supervisor: Associate Professor of Education, Katrin Saks, PhD

Tartu, 2025

Abstract

Epistemic and Achievement Emotions in Informal Learning: Student Experiences and Teacher Roles

The aim of this research was to find out the epistemic emotions experienced by students in informal learning environments, to assess the impact of formative assessment on learners' achievement emotions, and to investigate how teachers perceive and support the development of these emotions within such contexts. A mixed-methods design was used, combining pre- and post-course questionnaires with semi-structured interviews conducted with six teachers. Quantitative findings revealed high levels of positive epistemic emotions such as curiosity and interest, which students experience in UA-Teens educational space. However, it was discovered that negative academic emotions like shame and hopelessness increased slightly over time. Qualitative analysis provided insight into teachers' perspectives on the role of emotions in learning, highlighting both their perceived benefits and associated challenges. The results emphasize the importance of emotional sensitivity in informal education and the necessity of emotionally responsive teaching practices.

Keywords: epistemic emotions, achievement emotions, formative assessment, informal education, teacher perspective, student emotions

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Introduction

Previous research has shown that formative assessment enhances learning outcomes and has a strong and consistent impact on academic achievement (Hattie & Timperley, 2007; Leighton & Bustos Gómez, 2017). Existing research suggests that achievement emotions, such as enjoyment, hope, pride, anxiety, and shame, are playing a critical role in academic engagement, motivation and self-regulation (Pekrun, 1992, 2000; Pekrun et al., 2002). However, most studies focus on formal classroom settings, leaving a gap in understanding how formative assessment influences these emotions in informal educational contexts, where learning is often more student-driven and flexible.

Epistemic emotions, such as curiosity, surprise, and confusion, are equally important. These emotions, which are triggered by cognitive task characteristics, are linked to knowledge generation and learning outcomes (Pekrun et al., 2016). Although these emotions are crucial for knowledge construction, their role in informal educational environments is not well understood. Both types of emotions (achievement and epistemic) influence learning behaviors and academic performance, but while achievement emotions tend to reflect a student’s emotional response to success or failure, epistemic emotions are directly tied to the learning process itself and the pursuit of knowledge (Pekrun et al., 2016). However, traditional classroom settings, with their strong focus on academic performance, may suppress the expression and influence of epistemic emotions, highlighting the need to investigate how informal learning settings foster these emotional experiences (Lee et al., 2023).

Moreover, teachers play a pivotal role in shaping how formative assessment impacts students’ emotions (Wu & Yu, 2025). In informal learning environments, where teachers often have more flexibility and closer interactions with students, their approach to providing feedback and fostering emotional engagement becomes more significant. By offering supportive and constructive feedback, recognizing students’ efforts, and creating emotionally safe spaces, teachers can influence not only achievement emotions like pride and shame but also foster curiosity and emotional growth. Exploring teachers’ perspectives on managing and responding to students' emotions is therefore essential to fully understand the emotional dimensions of formative assessment in informal learning.

Although formative assessment has been widely studied in terms of its impact on learning outcomes, less is known how formative assessment affects achievement emotions and how informal learning environments influence epistemic emotions. Moreover, examining these dynamics from the perspective of teachers can provide valuable insights for better understanding the emotional dimensions of learning beyond formal settings.

The aim of this research is to find out the epistemic emotions experienced by students in informal learning environments, to examine the impact of formative assessment on learners' achievement emotions, and to investigate how teachers perceive and support the development of these emotions within such contexts.

Research questions:

1. What epistemic emotions do students experience in informal learning environments?
2. What is the impact of formative assessment on learners' achievement emotions in informal learning environments?
3. How do teachers perceive and support the development of students' epistemic and achievement emotions in informal learning environments?

Theoretical overview

Formative assessment

Formative assessment is a wide and deep concept which can include different techniques such as peer and self-assessment, checklists, observations etc. However, the main importance of formative assessment is a process of providing ongoing feedback to support and enhance students' learning (Black & Wiliam, 2009). The purpose of formative assessment is to adjust the activities of the teachers and students in the learning process. Formative assessment allows the teacher to monitor the process of students' progress towards their learning goals. It helps the teacher adapt the learning process at an early stage and the student to realize greater responsibility for their learning. This assessment becomes formative when the data collected is used to adapt instructions and improve the learning process (Wiliam, 2011).

One of the most critical elements of formative assessment is feedback, which serves both evaluative and supportive functions (Rowe et al., 2013). Effective feedback is timely, comprehensive, and aligned with assessment criteria, enabling students to understand their performance and identify areas for improvement (Rowe, 2011). Some research redefines feedback as a dynamic, two-way interaction that emphasizes learner engagement and dialogue

(Yang & Carless, 2013). This perspective positions students as active participants in the learning process rather than passive recipients of information (Rowe, 2016).

Black and Wiliam (2009) outlined five key strategies of formative assessment within a comprehensive framework that unifies the various practices of formative assessment. These strategies are: clarifying goals and success criteria, using classroom discussions, providing feedback that moves forward, encouraging peer learning and motivating students to their own learning. Teachers should clearly communicate learning objectives and the criteria for success to help students understand expectations. Because of that, both students and teachers benefit from it as all of the participants know clearly what to do and what is expected from them. Collaboration between teachers, students, and peers can further break down these goals into clear tasks (Wiliam, 2011). Setting up constructive classroom discussions emphasizes gathering evidence of student progress through questioning and other tasks. Teachers use this evidence to assess where students are in their learning journey (Wiliam, 2011). Effective feedback significantly enhances student achievement. Quality feedback should encourage reflection, dialogue, and continuous improvement. Black and Wiliam (2009) suggest using comments as opposed to grading students to support learning. Peer assessment fosters collaborative learning and enhances understanding (Wiliam, 2011). Showing students that they are responsible for their own learning strategy appeals to enhance students' motivation. Students are more engaged when they take responsibility for their learning through planning, monitoring, and evaluating their progress. Wiliam (2011) emphasizes that students are more likely to put effort into a task that they are interested in, which encourages self-assessment and metacognitive practices (Wafubwa, 2020).

In conclusion, contemporary perspectives on assessment highlight its dual function as both a measurement tool and a means to enhance learning. The shift from a test-centered view to a learning-centered approach emphasizes formative assessment's role in improving educational outcomes through continuous feedback and adaptive teaching strategies. As educational paradigms continue to evolve, fostering a more interactive and student-centered assessment culture remains essential for enhancing learning experiences and outcomes (Black & Wiliam, 1998; Wafubwa, 2020; Wiliam, 2011).

Emotions in education

The classroom is a deeply emotional space. Students spend many hours at school or other educational environments, communicating with peers, teachers, assistants, educational staff.

In these settings, emotions such as enjoyment of learning, curiosity, interest, hope, pride, anger, anxiety, shame, confusion, frustration, or boredom are frequent and often intense (Pekrun & Linnenbrink-Garcia, 2014).

Emotions play a dual role in education, they are experienced within the learning environment and instrumental for academic achievement and personal growth (Pekrun & Linnenbrink-Garcia, 2014). For instance, feelings of enjoyment while working on a challenging task can foster goal-setting, creativity, and self-regulation (Pekrun et al., 2002). On the other hand, intense anxiety about exams can harm academic performance, increase dropout risks, and negatively affect mental and physical well-being.

Despite the undeniable importance of emotions in education, they remained largely overlooked by educational research until the 1990s. Early research primarily focused on test anxiety and the relationship between emotions and achievement (Cramp et al., 2012). Although the study of emotions gained attention in fields like neuroscience, anthropology, and economics starting in the 1970s, educational research remained focused on cognitive outcomes, causing emotional aspects to be underexplored (Pekrun & Linnenbrink-Garcia, 2014).

Academic and achievement emotions

In the education process students often experience academic emotions such as enjoyment of learning, hope, pride, anger, anxiety, shame, hopelessness, or boredom. These emotions play a crucial role in shaping students' motivation, learning outcomes, academic performance, identity development, and overall well-being (Pekrun & Schutz, 2007).

Academic achievement and learning are the most important topics among students during their school years, usually because future success “depends” on achievement at school and huge social and parental pressure exists. Moreover, considering the broader functions of emotions in human behavior, it is likely that they impact students' thinking processes, academic outcomes, and overall psychological and physical health (Pekrun et al., 2002). Achievement emotions are those emotions that often are connected to achievement activities or their outcomes. Examples of these emotions can be enjoyment of learning, boredom experienced during classroom instruction, or anger at the task demands of academic learning (Pekrun, 2006; Pekrun et al., 2010). Pekrun and his colleagues (2002) proposed for emotions directly connected to academic activities, classroom settings and achievement to use the term academic emotions. In this way, the term academic is used similarly in concepts like academic motivation or academic self-concept. By this term all emotions mentioned above would include emotions experienced in school or other educational settings. It extends beyond emotions tied to success or failure, also including those related to classroom instruction and the study process (Pekrun et al., 2002).

Academic emotions arise in various academic contexts, including attending classes, studying, and taking exams, each with distinct functions and social dynamics. Consequently, emotional experiences may differ across these environments. For instance, the enjoyment of classroom learning may not align with the excitement of tackling an exam, some students may feel enthusiastic during lessons, while others thrive under exam pressure. As a result, assessing achievement emotions requires recognizing and differentiating the emotional responses specific to each academic setting. For example, hopelessness is thought to be experienced when achievement seems not manageable at all and students are certain about failure (Pekrun et al., 2011).

Emotions can influence the choice of learning strategies, encouraging either flexible approaches like elaborating on material or rigid methods like simple rehearsal. They also affect how learning is regulated, supporting either self-regulation by the student (Efklides, 2011) or external regulation by others (Pekrun et al., 2011). Also, emotions influence intrinsic motivation driven by interest, as well as extrinsic motivation, which is driven by achievement of positive outcomes (like marks). However, the effects of negative activating emotions, such as anger, anxiety, and shame, are more complex. While these emotions can weaken intrinsic motivation, they may also heighten extrinsic motivation to prevent failure, thereby increasing effort (Pekrun et al., 2011).

Epistemic emotions

Epistemic emotions are specific types of emotions that arise during cognitive activities related to knowledge acquisition. These kinds of emotions help to react to situations when individuals add new information to already existing knowledge and beliefs. For example, when a person gains new contradictory information then cognitive processes happen ‘accompanied’ by epistemic emotions. These emotions can shape how people process information and contribute to the creation of new understanding. From an evolutionary perspective, epistemic emotions form a significant category of human emotions, evolved to acquire new knowledge of the world and oneself (Nerantzaki & Efklides, 2019).

The most notable epistemic emotions are surprise, curiosity, and confusion (Vogl et al., 2020). While the role of epistemic emotions in learning is not yet fully clear, emerging research indicates their significance in learning processes, regulating learning, and influencing learning outcomes (Efklides, 2017; Muis et al., 2015; Vogl et al., 2021).

Epistemic emotions are linked to psychophysiological changes, which can be brief, as seen in surprise, or more prolonged, as with curiosity and confusion (Nerantzaki et al., 2021). Activation of positive emotions, such as enjoyment and curiosity, is linked to the adoption of effective learning strategies. Also, if confusion is resolved, it will also positively foster the usage of learning strategies (Nerantzaki & Efklides, 2019). Surprise, curiosity, and confusion are recognized as core epistemic emotions because they are directly tied to the process of acquiring knowledge. These emotions often arise during challenging learning experiences. Such situations frequently involve disbalance in cognitive flow, which can lead to surprise when the disbalance is unexpected. Curiosity tends to arise when individuals become aware of gaps in their understanding or feel uncertain about the information they are processing. If these disruptions cannot be resolved, confusion is likely to occur (Nerantzaki & Efklides, 2019). Moreover, there is wonder that arises when new and unusual experiences happen. This emotion is epistemic by nature because it reflects a desire to explore and understand new things. Wonder may also indicate uncertainty or doubt about unusual events or how to interpret them. In this sense, wonder shares similarities with surprise and curiosity and may also relate to interest. Furthermore, when the source of wonder cannot be explained and involves contradictory information, it may overlap with confusion (Nerantzaki & Efklides, 2019). Another epistemic emotion that allows individuals to focus and actively participate in a process or object is interest. It happens to exist in classrooms where it is safe but also new challenging tasks arise all the time. However, interest exists when individuals can understand and handle the challenges. Interest is a diverse term, which can be a permanent personal trait as well as triggered by specific task or situation (Nerantzaki & Efklides, 2019).

A wider definition of epistemic emotions includes any emotional responses that arise due to cognitive processes (Pekrun & Linnenbrink-Garcia, 2012). Within this framework, achievement emotions may also be considered as epistemic emotions if they center on knowledge-related issues (Muis et al., 2015). For instance, interest is associated with surprise and curiosity but it may also be triggered by knowledge states that raise epistemic emotions.

The role of emotions in formative assessment

Role of emotions in assessment and feedback is less explored compared to cognitive or motivational aspects. However, emotions play a crucial role, they influence students behavior during and after assessment. Moreover, emotions in assessment also impact how much students are willing to engage in a studying process (Rowe, 2016).

In social psychology, it is a framework that helps to understand the causes and consequences of students' emotional experiences. Social factors play a significant role in experiencing emotions in many ways at different levels. Some research highlights the importance of relationships, both between students and teachers and among peers, for overall learning and feedback (Rowe, 2011). Secondly, emotions as a concept are difficult to distinguish from other terms like "affect," "mood," and "feelings." Social functional and cognitive appraisal theories, in particular, offer valuable insights into the causes and timing of specific emotional responses in educational contexts, including feedback (Rowe, 2011; Rowe, 2016).

In the context of feedback, students can react differently depending on how they interpret the cause of an evaluation. If they believe the teacher is responsible, they might feel anger, while recognizing their own shortcomings could lead to feelings of sadness or disappointment. These emotional responses influence behavior in distinct ways: an angry student might challenge the lecturer instead of reflecting on the feedback, whereas a student feeling disheartened could disengage or even consider leaving the course if they doubt their ability to succeed. Emotions can drive both proactive and avoidant behaviors, each affecting learning outcomes in unique ways. Cognitive appraisal theory provides valuable insights for educators, academic developers, and researchers by explaining when specific emotions arise, why individuals may experience different emotions in response to the same situation, and how these emotions influence behavior (Rowe, 2016). For instance, Pekrun (2006) introduced the control–value theory, which highlights the significance of evaluation and emotions in educational settings. Emotions are seen as brief, distinct experiences categorized into specific emotion families (such as fear or joy) rather than broad or dispositional feeling states (Rowe, 2016).

While assessment is "deeply personal" (Crossman, 2007) and capable of evoking strong emotions, there is still limited understanding of how specific emotions influence students' ability to receive and process feedback (Rowe et al., 2013). Some achievement emotions, such as enjoyment, hope, pride, anger, anxiety, shame, hopelessness, relief, boredom, and interest, have been identified as important for learning in general (Pekrun & Stephens, 2010). However, there is less research on the role of social emotions, for example gratitude, in educational contexts. Empirical evidence suggests that positive emotions generally support academic learning and achievement by enhancing metacognition, task effort, self-regulation, strategy use, and motivation (Pekrun & Stephens, 2010; Nerantzaki et al., 2021). Although negative emotions often undermine motivation and performance (e.g., fear leading to avoidance behavior), they can also have positive effects (Pekrun & Stephens, 2010). For instance, feelings of anger may encourage a student to engage in dialogue with their teacher regarding feedback they perceive as unfair. Such discussions, when approached constructively, are crucial for fostering students' understanding of and engagement with feedback (Nicol et al., 2013).

Achievement emotions, both positive and negative, are present in assessment contexts, although their specific role remains less understood (Rowe et al., 2013). Educational research highlights feedback as a source of both positive emotions, such as confidence and pride (Beard, et al., 2014), and negative emotions, including anxiety and shame (Cramp et al., 2012; Rowe et al., 2013). Some evidence suggests that the negative feelings associated with assessment, such as anxiety and self-doubt, can amplify subsequent positive emotions, like euphoria, when outcomes exceed expectations (Cramp et al., 2012).

Rowe and colleagues (2013) identify a range of emotions (like joy, anger, fear, pride, guilt etc) play an important role in how students react to feedback. These emotions are experienced in response to achievements, to social situations and reflecting feedback (Rowe, 2011; Rowe et al., 2013). Moreover, "self-conscious" emotions (e.g. pride, guilt, and embarrassment) are more relevant to the evaluative nature of feedback due to their connection with social relationships (Hareli & Parkinson, 2008). For instance, when a student experiences guilt due to self-blame following a negative assessment, it may motivate reparative behaviors aimed at improving their relationship with the instructor. This could manifest as an apology or a renewed commitment to academic improvement (Hareli & Parkinson, 2008).

A range of epistemic emotions (gratitude, happiness, interest, anger, fear, and sadness) significantly influence how students engage with both the evaluative and supportive aspects of formative assessment (Rowe et al., 2013). Emotional experiences play a crucial role in cognitive processes, emotional events enhance memory retention (Talmi, 2013). While positive emotions like happiness broaden attention, negative emotions such as anxiety narrow

it (Huntsinger, 2013). Consequently, the type and intensity of emotions students feel when receiving feedback can affect how well they process, remember, and act on it.
Beyond memory and attention, other cognitive functions, such as motivation and information processing, are also shaped by emotional responses (Pekrun & Stephens, 2010). For example, gratitude has been shown to foster prosocial behaviors like a willingness to forgive, attribute success to others' actions, acknowledge and respond with assistance, and even reduce aggressive tendencies (Wood et al., 2010). Applying these findings to feedback contexts, students who feel grateful in response to feedback may be more willing to ask for help from their instructors and less likely to express dissatisfaction if the feedback does not fully meet their expectations. This emotional response may create a positive foundation for communication and future engagement with feedback (Rowe, 2016). Additionally, how students react to feedback is shaped by their emotional maturity and their perceptions and expectations regarding grading and assessment. These factors can further moderate whether feedback is received constructively or leads to disengagement.

In conclusion, formative assessment triggers emotional responses in both students and teachers, making it vital to understand how positive and negative emotions influence learning, teaching, and assessment. Secondly, although assessment and feedback are less directly connected to emotional engagement, certain learning activities (such as reflective tasks, collaborative group work, and experiences that challenge student assumptions) can intensify emotional commitment.

UA-Teens

The modern world with all its challenges and practical demands, needs education which would meet the requirements and help students adapt to new realities. Informal learning is shifting towards modernisations and updates (Lee et al., 2023). This agility is largely due to the flexible and autonomous nature of informal learning institutions (European Commission, 2020), allowing educational spaces to integrate new technologies and methodologies at their own pace.

Students who are ‘digital natives' demonstrate a higher degree of self-regulation in managing their learning processes, actively taking responsibility for their educational activities, and becoming more interested in informal educational institutions which promise them to be more ready for the future professions. Additionally, there is a noticeable shift in teaching and learning methodologies from traditional teacher-centered approaches to learner-centered models. In essence, learner-centered methods prioritize knowledge construction through collaborative experiences, moving beyond conventional lecture-based classrooms toward technology-enhanced, self-regulated learning environments (Matthews & Walton, 2017). This is exactly how UA-Teens Lviv educational space was designed and created: modern, tech-savvy, creative and adapted for the new educational model for afterschool informal learning.

UA-Teens Lviv is an innovative educational space located in Lviv, Ukraine, dedicated to empowering teenagers aged 12 to 18 through a diverse range of modern educational programs. The initiative aims to nurture creativity, technical skills, and personal growth by offering a unique learning environment tailored to the interests and aspirations of young learners. Students at UA-Teens Lviv have the opportunity to select three out of eight available disciplines, allowing them to customize their educational journey. The programs offered include 3D modeling, filmmaking, animation, robotics, programming, game development, graphic design, and music production. Each course focuses on practical skills, encouraging students to apply theoretical knowledge through hands-on projects.

The educational process in UA-Teens is divided into three stages. In the orientation stage, students explore all eight disciplines through practical exercises and complete tasks to help them identify their preferred areas of study. This phase typically lasts one month. During the next (workshops) stage all of the students have individualised supervision from teachers (so called workshop leaders). They are learning new skills and doing project work while receiving feedback during this month constantly, in the form of formative assessment. In this stage teachers guide students and track their progress through a student-centered approach. Formative assessment helps to identify and support students as well as adjust instruction if needed. In UA-Teens workshop leaders create a positive learning environment by encouraging students, motivating and supporting them. At the process of creating a project, students do not receive marks, only the help and feedback for further improvement.

UA-Teens Lviv is committed to providing teenagers with the tools and guidance needed to succeed in creative and technical fields. Through its flexible and supportive educational model, the program helps each student pursue their passions and develop skills that align with their future goals (UA-Teens Lviv, 2025).

Method

Research design

The research was designed in an informal educational centre ‘UA-Teens’ in Lviv, Ukraine to investigate teenage learners’ epistemic and achievement emotions and teachers' perspective on these emotions. The research was conducted during one month in April 2025. This period was chosen because it was a time for a workshop cycle stage, during which students perform project work and have constant support from the teachers. A mixed methods design was used in this study (Creswell, 2012).

Quantitative data were collected with pre- and post-course questionnaires measuring students’ achievement emotions and one questionnaire (pre-course) to measure epistemic emotions, using Likert-scale responses. Semi-structured interviews with 6 teachers were conducted in person or via Zoom at the end of April 2025, so teachers could give responses based on the recent workshop experience (the same learning stage during which students did the questionnaires). Both data sets were collected and analysed independently, after that results were compared and analysed.

Sample

Convenience sampling was used, i.e., the researcher selects participants because they are willing and available to be studied (Creswell, 2012). The participants of this study were teenagers and teaching staff of an informal educational centre ‘UA-Teens’ in Lviv, Ukraine. The participants include students aged 11 to 16 who attend the UA-Teens after-school program and the teachers who conduct the workshops, referred to as workshop leaders. The total number of student participants was 38, 14 female (36%) and 24 male (62%) with the average age of 13.5 (SD=1.4); and 6 teachers, 2 males and 4 females. Two student participants reported outlier ages (37 and 55), which were retained for the emotional data but excluded from age-based analysis. To protect the students' anonymity, only gender, age, and emotions were recorded. For the qualitative analysis, participants were assigned pseudonyms, for example Teacher A, Teacher B etc., to keep the confidentiality. All participants, teachers and students, were informed about the study’s purpose and participants had the right to withdraw at any time or not take part at all. Informed consent was obtained from all participants, in accordance with the UA-Teens privacy policy, permission for underage students to participate in the study was requested from their parents or legal guardians.

Data collection

For the data collection, I used three rounds of surveys. In the first session of the workshops students took an Epistemic emotions test (Pekrun et al., 2017)(See Appendix A) via Google Forms, translated into the Ukrainian language. The purpose of this stage was to discover which epistemic emotions students feel connected with the UA-Teens educational centre (informal learning environment) and to answer RQ1: 'What epistemic emotions do students experience in informal learning environments?' The epistemic questionnaire consists of 21 questions. The questionnaire was adapted from the previous research, where emotions were measured during epistemic activities (Pekrun et al., 2017). The questions were formed as statements and a 5-point Likert-type scale with predetermined responses were given, where the respondent is expected to rate the statements on a scale from 1 to 5, from the least pleasant (1) to most appealing (5) (See Appendix A).

For the second and third round of questionnaires Achievement emotions test (Pekrun et al., 2011)(See Appendix B) was used. Students filled in the questionnaire in the second workshop and after the last workshop. The purpose of the second questionnaire pre-test stage was to establish a baseline of achievement emotions which could be used to compare with the change in students' emotions at the end of the study. Right after the last workshop the Achievement emotions test was conducted. The purpose of this stage was to compare the students' emotions in the post-test with their emotions in the pret-test and determine whether learning in the environment where formative assessment was used, had had an impact on their achievement emotions and to answer RQ2: 'What is the impact of formative assessment on learners' achievement emotions in informal learning environments?'

Achievement Emotions Questionnaire (AEQ) was adapted from Perkun and colleagues' (2011), where emotions were measured during students' learning and performance. The original questionnaire has 24 statements in three-blocks (class-related, learning-related and test-related). For this research, I used only 16 statements from class-related and learning-related blocks, since in UA-Teens, there are no tests and summative assessment was not the focus of this research. The questions are in the form of statements as in Epistemic Emotions Questionnaire, and the respondent is expected to rate the statements on a scale from 1 to 5, from the strongly disagree (1) to strongly agree (5) (See Appendix B).

For the qualitative data collection, interviews with six teachers were conducted online synchronously via Zoom application or in person on site in UA-Teens Lviv. Each interview lasted around fifteen minutes and was recorded in audio format. The audio files of the interviews were transcribed and formatted in Google Docs. Five questions were developed for this interview (See Appendix C) to answer RQ3: ‘How do teachers perceive and support the development of students’ epistemic and achievement emotions in informal learning environments?’

Data analysis

The data was grouped according to the research questions and different techniques were used for its analysis. Since the study employs a mixed-method approach, both quantitative and qualitative data were analysed.

For quantitative data, which was collected through Google Forms, Google Sheets were used for the basic analysis. For example, descriptive statistics, including means, standard deviations, and response distributions. For further analyses JASP software (JASP Team, 2024) was used. To assess normality of distribution, the Shapiro-Wilk test was conducted. As the data did not meet the assumption of normality, non-parametric Mann–Whitney U test was used to compare pre- and post-test scores for each emotion. Effect sizes (r) were calculated to interpret the magnitude of differences.

For qualitative data, which consist of teachers’ interviews, the following measures were taken: transcription was formatted in Google Docs manually. It was analysed thematically, initially coded by using key concepts and patterns, which were later grouped into broader categories.

The following five categories emerged: emotional context, teacher roles in supporting emotions, challenges in emotion-sensitive teaching, emotions that support learning, and emotional change over the learning process.

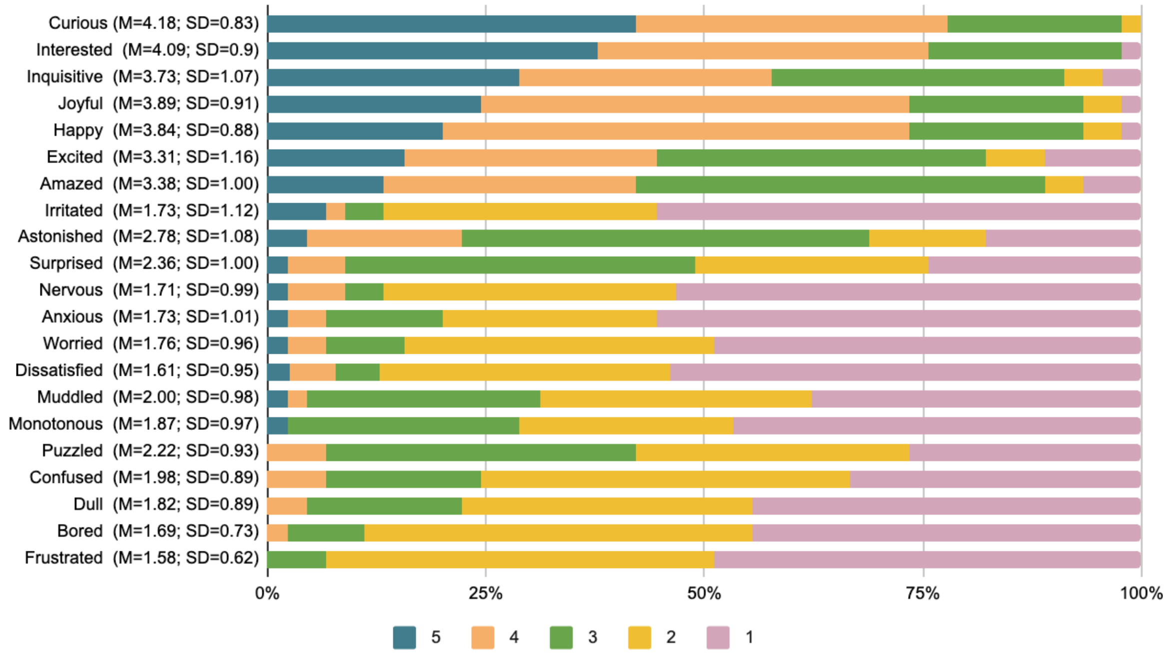
Result

This chapter presents the results of the quantitative and qualitative data analysis according to the research questions. Descriptive statistics were calculated to summarize overall emotional trends, and comparative statistics (Mann–Whitney U tests) were used to assess whether these emotions changed significantly over time.

RQ1. What epistemic emotions do students experience in informal learning environments?

Participants rated the intensity of 16 different epistemic emotions experienced during their learning at UA-Teens on a 5-point Likert scale (1 = not at all, 5 = very strongly). Most frequently rated as "very strongly" were curious (n = 19; M = 4.18, SD = 0.82), interested (n = 17; M = 4.09, SD = 0.89), and inquisitive (n = 13; M = 3.73, SD = 1.06). In contrast, the emotions most frequently rated as "not at all" were irritated (n = 25; M = 1.73, SD = 1.10), anxious (n = 25; M = 1.73, SD = 1.00), and nervous (n = 24; M = 1.71, SD = 0.98), suggesting generally low levels of negative emotions. Figure 1 presents the full distribution of responses.

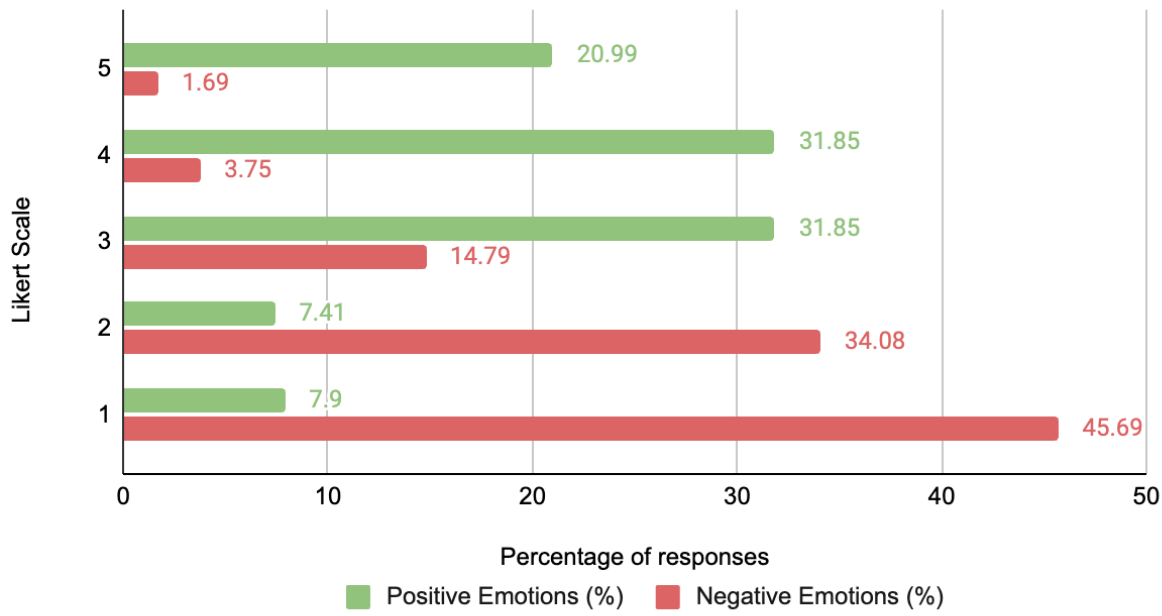
Figure 1. Epistemic emotions of students in UA-Teens



The descriptive analysis shows that most of the so-called 'positive' emotions were rated with the highest intensity ("5 - very strongly"), indicating that the majority of participants felt curious and interested when starting a new cycle of workshops at UA-Teens. Specifically, curiosity and interest received the highest mean scores, reflecting strong engagement and emotional involvement.

To gain clearer insight into the patterns of epistemic emotions experienced by the students, the data were divided into two categories: positive and negative emotions. Positive emotions included feelings such as curiosity, interest, excitement, joy, and amazement, while negative emotions encompassed frustration, confusion, boredom, dissatisfaction, and anxiety (Muis et al., 2018). The distribution of responses across the 5-point Likert scale revealed distinct trends. Among positive emotions (n = 405 responses), the highest proportion was recorded at 4 ("strongly felt") and 3 ("moderately felt"), each accounting for approximately 31.9% of responses, followed by 20.99% at 5 ("very strongly felt"). In contrast, negative emotions (n = 534 responses) showed a reverse pattern: nearly half of all responses (45.7%) were clustered at 1 ("not at all"), indicating that negative emotions were largely absent, while only 1.7% of responses reached 5 (Figure 2).

Figure 2. Distribution of Positive and Negative Epistemic Emotions (%)



RQ2. What is the impact of formative assessment on learners' achievement emotions in informal learning environments?

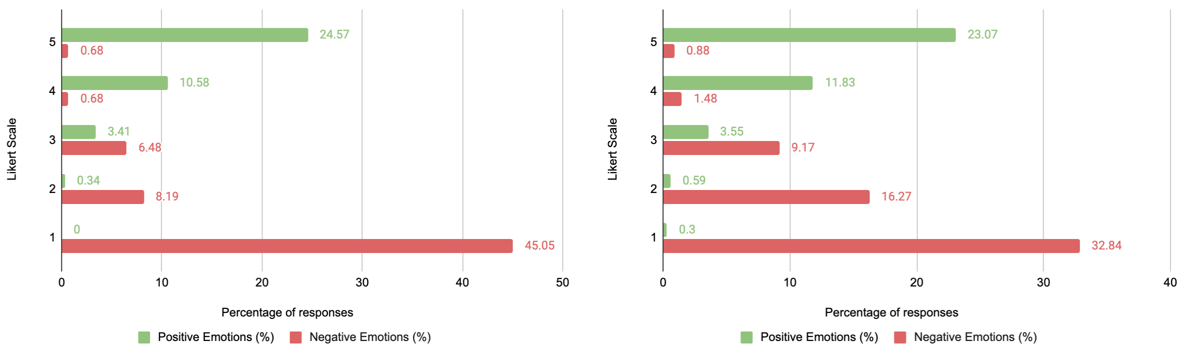
Pekrun et al. (2011), whose questionnaire I took to analyse achievement emotions, divided achievement emotions into 3 categories: class-related, learning-related and test-related. In this research, I measured students' achievement emotions in 2 categories: class-related and learning-related, since UA-Teens did not perform tests.

In achievement emotions, we can see the same tendency as in epistemic emotions: positive emotions, like enjoyment, hope, and pride, are dominating and often rated 4 or 5, indicating high emotional engagement in a Likert scale. In contrast, negative emotions such as shame, hopelessness, and anxiety were most frequently rated as 1 or 2, showing that students largely did not experience these emotions (Figures 3, 4).

To understand the overall emotional climate experienced by students in the learning environment, I calculated the percentage distribution of Likert-scale responses (1 to 5) for both positive and negative emotions. All emotion scores were grouped based on their emotional valence, either positive or negative. Each individual rating was treated as one emotional response. For each Likert value, I summed the total number of responses across all relevant emotions and divided it by the total number of responses (for positive and negative emotions separately and then across both pre- and post-tests). This approach allows a direct, visual comparison of how frequently students reported high (positive) or low (negative) emotional states.

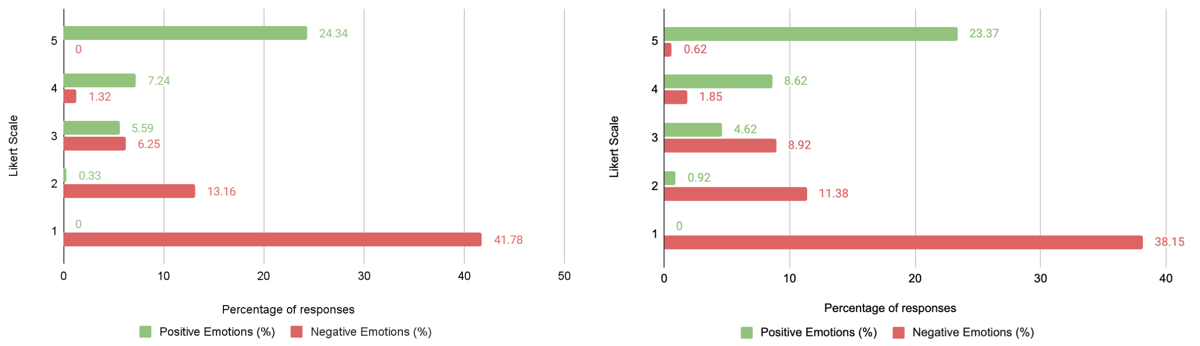
As can be observed in Figure 3 (class-related emotions), the majority of positive emotion responses appear at the highest Likert level, with 24.57% of responses scoring 5 and another 10.58% scoring 4. In contrast, negative emotions were primarily rated at the lowest levels, with 45.05% of responses at 1, and only 0.68% at 5, suggesting that students almost did not experience these emotions. After the course, this trend remained stable, though slightly moderated. Positive emotions remained high, with 23.07% of responses at 5 and 11.83% at 4, while negative emotions showed a modest decrease, with 32.84% at 1, and a noticeable increase in responses (16.27% at 2 and 9.17% at 3).

Figure 3. Distribution of positive and negative achievement class-related emotions in pre-test (left) and post-test (right) groups



The distribution of learning-related emotions follows a similar pattern to class-related ones. In the pre-test, the majority of responses for positive emotions (e.g., enjoyment, hope, pride) appeared at the top of the Likert scale, with 24.34% of all positive responses rated as 5, and only 0.33% as 2 or lower. In contrast, negative emotions (e.g., boredom, hopelessness, anxiety) were most frequently rated as 1 (41.78%), indicating a low intensity of negative affect. In the post-test, this pattern persisted with only slight changes: 23.37% of positive emotions were still rated as 5, while negative emotions showed a small reduction at rating as 1 - 38.15% and a moderate increase in middle-range scores (8.92% at 3 and 11.38% at 2).

Figure 4. Distribution of positive and negative achievement learning-related emotions in pre-test (left) and post-test (right) groups



After that basic descriptive measurements were performed. Shapiro-Wilk tests were conducted to check the normality of data distribution. The result showed that the data is not normally distributed, so in further calculations, the non-parametric Mann–Whitney U test was used.

Descriptive statistics revealed that mean scores for several achievement emotions changed slightly from pre- to post-test, though these changes were generally small in magnitude (Table 1, 2). For example, the mean level of class-related hopelessness increased from 1.29 (SD = 0.61) to 1.68 (SD = 0.88). Similarly, hopelessness in learning-related emotions also increased from 1.37 (SD = 0.68) to 1.51 (SD = 0.9). In contrast, positive emotions such as class-related pride remained stable (in pre-test M = 4.45, SD = 0.76 ; in post-test M = 4.46, SD = 0.78). Learning-related anxiety increased from 1.5 (SD = 0.8) to 1.73 (SD = 0.9), and learning-related enjoyment decreased from 4.66 (SD = 0.58) to 4.63 (SD = 0.62), showing minor shifts. These descriptive patterns suggest some emotional fluctuation during the course; however, further statistical testing was necessary to determine whether these changes were statistically significant.

Table 1. Class-related emotions

Emotion	Test	Mean	SD	p-value
Enjoyment	Pre	4.71	0.57	
	Post	4.49	0.75	0.14

Hope	Pre	4.42	0.72	
	Post	4.24	0.86	0.37
Pride	Pre	4.45	0.76	
	Post	4.46	0.78	0.86
Anger	Pre	1.4	0.82	
	Post	1.68	1.08	0.19
Anxiety	Pre	1.71	1.04	
	Post	1.81	0.95	0.47
Shame	Pre	1.4	0.86	
	Post	1.73	0.95	0.04
Hopelessness	Pre	1.29	0.61	
	Post	1.68	0.88	0.03
Boredom	Pre	1.58	0.79	
	Post	1.61	0.70	0.67

Table 2. Learning-related emotions

Emotion	**Test**	**Mean**	**SD**	**p-value**
Enjoyment	Pre	4.66	0.58	
	Post	4.63	0.62	0.96
Hope	Pre	4.4	0.86	
	Post	4.22	0.96	0.41
Pride	Pre	4.4	0.86	
	Post	4.49	0.75	0.76
Anger	Pre	1.34	0.58	
	Post	1.42	0.74	0.95
Anxiety	Pre	1.5	0.8	
	Post	1.73	0.9	0.19
Shame	Pre	1.82	1.01	
	Post	2.15	1.2	0.22
Hopelessness	Pre	1.37	0.68	
	Post	1.51	0.9	0.64
Boredom	Pre	1.34	0.58	

Post	1.42	0.67	0.72

To examine the impact of formative assessment on learners' achievement emotions in informal learning environments, Mann–Whitney U test was conducted to compare pre- and post-test emotion scores. A Mann–Whitney U test revealed a significant increase in shame scores from pre-test (Mdn = 1.0) to post-test (Mdn = 1.0), U = 955.5, p = .042, r = .23. Similarly, a significant increase in hopelessness scores was observed, with pre-test scores (Mdn = 1.0) and post-test scores (Mdn = 1.0), U = 967.5, p = .026, r = .24. No significant changes were observed for other emotions ($p > .05$).

Table 3. Mann-Whitney U test results

Emotion	**Mdn (Pre)**	**Mdn (Post)**	**U**	**p**	**r**
Enjoyment (C)	5	5	656.5	0.143	0.16
Hope (C)	5	4	694.5	0.365	0.11
Pride (C)	5	5	795.5	0.857	0.02
Anger (C)	1	1	889.5	0.194	0.14
Anxiety (C)	1	2	846.5	0.469	0.09
Shame (C)	1	1	955.5	0.042	0.23
Hopelessness (C)	1	1	967.5	0.026	0.24
Boredom (C)	1	1	818.5	0.669	0.05
Enjoyment (L)	5	5	772	0.936	0.01
Hope (L)	5	5	704.5	0.413	0.1
Pride (L)	5	5	807	0.757	0.04
Anger (L)	1	1	784.5	0.95	0.01
Anxiety (L)	1	1	898	0.187	0.15
Shame (L)	1.5	2	897.5	0.219	0.15
Hopelessness (L)	1	1	817	0.64	0.05
Boredom (L)	1	1	809.5	0.715	0.04

Notes. (C)-Class-related emotions; (L)-Learning-related emotions; Mdn - Median; U - Mann–Whitney U statistic; p - p-value; r - effect size (rank-biserial correlation)

RQ3. How do teachers perceive and support the development of students' epistemic and achievement emotions in informal learning environments?

After conducting and transcribing the interviews, I analyzed data thematically, dividing findings into five categories described below: 'emotional context', 'teacher roles in supporting emotions', 'challenges in emotion-sensitive teaching','emotions that support learning','emotional change over the learning process'.

In the theme 'emotional context' teachers mention how external factors shape the learning environment. They said that different factors influence students' emotional state, especially war, technology issues and students' personal life. Teachers C, D, and E noticed the influence of 'external' emotions on students' learning. Teacher D: *They bring in emotions from the outside world... As a result, the materials I present, the tasks they complete, won't be as good, because the day started negatively*. Teacher E added that students' moods can shift frequently due to hormonal changes: *They're truly struggling, their moods change every five minutes because of hormones.* However, Teacher A emphasised that students are able to momentarily forget the reality of the ongoing war in Ukraine within the learning environment. Teacher A further explained that educational activities in UA-Teens bring positivity and novelty: *Therefore, the educational processes that are built in this space, I believe, fill them with something positive, provide something new that helps them shift focus*. Teacher B highlighted the importance of creating a safe atmosphere where students feel free to engage creatively without fear of failure or judgment.

The theme 'teacher roles in supporting emotions' was about strategies teachers use to create a supportive, positive atmosphere. Many mentioned their use of personal check-ins, helping to build trust. Teacher A said: *At the beginning of each workshop, I asked everyone how they were doing, what was new, how they felt, and how things were at school*. Teachers B and C described creating an atmosphere of incentive and recognition, focusing on students' efforts rather than mistakes. Teacher B: *I encourage students… I find the good aspects in the student's try, and explain those good aspects in their work.* Teacher E named empathy as a key strategy used to make studies feel relaxed, while maintaining a balance of approachability and authority: *I try to listen to the students, to put myself in the place of a teenager*. When students felt heard, respected, and supported, teachers noted that they were more willing to take creative risks and engage deeply in learning.

The next theme ‘challenges in emotion-sensitive teaching’ revealed the difficulties teachers face in the educational process. Teacher C highlighted the difficulty of maintaining emotional boundaries, noting: *The hardest part is distinguishing where I end and where the students begin*. Teacher E shared feelings of fatigue and mentioned burnout, highlighting the effort required to maintain a supportive presence: *I also have my own emotional things like a bit of burnout or tiredness. I think to myself, how do I drag myself to work today? And I also have to make sure the students don't see that I'm dead inside*. In addition to their own emotional challenges, teachers discussed challenges in fostering student engagement and emotional responsiveness. Teacher B noted how difficult sometimes it can be to help emotionally disengaged students: *When a student is closed-off, it's quite difficult to draw them into a conversation. Not just a conversation, but even an emotional response.* To deal with these difficulties, teachers highlighted the use of different strategies. Teacher A and Teacher B explained their approach of being on the ‘same level’ to find a connection with students. Teacher A: *To let them know that I can also make mistakes… and sometimes it turns out that I don't quite look like a teacher, but more like one of students, and that might make them laugh a little*. Teacher B: *My approach is that it's better to be on the same ‘wave’ with the students, that they feel more comfortable and start to understand that they can't cross that boundary [between a teacher and a student]*. Half of the teachers (A, B, and D) mentioned humor as a key tool for managing emotional challenges. Teacher B said, *In such [difficult] moments, I try to joke in response so that they feel comfortable, I feel comfortable, and there is no tension in the air*. Teacher D shared: *I usually like to joke; I'm quite young, and I have humor that's similar to theirs [students'], so I can joke about something*. Additionally, Teachers B, C, and D noted that emphasis on positive moments in students' projects helps a lot in managing emotions. Teacher E said about the importance of active listening and keeping a balance between informality and a sense of adult responsibility: *I always put myself in their place and think, 'Well, yes, that's normal, I did that too.'… If they ask for advice, then I give it to them as an adult*.

In the next theme ‘emotions that support learning’, teachers identify specific emotions that facilitate the learning process. The majority of teachers said that positive emotions such as curiosity, interest, confidence, and joy are extremely beneficial. Teacher F noted that confidence makes learning more simple: *The most beneficial are positive emotions: interest, enjoyment. Then confidence appears, and learning becomes much easier*. Unexpectedly, a feeling of calmness emerged as a particularly important emotion for supporting learning, as was mentioned by Teachers C, D, and E. Teacher C said: *[The most useful state is] when you are calm and excited at the same time. Calmness is more like a neutral position. Because in this neutral position, you are most open, neutral, calm, and you absorb the most into yourself. Calmness and confidence*.

The theme of ‘emotional change over the learning process’ reveals how students’ emotions evolve throughout the course of workshops, from the teacher's perspective. It was observed that students’ emotions changed noticeably, reflecting a journey from initial lack of confidence and boredom to eventual engagement and pride. At the start, many students showed uncertainty, anxiety, or even hopelessness. Teacher B observed that while some students were puzzled at first, they gradually opened up: *At the beginning, students were confused, they couldn’t always understand what was happening, even the shyest students eventually came out of that state because of the relaxed atmosphere*. Additionally, half of the teachers (B, C, F) noted that by the end of the course, many students felt proud of their progress and the work they had produced. Teacher C told this: *At the beginning, I saw boredom in some students, but gradually it turned into satisfaction. By the end of the course, I saw pride.* Furthemore, group dynamics were changing as well. Teachers noted a positive shift by the end of the course. Students began to collaborate more freely and support each other. Teacher B said that he encouraged this “dream team” feeling from the very beginning: *I try to build such an environment where students interact with each other, and my work goes easier because of that, then they also try to help each other*.

Discussion

This chapter will discuss the findings of this study. For the clarity, this interpretation will be done according to the research questions for this study.

RQ1. In the first research question the aim was to find out which epistemic emotions students experience in an informal learning environment, specifically in UA-Teens.

The results revealed that students at UA-Teens predominantly experienced positive epistemic emotions such as curiosity and interest. These findings resonate with existing research suggesting that epistemic emotions play a crucial role in knowledge construction, curiosity-driven learning, and cognitive engagement (Muis et al., 2018; Nerantzaki & Efklides, 2019; Pekrun et al., 2016). Curiosity, considered a core epistemic emotion, plays a vital role in motivating students to explore and resolve cognitive uncertainties (Litman, 2008). It is widely acknowledged as essential for cognitive growth, personal development, and sustained educational engagement. Similarly, interest supports focused attention and active involvement with learning materials or experiences (Sansone & Smith, 2000). This emotion is more likely to arise in environments perceived as both safe and challenging, where learners perceive novelty and complexity but also feel confident in their ability to cope. As a central component of intrinsic motivation, interest drives individuals to seek out new knowledge and experiences, often without the need for external incentives (Nerantzaki & Efklides, 2019). The low experience of negative epistemic emotions such as irritation and confusion suggests that informal environments like UA-Teens may buffer against emotional stressors often found in formal academic settings. Lee and colleagues (2023) argue that informal learning contexts, which encourage autonomy and exploration, provide a conducive environment for positive epistemic emotions to flourish, supporting deeper engagement and idea generation. This aligns with the current study's findings, where participants reported a relaxed yet stimulating learning atmosphere.

RQ2. In the centre of the second research question were the influence of formative assessment on learners' achievement emotions.

In terms of achievement emotions, students predominantly reported positive feelings like enjoyment, hope, and pride, consistent with the control-value theory's assertion that these emotions promote engagement and motivation (Pekrun, 2006; Pekrun & Linnenbrink-Garcia, 2014). However, the significant increases in shame and hopelessness suggest that while formative assessment fosters positive emotions overall, it may also elevate negative emotions under certain conditions. Increase in shame after course may reflect a complex interplay of emotional and motivational factors. Research has identified shame as a central negative affective response, often linked to fear of failure (Pekrun et al., 2010). Although, some studies also suggest that shame, under certain conditions, can serve as a catalyst for increased motivation. Turner and Schallert (2001) demonstrated that students experiencing shame after negative feedback became more determined to achieve academic goals, provided they maintained confidence in the attainability of those goals. In the context of informal learning at UA-Teens, the rise in shame might be attributed to heightened self-awareness when students confronted challenges or received critical formative feedback. While this could momentarily diminish engagement, it may also, for some, reinforce commitment to future goals and improvement (Pekrun et al., 2010). Therefore, the impact of shame on learning is nuanced, as it can either impede or promote motivation depending on how students interpret feedback and assess their own capabilities.

Hopelessness, unlike activating emotions such as anxiety or anger, tends to suppress both intrinsic and extrinsic motivation, undermining cognitive performance and engagement (Pekrun et al., 2010). Although less frequently discussed in the literature, hopelessness has been consistently linked to negative outcomes in academic motivation, study behavior, and achievement. It is also possible that external stressors, such as academic pressures from school tests around April before spring break (when the study was conducted) or distressing news related to the ongoing war, may have worsened these feelings of hopelessness.

The findings at UA-Teens suggest that despite the overall positive emotional climate, some students may have experienced setbacks or unsatisfied expectations that contributed to feelings of shame or helplessness. This underscores the need for carefully structured feedback and support systems in informal learning spaces, as even minor increases in hopelessness can disrupt students' confidence and willingness to engage with future learning tasks.

RQ3. The third research question focused on teachers' perspective of perceiving and supporting students' emotions.

The findings from the interviews with teachers at UA-Teens have shown a detailed understanding of how emotional experiences are managed and supported in informal learning environments.

External stressors, including the ongoing war and personal challenges, had an impact on students' emotional states, however, with learning activities and teachers' support students can 'escape' difficult reality and just enjoy their studies. It means that UA-Teens informal learning environment together with teachers can provide a buffer role against external stressors and promote positive emotional engagement (Pekrun, 2006).

The interviews revealed that teachers actively foster a positive emotional climate. Their strategies included check-ins, humor, empathy and focusing on students' strengths. In UA-Teens education is facing the shift from teacher-centered to student-centered learning with emphasis on emotional safety, collaboration and inclusion(Jennings & Greenberg, 2009; CASEL, 2020). Teachers provide emotional sensitivity, high adaptability and individualisation in their approach, balancing content delivery and emotional support. It was shown that by improving a positive atmosphere, teacher-student relationships empower students' engagement and emotional stability, which play an immense role in informal learning (Fredrickson, 2001; Meyer & Turner, 2002).

This research revealed teachers' focus on calmness as a foundational emotion for effective learning. Teachers also highlight positive emotions as curiosity, interest, joy, and confidence as critical for sustaining motivation and focus (Meyer & Turner, 2002). What is also important, that workshop leaders actively cultivate these emotions through encouragement, empathy, and positive reinforcement, demonstrating a deep understanding of the connection between emotions and learning.

Teachers' mentioned the dual challenge of controlling their own emotions while supporting their students. Some teachers expressed feelings of exhaustion and burnout, consistent with literature on emotional resilience and teacher well-being (Sutton & Wheatley, 2003). To navigate these challenges, teachers employed strategies like humor, relatability, and active listening, aligning with emotionally responsive teaching practices (Jennings & Greenberg, 2009; CASEL, 2020).

Students' emotions evolved dynamically over the course of the workshops, transitioning from initial anxiety and confusion to curiosity, satisfaction, and pride. This progression aligns with the broaden-and-build model (Fredrickson, 2001), emphasizing how learning activities foster positive emotions. Teachers noted that a positive atmosphere, supportive feedback contributed to students' emotional growth. While moments of frustration or disengagement occurred, these were typically temporary. The overall shift from apprehension to confidence underscores the critical role of emotional support.

Conclusion

In this study epistemic and achievement emotions in an informal educational learning environment UA-Teens were discovered, with the focus not only on students' but also teachers' perspective.

Quantitative results have shown predominance of students' positive epistemic emotions emphasising engagement and interest in connection to this institution and learning activities. Same pattern was observed in achievement emotions with a slight increase in negative emotions as shame and hopelessness was observed after the course. While formative feedback is beneficial for learning, it can also evoke emotional tension.

Teachers' interviews' qualitative findings highlighted the importance of educators' role in perceiving and supporting students' emotions. UA-Teens teachers use formative assessment, personalised feedback, empathy and creating a positive, safe environment.

There are few limitations of this study that should be addressed. The sample size was small and specific to UA-Teens, an informal educational centre in Lviv, Ukraine. This could limit general applicability of the findings from this research to other educational institutions or populations. Part of this study was based on self-reported data from questionnaires, so it could be affected by inaccuracies in recalling emotional experiences or social eligibility bias. Moreover, the length of study was only one month, which can be not enough to understand the pattern of emotions change. Limitations above show the need for further research with exploring long-term emotional impact of formative assessment and teachers' influence and comparison of formal and informal educational settings.

Acknowledgements

I would like to thank my supervisor Katrin Saks, for supporting and guiding me throughout the thesis writing process. Also I am grateful to Emanuele Bardone, who believed in me from the very beginning and supported me in times of need. Many thanks to my colleagues, cohort 2024-2025 of EdTech Masters' program, for their helpfulness and encouragement. Moreover, I would like to thank all UA-Teens staff, who allowed me to conduct the research and who participated in the research personally. Last but not least, I am deeply thankful to my dearest friends and my family for unconditional support.

Author's declaration

I hereby declare that I have written this thesis independently and that all contributions of other authors and supporters have been referenced. The thesis has been written in accordance with the requirements for graduation theses of the Institute of Education of the University of Tartu and is in compliance with good academic practices.

Marharyta Martemianova 31.05.2025

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Appendices

Appendix A. Epistemic Emotions Questionnaire (adapted from Pekrun et al., 2016)

Instruction

Hello! We are interested in learning about the emotions you feel (or have felt) during your learning experience at UA-Teens. This survey is anonymous. For each emotion, please indicate its intensity by selecting the number that best describes the strength of your emotional reaction during learning at UA-Teens. (where 1 = not at all, 2 = very little, 3 = moderate, 4 = strong, 5 = very strong). Thank you!

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1. Curious (Do you experience spontaneous or easy interest, wanting to learn more?)
   (1 - Not at all, 5 - Very strongly)
2. Bored (Do you feel bored during the workshops?)
   (1 - Not at all, 5 - Very strongly)
3. Confused (Do you feel confused or unable to understand something or the situation?)
   (1 - Not at all, 5 - Very strongly)
4. Surprised (Does some information evoke unexpected or sudden emotional reactions?)
   (1 - Not at all, 5 - Very strongly)
5. Interested (Do you have a deeper, lasting interest that might lead to action?)
   (1 - Not at all, 5 - Very strongly)
6. Anxious (Do you feel worried, nervous, or stressed about workshops, results, deadlines, or overall learning at UA-Teens?)
   (1 - Not at all, 5 - Very strongly)
7. Frustrated (Do you feel disappointed because something didn’t go as you wanted?)
   (1 - Not at all, 5 - Very strongly)
8. Inquisitive (Do you like learning new things, having a strong interest in knowledge at UA-Teens?)
   (1 - Not at all, 5 - Very strongly)
9. Dull (Do you feel indifferent, like your emotions are “numb” with no vivid feelings?)
   (1 - Not at all, 5 - Very strongly)
10. Amazed (Do you feel excited or uplifted when something seems unexpected, incredible, or amazing?)
    (1 - Not at all, 5 - Very strongly)
11. Worried (Do you feel worried or scared about something, such as stress about future events or learning at UA-Teens (usually long-term))
    (1 - Not at all, 5 - Very strongly)
12. Happy (Do you feel joy, positive emotions, satisfaction from learning?)
    (1 - Not at all, 5 - Very strongly

13. Muddled (Do you feel overwhelmed with information, tired, or lacking clarity?)
(1 - Not at all, 5 - Very strongly)
14. Irritated (Do you feel irritation, dissatisfaction, or emotional tension due to learning?)
(1 - Not at all, 5 - Very strongly)
15. Monotonous (Does learning feel monotonous, unchanging, causing boredom or fatigue?)
(1 - Not at all, 5 - Very strongly)
16. Excited (Do you feel enthusiastic, joyful, or thrilled about something pleasant or important?)
(1 - Not at all, 5 - Very strongly)
17. Astonished (Do you experience surprise or shock when seeing or learning something unexpected and impressive, positive or neutral?)
(1 - Not at all, 5 - Very strongly)
18. Dissatisfied (Are you dissatisfied with the workshop or overall learning because it did not meet your expectations?)
(1 - Not at all, 5 - Very strongly)
19. Nervous (Do you feel nervous before workshops or about learning (usually short-term))
(1 - Not at all, 5 - Very strongly)
20. Joyful (Do you feel genuine, uplifting joy or excitement from learning?)
(1 - Not at all, 5 - Very strongly)
21. Puzzled (Do you experience momentary surprise or confusion when something seems illogical or difficult?)
(1 - Not at all, 5 - Very strongly

Appendix B. **Achievement Emotions Questionnaire (AEQ): Scales and Sample Items**
(from Pekrun et al., 2011)

Class-related emotions

1. Enjoyment: I enjoy being in class.
2. Hope: I am confident when I go to class.
3. Pride: I am proud of myself.
4. Anger: I am angry.
5. Anxiety: Thinking about class makes me feel uneasy.
6. Shame: I get embarrassed.
7. Hopelessness: I feel hopeless.
8. Boredom: I get bored.

Learning-related emotions

1. Enjoyment: I enjoy acquiring new knowledge.
2. Hope: I have an optimistic view toward studying.
3. Pride: I'm proud of my capacity.
4. Anger: Studying makes me irritated.
5. Anxiety: I get tense and nervous while studying.
6. Shame: I feel ashamed that I can't absorb the simplest of details.
7. Hopelessness: I feel hopeless when I think about studying.
8. Boredom: The material bores me to death

Appendix C. **Questions for teachers' interviews**

1. How important do you think emotions are in students' learning processes? Why?

2. Which emotions do you believe are most beneficial for learning, and why?

3. What kind of achievement emotions (e.g., pride, frustration) have you observed in students during informal learning activities?

4. Is it important for teachers to actively support students' emotional well-being in learning environments? Why? How do you support or respond to these emotions in informal learning contexts?

5. What challenges do you face when trying to foster a positive emotional climate?

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