

ORIGINAL RESEARCH

Achievement emotions within simulation in baccalaureate nursing education—A mixed methods study

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ABSTRACT

Objective: Simulation-based training equips students to meet the increasing demands of healthcare. While these trainings positively impact learning, the emotions experienced during simulations can influence these in learning outcomes. Achievement emotions, which are closely linked to academic performance, are considered to affect learning but have been underexplored in the context of simulation-based nursing education. Therefore, this study investigated the achievement emotions nursing students experience during simulation training and analyzed how they describe these emotions.

Methods: A concurrent mixed-methods design was used. The Achievement Emotions Questionnaire was administered to a sample of nursing students (n = 101) assessing their emotions during simulation training. Additionally, 31 problem-centered interviews were conducted to delve deeper into the students' emotional experiences. Quantitative data were analyzed using IBM SPSS Statistics Version 28, while qualitative data were analyzed using content analysis following Kuckartz methodology, utilizing MAXQDA (Version 24.2.0) for coding and analysis.

Results: Nursing students reported a range of achievement emotions, with positive emotions like enjoyment, pride, and hope scoring higher than negative emotions, such as boredom, hopelessness, and shame. Notably, anxiety levels were comparable to those of the positive emotions. Significant emotional shifts were observed during the simulation training. However, while quantitative data indicated a decrease in shame, interviews revealed students still felt shame after simulation, especially when knowledge gaps were exposed. Qualitative findings suggest that students' experience with simulation, the debriefing process, the training design, and their role in the simulation influence the achievement emotions experienced.

Conclusions: The dynamic nature of achievement emotions during simulation training calls for further research to better understand their complexity. The discrepancy regarding shame between quantitative and qualitative findings also requires more investigation. Nursing educators should consider achievement emotions in simulation design, as factors like training structure influence students' emotional experiences.

Key Words: Achievement emotions, Baccalaureate nursing education, Simulation training, Nursing education

1. INTRODUCTION

The growing demands in the healthcare sector, including the increasing prevalence of multimorbidity, challenging systemic conditions, and the inherent complexity of the health-

care system, necessitate a wide array of skills and competencies from healthcare professionals. Through critically reflected actions, diverse situations must be effectively managed to ensure patient safety and maintain the quality of

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care.^[1] Therefore, students must be thoroughly prepared through both theoretical and practical training to meet the high-quality care requirements for future patients. This goal can be achieved through real and interactive learning strategies,^[2] one of which is simulation. Students participate in the simulation training either as active participants or as passive participants (observers). Simulation training is characterized by a realistic learning environment that allows trainees to practice complex actions of everyday professional practice in a protected setting. Before successfully engaging in simulation training, students must receive theoretical input and skills training to achieve positive outcomes.^[1] The next step is the simulation training itself, where two students actively participate in the scenario while the rest observes from the debriefing room, using clearly defined criteria. The final stage of the simulation training is the debriefing, conducted immediately after the scenario, which is the most crucial part for student learning. Feedback and discussion with observers facilitate reflection on performance, thereby enhancing learning outcomes.^[1]

In recent years, there has been a significant increase in simulation-based teaching throughout health professional education.^[3-7] Simulation is described as a teaching method that creates or replicates specific real-life situations to mimic everyday challenges as closely as possible.^[8] Various forms of simulation training exist (low, middle, or high-fidelity simulation) and must be tailored to the training requirements. Low fidelity involves a low degree of complexity in the training,^[1] while high fidelity simulation utilizes computer-based patient simulators that can replicate authentic clinical situations.^[9] The benefits of using simulation training in nursing education have been well documented. Critical thinking, interdisciplinary collaboration, teamwork, and practical skills are promoted. Additionally, students often experience increased self-esteem and satisfaction with their learning.^[10] Feedback from students also indicates that simulation training is enjoyable and highlights learning success. The opportunity to practice typical actions in a protected setting and to train skills and scenarios unfamiliar to students are significant advantages of simulation.^[4] This is facilitated by the security of a protected learning environment where mistakes are permitted and even encouraged.^[1]

Despite the positive aspects, barriers to effective simulation-based education can arise, preventing the achievement of desired learning outcomes. These barriers may include time constraints, increased workload, lack of resources (staff, finances, structure), or the absence of curricular integration of simulation trainings.^[3] Incorrect application of the teaching method can also lead to undesirable results. Therefore,

the degree of abstraction and complexity of training scenarios must be adapted to the students' training level before each session to avoid overwhelming them.^[1] Another critical aspect of simulation research is the predominant reliance on self-report and subjective evaluations to assess learning outcomes. This raises questions about the effectiveness of simulation-based training, as there is no consensus on how to measure learning comprehensively.^[4]

Emotions, in general, can either facilitate or hinder the learning process. The perception of emotions can be categorized as either positive or negative. Positive emotions, such as joy, hope, pride, and excitement, are typically experienced as pleasant. In contrast, negative emotions, such as fear, stress, anger, shame, and hopelessness, are generally perceived as unpleasant. It is important to emphasize, however, that positive emotions do not invariably promote learning. Rather, the impact of emotions on learning is context-dependent. Notably, negative emotions can also be harnessed productively; for instance, less intense forms of anxiety, self-directed anger, and shame may enhance learning if students feel confident in their ability to resolve challenging situations.^[11] Additionally, research indicates that emotions can be differentiated based on their stimuli and whether they are activating or deactivating. Emotions can also be classified into various categories, such as achievement emotions, epistemic emotions, topic emotions, and social emotions.^[12] Moreover, emotions exhibit both universal characteristics and individual variability, highlighting the importance of avoiding stereotypes in their general description.^[11] Students often describe simulation as frightening, nerve-wracking, and anxiety-inducing. Additionally, they report feeling threatened by observers' performance evaluations and experiencing a high fear of failure in front of peers.^[13] According to LeBlanc (2019), this 'fear of failure' can also serve as extrinsic motivation, potentially enhancing participants' learning.^[14] Studies have demonstrated that anxiety can lead to greater learning success and better preparation for the stress levels encountered in clinical practice.^[15-17] An integrative review conducted by Maadsgard et al. (2022) indicates that students experience a range of emotions, from anxiety to excitement, joy, and pride, during simulation. These results illustrate that emotions during learning are dynamic, with students experiencing both positive and negative emotions.^[18] Active participants in simulation training tend to exhibit higher levels of stress and anxiety compared to observers.^[19]

Achievement emotions, which are discussed in the context of learning, teaching, and academic performance, are described as being directly related to the achievement activity or outcomes. The control-value theory differentiates achievement

emotions into activity emotions (e.g., enjoyment, frustration, boredom) experienced during achievement activities, and outcome emotions (e.g., joy, hope, pride, anxiety, hopelessness, shame, anger) related to achievement outcomes. Students' academic emotions stem from control-related and value-related appraisals and can be classified in terms of their valence (positive or negative), degree of activation (activating or deactivating), and object focus (activity or outcome).^[20] These dimensions result in a three-dimensional taxonomy (valance, activation and object) of achievement emotions (see Figure 1).

Object Focus	Positive ^a		Negative ^b	
	Activating	Deactivating	Activating	Deactivating
Activity	Enjoyment	Relaxation	Anger Frustration	Boredom
Outcome/ Prospective	Hope Joy ^c	Relief ^c	Anxiety	Hopelessness
Outcome/ Retrospective	Joy Pride Gratitude	Contentment Relief	Shame Anger	Sadness Disappointment

^aPositive = pleasant emotion.
^bNegative = unpleasant emotion.
^cAnticipatory joy/relief.

Figure 1. A three-dimensional taxonomy of achievement emotions^[20]

As example hopelessness felt from the student before a simulation because of a hard scenario would be marked as negative, deactivation outcome related achievement emotion whereas joy during the simulation because it works well would be considered a positive, activating outcome-related achievement emotion. Different expectations are presumed to trigger different achievement emotions. For instance, enjoyment is enhanced by high perceived competence and positive task-related beliefs, whereas anxiety is increased when students perceive low control over success and failure, combined with a high perceived value of the task.^[20] Literature also shows that debriefing strategies (peer led but also instructor led) are necessary to strengthen positive achievement emotions.^[21] Although achievement emotions have been investigated in other contexts, studies focusing on these emotions in the context of simulation-based education are scarce, particularly regarding the emotions nursing students experience before, during, and after simulation.^[18] Studies on medical students suggest that they perceive complex emotions during simulation training,^[22] and these emotions do not significantly differ before, during, and after the simulation.^[23] These findings can be utilized to increase awareness of the intense emotions experienced by students even prior to simulation and to adapt scenarios to the students' emotional states to enhance their learning.^[22] Hence the purpose of the study was to examine the achievement emotions experienced by baccalaureate nursing students during their simulation training.

2. METHODS

The main objectives of this study were to (1) investigate the achievement emotions experienced by baccalaureate nursing students before, during, and after simulation and (2) to gain a deeper understanding of these emotions experienced by the nursing students. To address these objectives following research question was formulated:

- Which achievement emotions do baccalaureate nursing students experience before, during and after simulation training and how do they describe those experienced emotions?

2.1 Study design

Because the research question could not be answered with a single paradigm,^[24] a mixed methods approach was employed to gain deeper insights into the emotions students experience throughout the whole simulation training process.^[25] Given the complexity of the phenomenon, a mixed-methods study provides a more detailed explanation.^[26] A convergent parallel (concurrent) design was used to obtain complementary data to answer the research question^[25] to be able to capture the emotions experienced by nursing students during simulation training and to explore how they describe the achievement emotions felt. A questionnaire survey was conducted to gather information from a larger group of students, while interviews were conducted to gain deeper insights into the emotions experienced by nursing students during the simulation training. Because both paradigms are equal in the chosen design quantitative and qualitative data are analyzed separately and the integration occurs within interpretation.^[25] This was deemed appropriate because the design should help to strengthen the understanding of the complex phenomenon of achievement emotions within simulation trainings.

2.2 Study setting and description of the simulation training

The investigation was conducted at a University of Applied Sciences in Austria with students enrolled in the three-year bachelor's degree in nursing. Throughout all semesters, students participate in theoretical courses, skills trainings, simulation trainings, and clinical placements. Approximately 100 students annually commence the nursing program. For this study, third-semester students with prior experience in simulation training were invited to participate.

The simulation training began with a briefing to familiarize the students with the setting and help them orient themselves. Subsequently, students either volunteered for the active role in the scenario or were selected by the lecturers if no one volunteered. Due to the multiple simulation trainings within a semester, every student assumes an active role at least once.

In this training the learning objectives were to correctly take a blood sample via central venous catheter and pass it appropriately to the laboratory as well as maintain proper communication with the patient while taking the blood sample. After simulation training debriefing was done using the Debrief Diamond.^[27] The simulation training sessions were always accompanied by two full-time lecturers (IW and KR). Two students actively completed the simulation trainings, while the other students of the group were in a separate room with one of the lecturers observing the scenario and taking a passive role within the simulation.

2.3 Quantitative component

2.3.1 Population and sampling

For the quantitative component of the study all third-semester students ($n = 103$) enrolled in the bachelor's nursing program at a University of Applied Sciences in Austria were invited to participate in the research by the lecturers overseeing the simulation training. 89.1% of the participants were female and 10.9% of the participants male with a mean age of 22.6 years.

2.3.2 Data collection

Data was collected in December 2022 where the simulation trainings took place for the nursing students of the third semester before, during and after the simulation trainings using the Achievement Emotions Questionnaire (AEQ). As self-reported instrument it was designed to measure student's achievement emotions in various academic settings.^[28] Permission was obtained by the authors prior using the questionnaire. The AEQ consists of three sections measuring class-related, learning-related, and test-related emotions which can be used together or singly. Furthermore, besides measuring students' typical achievement emotions experienced at university it can also be used to measure course-specific emotions,^[29] which fits into the current investigation were achievement emotions of nursing students in simulation training should be examined. The questionnaire contained eight achievement emotions: enjoyment, hope, pride, anger, anxiety, shame, hopelessness, and boredom including 68 items with response options ranging from (1) strongly disagree to (5) strongly agree.^[28] Achievement Emotions were measured at three measurement points: t0 (directly before simulation training), t1 (directly after the scenario) and t2 (directly after debriefing). The eight scales were given as following: hope (t0 & t1), pride (t1 & t2), shame (t1 & t2), anxiety (t0 & t1), boredom (t1), hopelessness (t0, t1 & t2), anger (t0, t1 & t2) and enjoyment (t0, t1 & t2). Collection of the data was obtained via Lime Survey online survey tool, whereby the link to the survey was distributed to the students by the lecturers of the simulation training via email. 101 out of 103

nursing students filled out the online questionnaire, which results in a very high response rate of 98.06%.^[30]

2.3.3 Data analysis

Data was analyzed using IBM Statistics Version 29 (IBM Corp.). Shapiro Wilk's Test was used for testing the normal distribution of the AEQ scales.^[31] Descriptive statistics of the overall scales (t0, t1, t2) were used to calculate the means and standard deviation. Cronbach's alphas of the Emotion indexes were calculated. Since the data deviated significantly from a normal distribution (except hope at t0) nonparametric tests were used for data analysis. Changes in achievement emotions between two measurement points were tested using the Wilcoxon test, and the Friedmann test was used for three measurement points.^[2] Significance level was set at 5%. Bonferroni correction (α/k) was applied in multiple testing.^[32]

2.4 Qualitative component

2.4.1 Population and sampling

For the qualitative component all nursing students who actively took part in the simulation training ($n = 32$) were invited to take part in the semi-structured interviews. Ultimately 31 nursing students participated in the interviews (26 women and 5 men). The participants' ages ranged from 19 to 30 years. The mean age of the students participating in the interviews was 22.9 years. 83.9% were female and 16.1% male. Table 1 presents the sociodemographic variables of the participants.

2.4.2 Data collection

In December 2022 (after the simulation trainings) MB, AM and VP conducted 31 problem-centered interviews to delve deeper into the experienced achievement emotions of the nursing students during the simulation trainings. This interview method was chosen because of its ability to combine inductive and deductive approaches, which facilitates the exploration of a personal view on a specific subject area.^[30,33] The average time of the interviews was 10 minutes, with a range from 10 to 20 minutes. The semi-structured interview guide (see Table 2) was developed by KR, AM and VP adhering to the five-phase framework by Kallio et al. (2016).^[34] This framework contains of the identification of prerequisites for using semi-structured interviews, the integration of existing knowledge, the formulation of a preliminary guide, pilot testing and the presentation of the complete guide.^[34] The questions for the semi-structured interview guide were developed deductively out of the literature by Pekrun et al. (2017).^[35] For pilot testing internal testing within the research team was chosen, ensuring that the interview guide contained all necessary aspects for answering the research question. Internal testing was done by IW and MB. In these

stage three questions were modified because of lack of clarity. Different measures were taken to minimize bias in data collection and to enhance data quality.^[36] The interviewers did not participate in the simulation training sessions to ensure an appropriate interview rapport between interviewers and interviewees. The rationale for this decision was to minimize the risk of interviewers influencing interviewees through excessive familiarity and to promote open and honest communication.^[30] This approach was deliberated by the research team, acknowledging the possibility that emotions could be triggered during the debriefing process. The aim was to prevent any potential barriers to students' honest reporting of their experiences.

Table 1. Sociodemographic variables of the participants

Participant number	Sex	Age
SONO6	female	21
ANMÄ2	male	27
ALFE1	female	20
ALJU3	female	23
ALMA7	female	19
BADE1	female	28
BIAU5	female	24
CIJU2	male	30
ELOK3	female	23
SAMÄ7	female	21
CLAP2	female	19
EMJÄ1	female	21
FELIX	female	23
HEAU5	female	21
BAMA3	female	27
INOK2	female	21
MEJU1	female	20
MOAU7	female	21
SAJU5	female	21
LOTTA	female	22
REFE3	female	21
SAFE2	female	21
KAJU1	male	20
INFE7	female	19
GIJÄ1	male	20
GEMÄ1	female	28
ANJU1	female	25
SAMA1	female	20
SANO3	female	26
MESE1	male	26
LUDE1	female	22

Secondly the interviews were audio-recorded and transcribed

verbatim.^[30] Another measure was that data were securely stored on a password-protected computer and only accessible to the study's authors. Last data collection was continued until data saturation was achieved. Redundancy in the last interviews led to the consensus among the authors that no further interviews were required.^[30] To be able to comprehend interview situations or possible disturbances field notes were taken by AM, VP and MB during the interviews.^[30]

2.4.3 Data analysis

Data were transcribed verbatim and anonymized by IW, KR, VP, AM and MB using MAXQDA Network 24.2.0. The transcription rules established by Kuckartz et al. (2008) were used transcribing the interviews.^[37] Data were analyzed through qualitative content analysis, as described by Kuckartz, which is suitable for exploring human experiences with limited prior research,^[38] which makes these analysis fit for the investigation of achievement emotions nursing students experience before, during and after simulation trainings because for this part research is missing. Content analysis by Kuckartz follows seven stages: 1) initiating text work, 2) developing main categories, 3) first coding process using main categories, 4) developing sub-categories, 5) second coding process using sub-categories, 6) data analysis and 7) documentation of the results and analyzation process.^[38] In stage one familiarization with the data leads to a hermeneutic understanding of the data.^[38] This was reached through KR, VP and AM reviewing the transcripts and noting case summaries and memos for each interview. Main categories were developed in stage two of the process by KR, VP and AM deductively from the research question and the interview guide.^[38] Three main categories were developed deductively out of the interview guide (achievement emotions experienced during simulation; factors influencing the achievement emotions; influences of the achievement emotions on the performance). In stage three KR, VP and AM coded the transcripts according to these main categories.^[38] After those sub-categories were developed in stage four, using an deductive and inductive approach.^[38] 18 sub-categories were created by KR, VP and AM, with 8 sub-categories formulated deductively out of the interview guide describing the achievement emotions and 10 sub-categories emerging inductively out of the transcripts, mentioning influencing factors on achievement emotions and their influence on the performance. In stage five the whole data were coded according to the sub-categories.^[38] KR, VP and AM developed a coding scheme to ensure quality of categorization. To ensure reliability in the coding process all authors (IW, KR, VP, AM and MB) coded the data independently and then discussed any discrepancies until consensus was reached.^[38] For optimizing scientific rigor, four rigor criteria for trustworthiness by Lincoln and Guba (1985) were

used.^[39] To ensure trustworthiness in qualitative research measures to establish credibility, dependability, confirmability and transferability are required.^[39] Measures ensuring credibility were research triangulation through independent data analysis and following consensus discussion on the categories. Furthermore, methods triangulation through the mixed methods design was used to deepen the understanding of the phenomenon.^[39,40] To guarantee transferability a thick description of data was done by detailed description of the study's context and maintaining transparency throughout the research process.^[39] In addition awareness of the researchers' positions, which could influence the research process and findings, was considered.^[39] All authors were aware of potential influences on data collection, including follow-up questions due to familiarity with the field because of their role as nurse lecturers in the nursing program the study was carried out. Therefore, the interviews only were held by MB, AM and VP who didn't take part on this simulation trainings examined. Dependability was gained through data triangulation, which enables to show complementary aspects of the examined phenomenon.^[39] In addition quality in data collection was ensured by reflection the first five interviews by AM and VP to critically reflect on the interview situations. To strengthen confirmability standardized methods in coding and analysis were used^[39] by formulating a detailed inter-

view guide, creating transcripts and formulating a coding scheme. Furthermore, anchor examples from the interview data were presented to show a deeper understanding of the participants' statements.

2.5 Ethical considerations

All participants provided written informal consent and took part in the study voluntary. They received no financial or other incentives for their involvement in the study. To ensure anonymity, the interviews and questionnaires were coded using pseudonyms.^[30] Approval for carrying out the study was obtained by the rector of the University of Applied Sciences. Ethical approval was obtained by the Ethics Committee of the Province of Carinthia following their review of the ethics proposal (EK number: S2022-23).

3. RESULTS

3.1 Quantitative results

Positive emotions enjoyment, hope and pride scored highest overall measurement points, whereas most of the negative emotions (anger, shame, hopelessness, and boredom) had neutral to low scores. Only anxiety also scores as high as positive emotions. Table 3 shows an overview of the students' responses.

Table 2. Semi-structured interview guide

Question number	Question
1	Can you describe how you felt during simulation?
2	What emotions did you feel during the simulation? How would you describe them (consider all phases of the simulation - the briefing, the scenario, and the debriefing)?
3	What situations or actions triggered the emotions you described? Can you elaborate on this?
4	In your opinion, what role do emotions play in simulation training?
5	Take a look at the Emotion Compass with the Achievement Emotions listed - is there another emotion that you have experienced and not yet mentioned?
6	How do the emotions experienced influence their performance in simulation training?
7	Are there emotions (before, during and after the simulation training) that support or inhibit your performance?
8	Is there anything else you want to mention about emotions in the simulation training we haven't discussed in the interview?

Table 3. Achievement emotions experienced by nursing students in simulation training

Scale	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Mean	SD	Cronbachs Alpha
Enjoyment	0%	12%	47.5%	38.5%	2%	3.23	0.63	0.497
Hope	0%	7.2%	46.4%	42.3%	4.1%	3.47	0.61	0.494
Pride	0%	2.2%	19%	68.8%	10%	3.81	0.52	0.396
Anger	12%	58.6%	27.2%	2.2%	0%	2.21	0.58	0.389
Anxiety	0%	13%	34%	37%	16%	3.56	0.83	0.539
Shame	10.1%	31.3%	33.3%	20.2%	5.1%	2.75	0.94	0.616
Hopelessness	17.3%	57.3%	18.3%	7%	0%	2.10	0.69	0.543
Boredom	34.7%	50%	13.3%	2%	0%	1.85	0.68	0.199

*Scores values expressed as percentages; overall (1-5) as mean +/- SD and Cronbach alpha of the overall scale (over all measurement points)

There were significant differences in reported emotions before, during and after the simulation training. As shown in Figure 2, there were changes between the two measurement points in the scales shame, pride and hope. There was a significant decrease in the scale shame during and after simulation ($Z = -5.47; p < .001$). The scale pride has also significantly decreased between t1 and t2 ($Z = -5.02; p <$

$.001$). The scale hope showed a significant increase in the values between before and during the simulation training ($Z = -5.30; p < .001$). Only the scale anxiety didn't show significant changes between t0 and t1 ($Z = -0.42; p = .676$). The scale boredom is only measured at t1 (during simulation training) and shows a significantly lower mean value than the other scales.

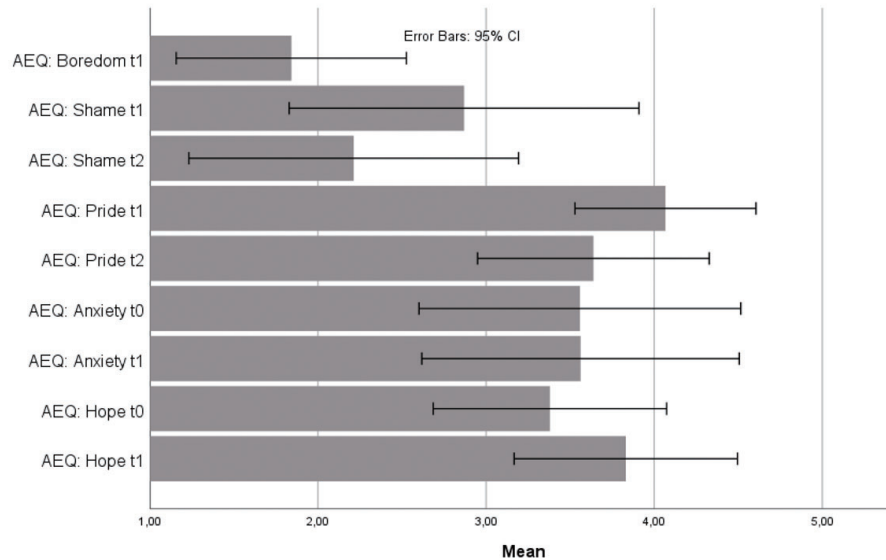


Figure 2. Means and standard deviation for the scales Boredom, Shame, Pride, Anxiety and Hope (two measurement points)

Figure 3 shows that Friedman test indicated significant results for all three tested scales. Hopelessness decreased significantly over the three measurement points ($\chi^2 = 18.95; p < .001$), as well as the scale Anger ($\chi^2 = 35.64; p < .001$).

The scale Enjoyment showed no linear course. While Enjoyment decreased during the simulation training, afterwards the highest expression showed up ($\chi^2=57.88; p < .001$).

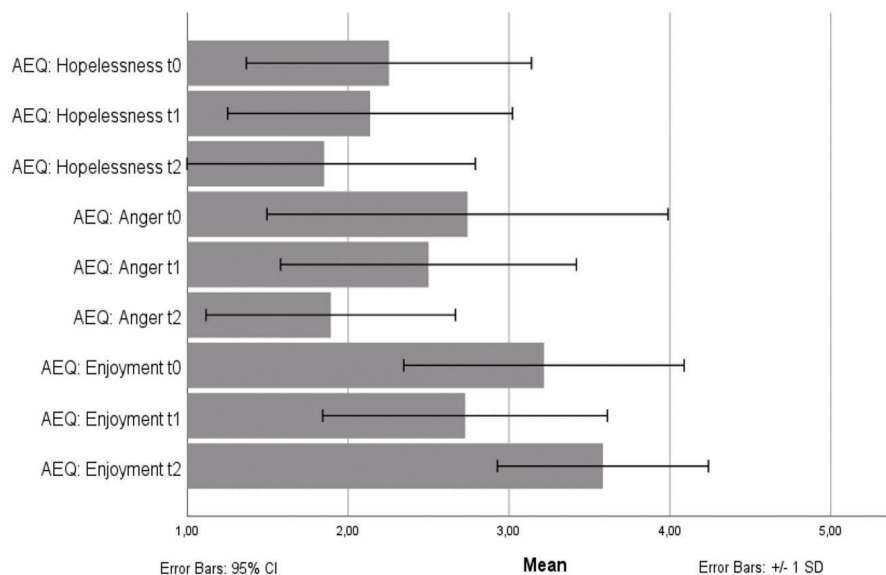


Figure 3. Means and standard deviation for the scales Hopelessness, Anger and Enjoyment (three measurement points)

3.2 Qualitative results

Data analysis showed three main categories and 18 sub-categories (see Table 4). Three major themes were identified: achievement emotions experienced by nursing students during simulation; factors influencing the experienced achievement emotions and influences of the experienced achievement emotions on the performance of the students.

3.2.1 Achievement emotions experienced during simulation training

When students discussed the achievement emotions they experienced, it became evident that simulation training elicited a wide range of emotions. Nursing students reported experi-

encing all types of achievement emotions during simulation training. Enjoyment, pride, shame, and anxiety were frequently mentioned by the students, whereas emotions such as hope, hopelessness, anger, and boredom were described by only a few participants. Students also reported that their emotions shifted over the course of the simulation training. Anxiety, in particular, was prevalent before the simulation, as noted by one nursing student:

“Yes, you’re just excited, you’re afraid of doing something wrong. Which case study do you get? Will I know everything from the lessons? Do I know that? Have I learnt that? (I: mmh) and then you’re just insecure (laughs).” (ALFE1)

Table 4. Main categories and sub-categories after data analysis

Main categories	Sub-categories
Achievement Emotions experienced during simulation training	Boredom
	Enjoyment
	Pride
	Hopelessness
	Hope
	Shame
	Anxiety
	Anger
Factors influencing the achievement emotions	From experience to inexperience
	From positive to negative attitude towards simulation training
	Success within simulation training
	Debriefing situation
	From active to passive role during simulation training
	Design of the simulation trainings
	Observation
Influence of the achievement emotions on performance	Enjoyment
	Pride
	Anger

While anxiety was predominantly expressed in the context prior to the simulation training, enjoyment and pride were most experienced during and after the simulation sessions.

“I’m proud of that and also of today. Although there were a few deficits, I think I was proud of myself for the fact that we didn’t go through this so often and I hadn’t seen it in practice before. That we managed that.” (ALJU3)

Shame was an emotion nursing students experienced in various situations during the simulation training. While some achievement emotions were only present before or during the simulation, shame was also reported by participants after the training sessions. Nursing students associated this emo-

tion with their perceived lack of knowledge and the concern that their peers would notice these gaps, as well as with the feeling of being observed during the training.

“[. . .] a bit embarrassing. Yes, that the others simply think she doesn’t know her way around at all.” (REFE3)

3.2.2 Factors influencing the AE

Another major category (factors influencing achievement emotions) emerged when participants discussed potential factors that could impact the occurrence of various achievement emotions within the context of simulation training. Factors such as prior experience or inexperience, attitudes toward simulation training, success during the simulation, the de-

briefing situation, taking an active or passive role in the training, the design of the training itself, and the experience of being observed were identified as influencing different achievement emotions (see Table 5).

Table 5. Achievement emotions and influencing factors

Main category	Subcategory	Influenced Achievement Emotion
External factors affecting the AE	From experience to inexperience	Boredom, hope, pride, enjoyment, anxiety, shame, hopelessness
	From positive to negative attitude towards simulation training	Enjoyment, anxiety
	Success within simulation training	Pride, enjoyment
	Debriefing situation	Pride, enjoyment
	From active to passive role during simulation training	Anxiety, pride
	Design of the simulation trainings	Enjoyment, anxiety, hopelessness
	Observation	Anxiety, shame

From experience to inexperience: Students expressed a reduction in their feelings of anxiety and hopelessness based on previous experiences during simulation training. One student explained *“Well, if you are/. If you’re often nervous and you’ve been in simulation training two or three times, I think the fear disappears a little. Before you go in again the next time. So, I think you already have that/. You’re used to the fact that you’ve always done well and then it’s fine.”* (KAJU1) In contrast, inexperience was described as factor of increasing anxiety, shame and hopelessness among nursing students. As one participant stated *“Sure, it’s uplifting, but then there’s also this huge uncertainty factor. This fear factor. Um, I now have a case where I have a skill, um, to use, that I really only did once a year ago at/. So in the skills lab and never had anything to do with it before. So, in the meantime I’ve simply had nothing more to do with it. Neither in the internship nor once, um, even practiced. That’s also this big uncertainty factor.”* (GEMÄ1)

From positive to negative attitude towards simulation trainings: The own attitude concerning simulation trainings and the motivation in taking part in the simulation also were mentioned as factors influencing the achievement emotions experienced during simulation. While a positive attitude towards simulation trainings were seen as factor enhancing enjoyment, a negative attitude related to a greater level of anxiety by the nursing students. As one student mentioned *“So, if you just go in without any preconceptions and get involved right from the start, then I think the whole thing is just easier, because you really only put yourself under stress. [...] So I think if you are more open, maybe with a bit more joy it’s kind of fun. To be honest, before the first time I didn’t think it would be fun, but now that you’re inside it’s just kind of fun. If you go in there with joy, it is ok.”* (ALMA7)

Success within simulation training: Success in simulation training was associated with feelings of pride and enjoyment

among the nursing students. Several participants noted that successfully resolving a situation during the training led to these emotions. As MOAU 7 described *“Well, I have to say I was proud that we both did well. That we managed it well. [...]”*

Debriefing after simulation training: Not only success in the simulation, but also the debriefing situation, could impact the achievement emotions experienced during the training. Although anxiety was prevalent before the scenario, positive feedback during the debriefing and the perception of personal progress triggered feelings of pride and enjoyment.

“Well, I was very pleased because a lot of positive things were said and that gave me the feeling that I knew Ok, I did, I realized for myself, ok, I still need to improve that, but I then realized that I understood the technical aspects and that the others actually saw what I had done well.” (CLAP2)

From active to passive role within simulation training: Nursing students rated the active role in the simulation trainings as anxiety-provoking, while the passive role was associated with less anxiety. Regarding the achievement emotion of pride, taking an active role was perceived as enhancing this emotion.

“But as an active participant, I don’t know, it’s the fear that’s in the foreground.” (BIAU5)

Design of the simulation trainings: Several design factors of simulation training were identified as influencing the achievement emotions of nursing students. Familiarizing students with the simulation lab and equipment, such as simulators, prior to the training was reported to reduce anxiety. Additionally, being informed in advance about the topics covered in the simulation was also described by participants as anxiety-reducing. Conversely, when the topics were not communicated beforehand, and students were unfamiliar with the lab and equipment, this was perceived as anxiety-inducing.

Furthermore, feelings of hopelessness were reported in the context of poorly designed simulation training.

“And um, I also think it’s good that we’ve now been sent the topics beforehand, for example, um, by email. Because that way I was able to read up again and prepare myself. Because otherwise I always had this, really, this feeling of hopelessness before every training, I would say. [...]” (MOAU7)

Observation: In the context of factors influencing achievement emotions, nursing students also discussed the impact of being observed during simulation training via the video system. Many students reported that the awareness of being observed heightened feelings of anxiety and shame, as noted by ALMA 7

“Maybe a bit of a feeling of shame again when you think like that or maybe you have it in the back of your mind from time to time ok the other 15 colleagues know that straight away, they would have known the answer straight away. And not that they now think she can’t do anything like that, so that’s when the cameras and the micro ok the others might know now” (ALMA7)

3.2.3 Influence of the AE on performance

Some participants also mentioned possible influences of AE on their performance. The performance emotion of ‘pride’ was mentioned by one participant in relation to their performance, with the statement carrying positive connotations. The individual suggested that the emotion of ‘pride’—following the successful completion of a simulation training—could positively influence performance in subsequent training sessions.

Mmm. It does influence you. Maybe that if you. (...) Well, you always hear positive things from your colleagues anyway, they always see that you have positive and negative points. And you always take the positive points for yourself, too. And if it goes well, you’re certainly proud of it and it influences the next simulation training, I think. (I: Yes) Because simply (...) yes, how should I put it, you, I don’t know, joy is perhaps the wrong word for it now, but you just think to yourself “okay, it wasn’t so bad last time either, then I’ll manage it this time too”. (I: Mhm). Yes. (SAJU5)

The performance emotion of ‘anger’ was mentioned twice in relation to performance, both with positive connotations. Both participants expressed the belief that the emotion of ‘anger’ enhances the learning effect for subsequent simulation training, leading to a reduction in mistakes.

I think that plays an important role, because (./). I mean, sure, if you make mistakes now, you do get a bit (annoyed?). But that’s healthy anger. Not getting so worked up about it,

but: “Okay, I might get so annoyed that I’ll do it differently next time.” Because if I go into it indifferent, then I’ll do the same thing again next time. And so the hope is that I/. “Okay, I’ve got a bit annoyed now (...) and it’s been addressed, and I’ll remember that for next time.” (ANJU1)

The performance emotion of ‘enjoyment’ was mentioned by three participants in relation to their performance, with all statements carrying positive connotations. The participants described feeling enthusiasm and enjoyment once immersed in the simulation situation, noting that this had a positive influence on their actions.

I: Are there emotions, um, that you know about yourself, where you say, um, yes, the emotions support my performance now and when I have the emotions, they tend to inhibit my performance. MOAU7: So, joy and knowing that you’re doing well or that it’s just right, that naturally has a positive influence on my actions. (MOAU7)

4. DISCUSSION

One of the key objectives of this study was to investigate the range of achievement emotions experienced by baccalaureate nursing students before, during, and after simulation training. The findings reveal that students experienced various types of achievement emotions throughout the simulation process. Positive emotions, such as hope, enjoyment, and pride, were the most frequently reported across all measurement points, while negative emotions, including anger, shame, hopelessness, and boredom, remained at neutral to low levels, as corroborated by both quantitative data and student interviews. These results align closely with previous research by Maadsgard et al. (2022) and Behrens et al. (2019), which also found higher levels of positive emotions in simulation training.^[17,22] However, a notable deviation from the existing literature was observed in the experience of the emotion ‘anxiety’. Unlike previous studies, which found anxiety levels lower than positive emotions,^[17] our study showed that anxiety scores were comparable to those of positive emotions. Anxiety was particularly prominent before the simulation training began, and its persistence through the training process highlights the need to address this emotion more thoroughly in future simulation designs. Qualitative data support this, as students frequently mentioned anxiety before simulation but did not emphasize it during or after training. This can be achieved by educators considering the following aspects when designing simulations. First, emphasis should be placed on creating a learning environment where mistakes are viewed as opportunities for growth rather than personal failures, as highlighted in the literature on simulation-based learning. Additionally, providing students with opportunities to prepare for the simulation, such

as informing them about the upcoming topics and reviewing theoretical concepts beforehand, can help reduce anxiety prior to the simulation training.^[1]

Another significant finding from this study was the change in achievement emotions throughout the stages of the simulation, except for anxiety, which remained constant across measurement points. This contrasts with the findings of Maadgard et al. (2022), who observed no significant change in achievement emotions over the course of the simulation.^[17] The fluctuation of emotions in our study points to the complexity and individuality of emotional experiences during simulation training. Furthermore, while quantitative data suggested a decrease in shame after simulation, the qualitative interviews revealed that students continued to feel shame, particularly when gaps in knowledge were exposed or when they felt overly observed during training. The observed differences in the data could be attributed to students potentially labeling emotions differently during the interviews. For educators, understanding the role of shame is particularly relevant, as it can hinder students' learning processes.^[11] Therefore, it is crucial to implement measures to reduce shame, such as fostering clear communication within the group, familiarizing students with the learning environment, and establishing well-defined communication and feedback roles. These roles should ensure that individual student performance is recognized and valued not only by nurse educators but also by peers. From the students' perspective, thorough preparation on the subject matter can enhance their confidence and provide a sense of security, which is essential for effective self-directed learning. This confidence can be further strengthened through simulation training.

The second objective of the study was to gain more in-depth insights into the factors that influence achievement emotions. Several factors were identified that shaped the emotional experiences of nursing students. A key factor in reducing anxiety was familiarity with simulation training—students who had participated in more simulations reported lower anxiety levels. In contrast, inexperience with simulations or unfamiliar tasks within scenarios tended to exacerbate anxiety. These findings align with previous research that links high anxiety levels to low control over the situation.^[19] Additionally, students' attitudes toward simulation training emerged as a critical determinant of their emotional experiences. A positive attitude was associated with greater enjoyment, while a negative attitude was linked to higher anxiety levels. This is a novel finding, as the role of attitude in shaping achievement emotions has not been extensively explored in prior simulation-based education studies. Success in simulation training was another factor that influenced achieve-

ment emotions. Students reported experiencing pride and enjoyment when they successfully completed a simulation, reinforcing the idea that positive outcomes lead to positive emotional responses. This observation is consistent with the "ceiling effect" of positive emotions described by Behrens et al. (2019),^[22] where students with high performance levels tend to experience more positive emotions. Additionally, the role students assumed during the simulation played a significant role in their emotional experience. Active participants reported higher levels of anxiety compared to observers, a finding consistent with prior research.^[18] Active participation in simulations is perceived as more anxiety-provoking, likely due to the pressure of performance and observation by peers. The design of the simulation training also emerged as a significant factor influencing emotions. Students reported reduced anxiety when they were familiar with the simulation lab, equipment, and the topic of the scenario prior to the training. In contrast, a lack of prior information was associated with increased anxiety and even hopelessness. This finding aligns with existing literature, which emphasizes the importance of a well-structured simulation design for successful training outcomes.^[1] Ensuring that students are well-prepared and comfortable with the environment before training can enhance their emotional experience and, by extension, their learning outcomes.

This study is not without limitations. One notable limitation is the potential for interviewer bias,^[29] as the interviews were conducted by nursing lecturers who had an existing relationship with the students. Although none of the interviewers were involved in the students' simulation training, there is still a possibility that students may have felt inhibited in sharing their true emotions or provided responses they believed were expected. This may limit the objectivity of the data.^[30] However, objectivity is not necessarily the primary criterion in qualitative research. Instead, the concept of internal comparability is relevant, emphasizing that data should be collected in a manner that ensures consistency within the context of individual participants, such as fostering a trusting environment. Researcher consensus, and comprehensibility serve as alternative measures of comparability in place of strict objectivity.^[41] Additionally, the quantitative data may have been limited due to the self-reported nature of the responses provided by the nursing students.^[30] Furthermore, this study was conducted at a single site, which may limit the generalizability of the findings to other settings or institutions.^[30] Another limitation was the absence of member checking of the transcribed interviews, which could have affected the credibility of the qualitative data.^[39] However, investigator triangulation was employed to enhance the reliability of the data analysis and to ensure a comprehensive

interpretation of the findings.

5. CONCLUSION

The results indicate that nursing students experience a full spectrum of achievement emotions throughout simulation training. While some findings are consistent with the emotions described in previous studies, our research offers novel insights. Notably, significant changes in emotions were observed during the simulation, except for anxiety, where no significant differences could be shown between the pre- and during-simulation phases. This variation underscores the complexity and individuality of achievement emotions, highlighting the need for future studies to focus on the dynamic nature of these emotions across different phases of simulation training. Another important finding is the impact of attitude on the experience of achievement emotions, where a positive attitude toward simulation was associated with reduced anxiety. Future research should further explore the influence of attitudes on achievement emotions in simulation settings. The impact of emotions on learning outcomes was only sparsely addressed in the results. Consequently, future studies should focus on the outcomes experienced by students when encountering different achievement emotions. This would enable a deeper understanding of how various emotions influence the outcomes of learning situations.

In implementing simulation training, educators should pay greater attention to emotional factors to enhance learning outcomes. Nurse educators should focus on implementing various interventions to mitigate negative emotions both prior to and during simulation training. As the results indicate, emotions such as anxiety and shame, commonly experienced by nursing students, highlight the importance of psychological safety in shaping participants' emotional experiences. This can be addressed through interventions carried out by nurse educators, institutions, and students themselves. Educators can reduce anxiety by informing students about the topics covered in simulation training. Providing students with the opportunity to prepare in advance fosters a sense of security as they begin the training. Additionally, brainstorming sessions to review relevant theoretical concepts before the simulation can alleviate anxiety by enabling students to refresh their knowledge, which is essential for making informed decisions during training. To address feelings of shame, nurse educators should establish clear debriefing rules that outline communication protocols, guidelines for constructive feedback, and the importance of valuing individual performance within the group.

At the organizational level, embedding simulation training within the curriculum ensures that students acquire the necessary theoretical knowledge and practical skills before par-

ticipating in simulations, thereby enhancing psychological safety and reducing anxiety. Similarly, embedding simulation training within a structured curriculum can help mitigate feelings of shame. Team-building activities conducted prior to the first simulation training sessions can foster trust and create an environment where errors are viewed as opportunities for growth rather than personal failures. Furthermore, nurse educators must be adequately trained to design effective learning environments, define clear objectives, and facilitate scenarios that allow students to reach their full learning potential.

Students themselves also play a critical role in reducing anxiety and shame. Respectful interaction within the group can minimize feelings of shame, while thorough preparation and a focus on learning content can help alleviate anxiety. Most importantly, students should adopt a constructive attitude toward errors, viewing them as opportunities for personal and professional growth rather than as indicators of failure.

In conclusion, this study offers valuable insights into nursing students' experiences of achievement emotions during simulation training. These findings underscore the importance of creating training scenarios that build students' confidence and equip them to apply their knowledge in practical settings. Addressing emotions such as fear and shame, as well as integrating these considerations into curricular revisions, is essential for optimizing the educational experience and fostering student development.

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AUTHORS CONTRIBUTIONS

MB, KR, and IW were responsible for the conception and design of the study. KR, IW, AM, and VP were responsible for revising the manuscript and provided critical revision on the draft. KR and IW were responsible for providing the simulation trainings. MB, AM and VP were responsible for data collection. KR, AM, and VP played a significant role in data analysis. MB and IW were responsible for drafting the manuscript. All authors read and approved the final manuscript.

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The authors declare that there is no conflict of interest.

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No additional data are available.

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