Affective State for Learning Activities Selection

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Abstract. This paper presents a qualitative study (consisting of 8 focus groups) investigating what feelings learners experience while learning, how these may affect learning, and how learning activity selection should be adapted to affective states.

Keywords: Learning, Activity Selection, Affective State, Adaptation

1   Introduction and Related Work

E-learning enables personalization and computer supported control of the learning process. The aim is to effect the construction of knowledge with respect to a learner's experience, practice and knowledge [34]. It offers flexibility to what learning activities are learnt, and how and where they are learnt [18]. Learning activities are well defined lesson units which learners undergo to develop the skills, knowledge, competence and understanding required to achieve desired learning outcomes [40, 49]. Effective activity selection choses the topic and task that engages learners in an active, constructive, intentional, authentic, and cooperative way and enables them to use what they have learnt in another context. When activities are articulated to have clear goals and scaffolded into manageable pieces to find the right balance, learners tend to attain so called flow [8].

   Flow is defined by [7] as a state in which people are so involved in an activity that nothing else seems to matter; the experience is so enjoyable that people continue to learn even at excessive cost, for the sake of learning. It is a state of ideal experience characterized by total absorption in the task at hand [46]. A learner can out of flow experience develop the desire to replicate the experience [46]. It is a state of intense emotional involvement [22] which comprises of concentration and absorption in an activity with no psychic energy left over for distractions but integration of knowledge with action, feeling of control, loss of self-consciousness, and reduction of the normal sense of time [8, 35, 46, 48, 47]. Flow may be the secret of retaining learners in the learning process because it is captivating. Research has established a positive relationship between flow and improved learning in adolescents and high school students [48]. Sharifah et al [33] proposed a model of motivational influences on academic achievement with flow as a mediator. It was discovered that when motivational forces work together effectively, they can influence students to be in a state of flow. Mills et al [32] found a significant relation between flow experiences in academic activities and more self-determined forms of intrinsic motivation. Habibah et al [20] found significant

correlations between flow and motivational forces, implying that the individuals that have engaged in a flow state have a high level of intrinsic motivation.

Intrinsic Motivation is based on self-determination theory by Sharifah et al [44]. According to them, intrinsic motivation is an undertaking of activity for its inherent satisfaction rather than its separable consequence. Brophy [4] described it as a situation where people pursue their own agendas by doing what they do because they want to do it rather than because they need to do it. According to him, Flow by [8] captured what peak experiences of intrinsic motivation feel like in his concept of flow. Since motivation energises and directs behaviour, it may be that intrinsic motivation can be a key element that leads to flow. Ryan et al and Brophy [44, 4] believed that intrinsic motivation is attainable in a situation where learners can make choices, take ideal challenges, collaborate with each other and where activities can be adapted to suite learner characteristics. Intrinsic motivation may lead to flow and for flow to take place, given that affective state has a link to motivation, it may also have a role to play in learning.

Affective State is regarded as emotion or feeling expressed in the face, voice, or gesture. Darwin as referenced in [21] defined affect as a means of communication to survive. It is the properties of any mental state that can be pleasant or unpleasant with some degree of arousal [3] which forms the individual differences in the parameters of emotional reactivity [9]. It has a powerful and subconscious influence on how people think, behave, and deal with social information [15, 26]. This state is consciously accessible as the simplest raw feelings obvious in moods and emotions [16, 43]. According to an affect infusion model by [12], affect information influences judgmental processes. This is anchored in Two Factor Theory of emotion by [45]. This theory stressed that emotion is based on the interaction between physical arousal and how this arousal is cognitively labeled. They argue that when people become aroused they look for cues as to why they feel the way they do. A learner can experience emotions on the condition they find themselves in during learning and from the environment and interpret if such conditions are of a positive or negative affect. In this paper, we take affective state as a specific form of good or bad feelings (consciously or unconsciously) essential for obtaining quality feedback on how the learner is doing for adapting the required learning activities to.

Positive Affect (PA) is marked by feeling cheerful, enthusiasm, energetic and good [53]. It prompts individuals to engage and partake in adaptive events around the immediate environment [16]. According to [16] positive affect are worth cultivating, not just as end states in themselves but also as a means to achieving psychological growth and improved well-being over time. People with a high PA tend to be goal oriented [29].

Negative Affect (NA) is a general factor of subjective distress [55] or emotional distress [54]. According to [1] it is the extent to which an individual feels upset or unpleasant; it influences anxiety, depression and physiological hyperarousal [5]. NA can provide adaptive advantages in social situations and can produce benefit in some circumstances that threaten survival [13].

Both PA and NA are expected in a learner. Inspired by their two routes Elaboration Likelihood Model of persuasion, Petty et al noted that the central route takes place when motivation and ability are high, and the learner is totally focused on a situation and is likely to experience flow [38]. This is supported by [8] that flow is a consequence of high challenge with high skill. The peripheral route takes place when motivation or ability are low, at this point the learner is not thinking carefully about a situation and this can permit simple/wrong interpretation of information. Learners in PA states are more careful in taking decisions than those in NA states whose decision may be influenced by their mood [14]; also, PA learners are optimistic while NA learners are pessimistic [57]. People experiencing PA have been found to facilitate and produce a greater degree of accuracy when making judgments [10]. The Broaden and Build Model [16] proposes that PA broadens individual consciousness and inspires investigative thoughts and actions, while NA narrows individual consciousness. PA is a powerful source of growth and change in learners [6], because it broadens the mindset and helps to develop the ability to experience flow. Meanwhile some evidence shows that NA, confusion and mild stress, may sometimes trigger the energy to perform better [11] and that the seeking system in humans facilitates learning because when stirred, it fills the mind with interest that motivates the individual to search out and learn things that they need, crave and desire [50].

Several researchers have investigated affective state and its relationship to elearning. Confusion, frustration and anxiety have been found to be prominent affective states experienced during learning [28]. Facial features have been used to detect learners' affective state in [31] and affective states of boredom, confusion, delight, flow, frustration, and surprise were present. A study investigating the dynamics of affective transitions in simulation problem-solving environments revealed that affective states like flow, boredom, and frustration, but not surprise, persist for long periods [2]. To recognize and respond to affect in AutoTutor, Woolf [56] used sensors that give information on performance during learning, and when learners are in a non-productive states the system can provide appropriate interventions. A relationship has been found between an intelligent tutoring system's feedback and learners' self-reported affective states and physiology [39]. Research showed that students who are anxious, angry, or depressed do not learn in a proper manner [17].

2   Focus Group Design

This study aimed to identify the affective states that students experience during learning and how these impact appropriate learning activity selection. Data was collected through focus group (FG) interviews. FGs were considered appropriate because they can generate comprehensive insights into a topic in a well-organized and appropriate manner which may be impossible through other means [30, 25]. Participants were university students who would have opinions on the topic [42].

Table 1. Composition of Focus Groups

	Postgraduate (PG)			Undergraduate (UG)				
Gender	PG1	PG2	PG3	UG1	UG2	UG3	UG4	UG5
Male	3	4	7	4	3	5	3	3
Female	3	2	0	1	3	1	3	4
Total	6	6	7	5	6	6	6	7

2.1   Participants

Eight FGs were conducted with 5 to 7 people per group, and 49 in total. Three FGs were postgraduates (PG1-PG3) and mostly international students (including many from Africa, the Middle East and Asia). Five were undergraduates (UG1-UG5) and mostly European nationals (including UK and many from Eastern Europe). Table1 shows demographics. Each FG lasted about 20-40 minutes.

2.2   Procedure

Open-ended questions with four typical scenarios (see Table 2) representing students' affective states were developed to guide the study. Each FG was facilitated by a moderator and a notetaker. Ethical approval was obtained from the University's Ethics Board. Participants provided informed consent. The reason for the FG was explained, that it is to discuss the way an e-learning system can automatically select learning activities based on learners' affective state. The FG discussions were recorded with the permission of all participants. The main questions put to the FGs were: (Q1) What positive and negative feelings may students experience during learning, (Q2) What can happen to a student's learning when they feel some of these emotions?, (Q3) For each scenario, how should the student's affective state influence the selection of a learning activity?, (Q4) What can induce PA in a student who is in a NA state?

3   Results

We went through the FG recordings and notes to get familiar with the data and reflect on their meaning. With the audio and notes, the data was phrased and categorized to form a thematic framework. Next, we highlighted, sorted quotes and selected key elements within and between groups. Charting and re-arranging of data was carried out for proper data reduction [41]. A detailed analysis was performed, and data were divided into sections that reflected the specific affective state (PA and NA), how students feel when they are in some of these states, what they feel about each scenario example and what can be done to induce PA. At the end of this process, a list was compiled into categories and labelled as key findings. Each FG's findings were further examined to determine connections.

Table 2. Scenarios

Scenario	Story
Scenario 1	Ben is a student. He is a brilliant guy who is hard working and generally doing well in his courses. However, when he encounters an unfamiliar topic, he becomes uncomfortable and frustrated.
Scenario 2	Martin is a student. He is hard working, but he is sad because he feels he does not move at the same pace as other students. He needs more time and effort to cope with learning activities.
Scenario 3	Carol is a student. She wants to obtain good grades. After seeing her performance on the last topic, she becomes nervous and anxious if she can still cope with the challenge because the next stage seems to her more difficult and challenging.
Scenario 4	Nancy is a student. She is always cheerful, and she likes making everyone around her happy. She is curious and will always see the next topic as a challenge which needs to be conquered. She spends some of her free time engaging in learning related to previous topics and likes to explore the next topic before the next class. She is always enthusiastic and happy when a new topic is introduced. She is ever ready.

Table 3. Students' Feelings

Positive	Excitement	Healthy	Confident	Relief
	Inspired	Curiosity	Satisfied	Focused
	Flow	Happiness	Interactive	Engaged
Negative	Anger	Confusion	Boredom	Pride
	Uncomfortable	Lost	Language problem	Anxiety
	Lonely	Nonchalant	Hunger	Surprised
	Frustration	Exhausted	Sleepy	Stress

Q1: Positive and negative feelings that students may experience during learning. Table 3 shows the feelings identified in the FGs. These are in line with those identified in the literature (see above).

Q2: What can happen to a student's learning when they feel some of these emotions? Table 4 shows the affective states discussed by the FGs.

PA. FGs believed that engaging content triggers **excitement** and makes learners develop a positive attitude towards learning. Excitement gives learners the zeal to reach out for more materials. Similarly, FGs agreed that a **happy** learner is not likely to withdraw from school because it boosts interest, allows exploration of materials and creates an enabling atmosphere for flow. FGs also stated that when an assignment is successfully executed, a learner becomes **joyous** and likely to be **curious** to acquire new knowledge and feel confident to search for more materials. Similarly, **inspiration** was noted to boost learners' interests and create the energy to work outside the content without being bored. These results are in line with evidence in [23, 19, 37] which shows that PA facilitates problem solving. Also, the control value theory of emotion by [36] makes the

Table 4. Affect discussed across groups (+)

	Affect	PG1	PG2	PG3	UG1	UG2	UG3	UG4	UG5
Positive	Excitement	+	+	+				+	+
	Happiness			+	+	+	+		
	Curiosity							+	+
	Inspired				+	+			
Negative	Frustration	+	+	+		+	+	+	+
	Boredom	+	+	+	+	+	+	+	+
	Lost	+							
	Anger		+						
	Pride		+						
	Stress	+	+	+				+	+

predictions that motivation, strategy use, self-regulation, and resulting achievement are the effects of emotions on cognitive resources.

NA. FGs noted that **frustration** may cause a learner to think that the content is not taught correctly and be likely to give up. **Boredom** is believed to make learners lose focus, stop paying attention and lose interest. In addition, it may cause distractions, impatience, procrastination and make learners work under pressure. FGs also identified that a learner may be **lost** leading to disconnection from the process and when **angry** will not seek for help or ask questions. **Pride** may cause over-confidence in one's ability. FGs believed that **stress** is likely to cause divided attention, e.g. between working and studying. FGs felt that NA cannot trigger the urge to search for more materials, which is also evidenced in a study by [11, 13, 51]. Results are in line with [17] who believes that learners experiencing NA do not take information efficiently.

Q3: How should a student's affective state influence learning activity selection for that student based on each scenario? Table 5 shows the ways the FGs felt the selection should be adapted to the students portrayed.

Scenario 1: Uncomfortable with unfamiliar topics. FGs felt that a connection should be made between old and new content, and that there is a need to allocate extra time and materials, with materials based on the learner's ability. They also suggested that the learner should join a discussion group, and that kind advice be provided to avoid drop out.

Scenario 2: Sad as does not move at the same pace as others. FGs want the learning material to be allocated based on personality. Sufficient time and material should be made available to the learner. Group collaboration should be advised. Contents should be presented beginning from simple to complex. The learner should be provided with kind advice, and the learner also should work outside the content to catch up.

Scenario 3: Nervous after last performance. FGs agreed that the learner should be given kind advice, and extra material. The learner should be assigned to a collaborative group (who can help them), and revise the previous topic.

Table 5. How learning activity selection should be impacted by affective state

Scenario	Decisions	PG1	PG2	PG3	UG1	UG2	UG3	UG4	UG5
1. Uncomfortable with unfamiliar topics	Connect old and new content	+	+	+	+	+	+		
	Give extra time and materials		+	+	+			+	+
	Suggest collaboration	+	+			+			+
	Provide material based on ability		+						
	Give kind advice						+		
2. Sad as does not move at same pace as others	Personalize the content	+	+						
	Allocate sufficient time and materials		+	+		+	+		
	Suggest collaboration	+	+		+				+
	Present content from simple to complex	+				+			
	Give kind advice	+				+		+	
	Work outside the content							+	+
3. Nervous after last performance	Give Kind advice	+	+	+	+	+		+	+
	Allocate extra materials					+	+		
	Suggest collaboration					+	+		
	Revise previous topics	+	+			+			+
4. Happy with learning	Assign more challenging work	+	+	+	+	+		+	
	Give kind advice		+	+			+		+
	Suggest collaboration	+	+	+		+		+	+

Scenario 4: Happy with learning. FGs felt that the learner should be given more challenging work to avoid feeling stagnated. The learner should be assigned to a collaborative group, to help other learners who are struggling. Kind advice (reinforcement) should be given to keep the learner going.

Interestingly, FGS felt that all scenarios need reinforcement with kind words including the happy learner one; this is in line with [4] who noted that careful work on assignments leading to successful task completion might be reinforced by giving verbal or written praise. The results also showed that learning activities should be given to learners based on ability, and that affective state can be a reason for getting learners to collaborate.

Q4: What can induce PA in a student who is in a NA state? As summarized in Table 6, FGs suggested that contents should be gamified, which is in line with Karl [24] who noted that gamification is a powerful tool for delivering education. Anonymous feedback is needed, as they did not want other learners to know about their results. They also suggested study group formation for learner collaboration, which is in line with [52] who posits that collaboration is an important activity in academia, because learners perform better through interactions with each other. Materials should be provided based on learners' ability, which requires good course design with different difficulty levels. This is in line with Item Response Theory [27] which considers both course material difficulty and learner ability to provide individual learning paths for learners. Also there should be an interface to give kind advice, providing feedback to make learners aware of their performance. FGs believed that music may induce positive affect for some learners, but that it may distract others, so this should be personalized.

Table 6. How to induce positive affect

Decisions	PG1	PG2	PG3	UG1	UG2	UG3	UG4	UG5
Gamify the contents	+	+	+			+		
Provide anonymous feedback	+		+	+	+		+	+
Provide video lectures instead of slides	+		+			+	+	+
Group collaboration is needed	+		+	+			+	+
Course design with different difficulty level			+	+	+		+	
Provide interface to give kind advice		+		+		+	+	

4   Conclusion

The study generated qualitative insights into how affective state may need to influence learning activities selection. FGs agreed that difficulty level (in balance with the learner's ability) needs to take the affective state into account. They also strongly advocated for collaborative learning, with learners' affective state being taking into account when forming collaborative study groups. Future work will use a combination of qualitative and quantitative studies to investigate how to use learners' affective state and ability to inform learning collaboration.

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