

Appendix A Dimensions of Student Engagement

Dimension	Citation	Description
Cognitive	Yundayani et al. (2021)	- Cognitive engagement is student interest in learning, ability to undertake difficult mental challenges, and use of self-regulatory techniques to monitor the progress of thinking. It is the key role to predict students' success in academic performance and refers to directly use of learning strategies.
Behavioural, Cognitive	Dragomir and Dumitru (2023)	- Behavioural engagement is class attendance, participation and ability to complete a course despite any adverse circumstances and obstacles, incorporation thoughtfulness and willingness to exert the effort necessary to comprehend complex ideas and master difficult skill. - Cognitive engagement is involvement in designing the structure, process, interaction, and evaluation aspects of online courses that can be boosted by student social presence.
Behavioural, cognitive, emotional	Marôco et al. (2020)	- Behavioural engagement is students' participation in classroom task, student conduct and participation in school-related extra-curriculum activities. - Cognitive engagement is investment and willingness to exert necessary effort for comprehension and mastering complex ideas and difficult skill. - Emotional engagement is the attention to teachers' instructions, perception of school belonging, and beliefs about the value of school.
Behavioural, cognitive, emotional	Salta et al. (2021)	- Behavioural engagement is the measure for student participation which include attendance in academic and social activities which give positive impact on academic outcomes and prevent student from dropping. It includes the use of lecture slide and reading material, and attendance of student. - Cognitive engagement is the effort needed for student to understand complex ideas and master difficult skill, which is also referred as being strategic or self-regulating - Emotional engagement is the positive and negative reactions of student towards teachers, classmates, academics, and school that will consequently affect the willingness of student to do their work. It is reflected by the attendance emotion and attention of the student during class.
Behavioural, cognitive, emotional	S. Park and Kim (2021)	- Behavioural engagement is concrete behaviour of students' effort to learn such as actively interact with group members and seeking help from instructor for assigned tasks and learning activities. - Cognitive engagement is the effort of students to acquire new knowledge and skill through learning by emphasizing the relationship between the learning motivation and cognitive engagement. - Emotional engagement is the students' emotion and feeling in school and classroom environment.
Behavioural, cognitive, emotional	Dubey et al. (2023)	- Behavioural engagement is used to characterize the level of interest shown by students in their academics. It is measured on how they are invested in learning. - Cognitive presence is effort of student in studying to grasp and master challenging subjects. A state of mind in which students take pleasure in their studies since they have identified the learning goal and are motivated to get more information about the prerequisite. - Emotional engagement is the students favourable or negative sentiments towards their instructors, peers, academic and educational institution. It is represented by how students respond and includes curiosity, enjoyment, and belonging.
Behavioural, cognitive, emotional	Booth et al. (2023)	- Behavioural engagement is the direct involvement of student in a task and encompasses behavioural features like participation and persistence practice and level of effort. - Cognitive engagement is the allocation of cognitive resources to a task, ranging from maintaining attentional focus to adopt high level learning strategies, as such, it captures aspects related to cognitive outcomes such as memory recall, learning, and a deep understanding or mastery of knowledge pertaining to the task. - Emotional engagement refers to the student's feeling and attitudes about specific task or the context in which it is performed, which include feeling of interest towards a specific subject or liking specific lecturer.
Behavioural, cognitive, emotional	Ahmadi et al. (2023)	- Behavioural engagement is determined by the general use of communication tools and platform which include the student log-in and log-out data. - Cognitive engagement is represented by revisiting, performing assignment submission and completing online quizzes. - Emotional engagement is analysed by student's self-expression in forum or discussion environment.
Behavioural, cognitive, emotional	Zafar and Nausheen (2022)	- Behavioural engagement is indicated by the involvement of student towards learning. - Cognitive engagement is represented in the form of intellectual work. - Emotional engagement is the involvement of student's emotions during the learning process.
Behavioural, cognitive, emotional	Torres and Statti (2023)	- Behavioural engagement is the participation of students in academic activities and learning task. - Cognitive engagement is centred on student's willingness to take on and complete learning activities by investing time and effort in the task. - Emotional engagement is the student's sense of belonging, connection to their school, and concern towards learning and their involvement level.
Behavioural, cognitive, affective	N. Luo et al. (2021)	- Behavioural engagement is the active effort and participation of the student in learning process - Cognitive engagement is the task specific thought processing and elaboration that student employs to undertake the learning activity - Affective engagement is the affective investment and reaction which enrolls students' interest, identification, and positive attitudes or values in the learning process.

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Behavioural, cognitive, academic Community of Inquiry	Gledson et al. (2021) Galikyan and Admiraal (2019)	-	Behavioural engagement is the attendance and participation of students in class
		-	Cognitive engagement is the motivational goals and self-regulated learning skills to learn.
		-	Academic engagement is the time spend by the students to complete their task and assignment
		-	Cognitive presence is the degree of students able to construct and confirm the meaning by sustaining reflection and discourse in a critical Col
		-	Social presence is the ability of students to engage socially and affectively on Col.
Behavioural, emotional, social	Quigley et al. (2022)	-	Teaching presence is the conceptualize of the instructional design, facilitation of productive discourse and direct instruction.
		-	Behavioural engagement is the key learning skill for student, and it is measured by the item for example “staying up to reading”
		-	Emotional engagement is the student’s emotional participation in their learning and includes item for example make learning material interesting.
Behavioural, cognitive, emotional, social	Ayouni et al. (2021)	-	Social engagement is the participation of student engages in educational activities both with instructors and fellow peers
		-	The emotional dimension is related to the SE construct; however, it is difficult to be measured and captured the emotional connection of the student especially during online learning environment.
Behavioural, cognitive, emotional, social	Binali et al. (2021)	-	Behavioural engagement is the behavioural involvement in academic, rules, and task-based activities in OL.
		-	Cognitive engagement is the employment of cognition in OL.
		-	Emotional engagement is the presence of emotional reactions of student towards the learning content, peers and faculty during online learning.
		-	Social engagement is an additional dimension that should be incorporate in the context of OL that encourage the active collaboration and socialization of students which include student-student or student-teacher interaction especially through online discussion forums. It is the presence of interactions and collaborations of students with peers and faculty, willing to establish and maintain relationship for online learning.
Behavioural, cognitive, emotional, social	Deng et al. (2020)	-	Behavioural engagement is students’ observable actions, participation and involvement in the educational activities. It is represented by revisit notes to prepare assessment task, take notes and spend regular time on learning
		-	Cognitive engagement is the students’ mental investment to conclude complex ideas and master the difficult skills. It is measured by read repeatedly until the content is understood, search for further information and watch the video repeatedly.
		-	Emotional engagement is both positive and negative feelings connections of students with institution, instructors, peers and content. It is measured by enjoy of watching video, found interesting and inspired to expand knowledge.
		-	Social engagement is centred on student-instructor and learner-learner interaction, which is the participation in academic activities with peers, quality of interaction and willingness of investment in create and maintain the relationship during study. It is the sharing of learning material, contribution in course discussion and respond to peers’ question.
Behavioural, cognitive, emotional, social	Ayouni et al. (2023)	-	Behavioural engagement pertains the physical effort exhibit by student to perform their task, which is indicated by the participation attendance of the students in OL, which can be measured by number of participations in the class activities, number of logins clicks and virtual classroom attendance. In fact, it can be considered as the energy and time spent on OL and participation in all online environment interactions.
		-	Cognitive engagement pertains to the beliefs of student about educational institution, instructors, and learning facilities, which is indicated by the self-regulation time spend on course material and it is measured by the time spend on course and participation of extra quizzes. It refers to which extend of student’s willingness and ability to take on the learning task at hand.
		-	Emotional engagement pertains to how student feels about each of the three elements and whether they have positive and negative attitudes towards the course and lecturer, which is the enjoyment sense of belonging that measure by the emotion descriptors in posts and response. It reflected by student commitment to their online course and achievement of the learning objectives.
		-	Social engagement pertains the central in OL that can be used to described to what extend people socially interact in such environment, which is the student-student and student-instructor interactions which is measured by the number of discussions, chats and emails with the peers and instructors. It has been found that social presence influences online interaction and can be the major lever of engagement. Social interactions are considered to conceptualize student engagement construct.