

The Inverted Classroom in ESP: Engaging Students in Active Learning

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Abstract

The Inverted Classroom Model (ICM) was introduced in English for Specific Purposes (ESP) courses at an Austrian university to enhance student engagement. This study aimed to explore the effectiveness of ICM in fostering engagement among part-time and full-time undergraduate Engineering students, who often face anxiety in language learning due to their focus on technology. Using a design-based research approach across three iterative cycles over four years, the study employed mixed methods—focus group interviews and questionnaires—to assess behavioral, cognitive, emotional, and social engagement. Findings revealed consistently high engagement, particularly in the social and emotional dimensions, with part-time students showing stronger peer collaboration and reflective learning. Pre-class assignments were found to substantially enhance in-class participation but posed challenges in home study phases, especially for part-time learners. Furthermore, the educator's engagement seemed to significantly influence student engagement and performance. The study concludes that ICM is a viable method for ESP instruction, though course design should be tailored to diverse student needs and promote self-regulated learning.

Introduction

The Inverted Classroom Model (ICM) was originally implemented in my university English for Specific Purposes (ESP) courses during the pandemic, when synchronous online class sequences were seemingly tedious, and maintaining students' attention and engagement seemed challenging. Due to the successful outcome of these more active and engaging lessons, the methodology was maintained and adapted in a design-based research (DBR) project when classes were resumed on campus in 2022. The overall aim was to develop my teaching through fostering student engagement in my undergraduate English for Engineering courses. Engineering students often experience anxiety and stress in language classes and struggle with efficient and effective communication due to their heavy focus on technology. The goal was therefore to provide a pleasant learning environment where students would feel safe, experience competence, and hence feel motivated to learn and develop their language and other skills. Even though many studies on student engagement exist, very few focus on the ICM in ESP in higher education. This paper first presents the concepts of student engagement and the ICM. Then, the three DBR cycles are described with the course design, methodology, hypotheses and research questions, qualitative and quantitative results, and discussions. Finally, the conclusion summarizes the findings and provides a future outlook.

Student Engagement

Student engagement is viewed as a key notion for addressing ubiquitous issues in education, such as low academic achievement, high levels of boredom and alienation,

and dropout rates (Fredricks, 2011). Its effect on learning, tasks, grades, and personal development is undisputed (Groccia, 2018). Research in this area addresses the issue of keeping learners engaged and focuses on learning, which is a challenge that instructors worldwide encounter (Hiver et al., 2021).

Student engagement is a multifaceted construct interacting with external influences such as peers, the institution, and learning environments in various contexts. It can be examined within various contexts, for instance, community, institution, classroom, and task, through the application of multiple theoretical models. The present study focuses on the classroom level, and the 4-dimensional student engagement model proposed by Fredricks et al. (2016) was identified as the most appropriate framework for this setting. It features the four dimensions of behavioral, cognitive, social, and emotional engagement, which are interdependent but fluid, hence also tend to overlap. Thereof resulting challenge of clearly delineating the individual dimensions are some of the reasons why the whole concept of student engagement and related studies has been subject to much debate (Fredricks et al., 2016; Sinatra et al., 2015).

ICM

The OECD (2019) emphasizes the importance and effectiveness of recognizing students' heterogeneous prerequisites, prior knowledge, and needs, and recommends a stronger focus on learners. The ICM promotes such a student-centered classroom and active learning, which requires students to become active participants in their learning through, for example, group work, self and peer evaluation, project work, and the integration of information and communication technology in and for class work (Bosch et al., 2008).

The core idea of the Inverted classroom (IC) is to reverse home- and classwork, thus moving direct instruction from the group learning space to the individual learning space (Bergmann & Sams, 2012). This approach not only individualizes learning but also frees up classroom time for more meaningful, dynamic, and interactive learning experiences. Studies found that in tertiary education, student achievement in the IC exceeds that in traditional classrooms (Alsancak Sirakaya & Ozdemir, 2018; Chen et al., 2018; Nja et al., 2022). However, it has also been suggested that this model might pose challenges if introduced to higher-semester students who already have established a learning routine (Burke & Fedorek, 2017). Müge (2017) further points out students' potential lack of engagement with pre-class materials and unwillingness to embrace this unfamiliar concept, which can result in unproductive and fruitless in-class discussions or failed task completion.

Students may also struggle with relinquishing their passive learning attitude, which is fostered in the still widely prevalent teacher-centered classroom and appropriated during the many years of schooling. Remedies have been suggested by Filiz and Kurt (2015) and McNally et al. (2017): the ICM concept should be clearly introduced to students; in order not to overwhelm students, a half-flip, which features the ICM only in specific lessons instead of a whole course, may be more appropriate. Yet another challenge of the ICM is to find suitable teaching materials, which are still scarce, especially for such a specific area as ESP for science and technology (Y. Li, 2020).

Student engagement in the inverted EFL classroom

Studies on student engagement in the inverted EFL classroom have predominantly found increased cognitive, behavioral, emotional, and social engagement due to the flexibility and freedom of study time and location, as well as the incorporation of learning management systems (LMSs), which can provide an interactive and stimulating learning environment (Z. Li & Li, 2022). A comparison of the traditional and inverted classroom settings by Vitta and Al-Hoorie (2020) demonstrated that the IC not only helps students to understand content better, but is particularly effective for learners of higher proficiency levels with skill-based and procedural learning outcomes. Furthermore, student academic achievement was found to be higher in such settings, displaying increased cognitive and behavioral engagement, since the IC can help students to develop a better understanding of content and increase participation in class (Hoang Oanh, 2020).

Even though the ICM was found to be less adequate for high school students (Moran, 2014), it can substantially foster student engagement in higher education (Bormann, 2014; Moran, 2014; Vitta & Al-Hoorie, 2020). Alsowat (2016) found increased engagement and satisfaction due to the student-centered and active nature of this methodology, which can positively affect motivation and enthusiasm in learners (Salem, 2018). Combined with technology-based learning, it was found to enhance emotional engagement (Obari & Lambacher, 2015; Yang, 2020). Other studies showed that PCAs can reduce anxiety levels in class and result in increased participation (Bouchareb, 2024). The PCAs further address self-regulation, which is the learner's control over their learning (Nyman, 2024; Schmidt & Mindt, 2020; Zimmerman, 2002). In the IC, self-regulation is required, particularly when working on and with content during the pre-class preparation, thus giving students the opportunity to more visibly present and experience competencies.

Methodology

The present study was carried out to identify effective strategies for fostering student engagement in my English for Engineering courses based on the ICM. Data were collected from 2020 to 2024 and included 73 undergraduate students in total, whereby the average class size was ten students. The study was carried out in both included part-time and full-time student groups: Part-time classes are scheduled in the evenings and on the weekends to allow a better management of work and education.

The underlying method of this research was Design-based research (DBR), which is an approach for teachers researching their practice in a scientific way with the overall aim of improving their teaching in several iterative cycles. Three DBR cycles were conducted featuring mixed-method research: Qualitative data were collected with semi-structured focus group interviews and analyzed using Mayring's content analysis. Quantitative data were collected with questionnaires and analyzed using descriptive statistics and Pearson correlation.

Course design

The courses were scaffolded on the university's LMS Moodle and included the digital availability of all assignments and materials. The pre-class assignments (PCAs) were designed in such a way as to provide students with a variety of engaging formats, including H5P videos, collaborative whiteboards, readings, low-stakes quizzes, and worksheets. Every completed PCA was graded with five points if completed. They were not checked in detail or corrected, but only scanned for completeness. After all, these assignments were to be discussed and expanded upon in class, and the educator's workload also needed to be balanced. Furthermore, the purpose of home study in the ICM is not for students to know everything when coming to class, but rather to have engaged with the content as a basis for the in-class activities.

Hypotheses & Research questions

The following hypotheses and research questions were explored in the various DBR cycles:

1. Student engagement in the ESP ICM in higher education is overall high if the course has been designed adequately and in accordance with the ICM methodology.
2. Social Engagement is particularly high in the ICM due to the focus on collaborative activities in class.
3. The ICM contributes to students' better understanding of content and participating more actively in class.
4. Can the educator affect student engagement with their engagement and behavior?
5. Do full-time and part-time students experience different levels of effectiveness in the ICM?
6. Do students perceive the PCAs as beneficial and regard them as necessary, hence always complete them?

Results and Discussion

DBR cycle 1

The first cycle served as preliminary research and the basis for creating the questionnaire. Focus group interviews were conducted at the end of the courses in order to establish concepts and issues to explore in the questionnaire.

The analysis of the interviews revealed that engagement in the ICM is generally high. All four engagement dimensions emerged, whereby most comments related to emotional engagement (see Table 1). The remarks were categorized under the four topics: course structure and content, ICM and PCAs, student-educator relationship, and group work.

Cognitive engagement	Self-regulation (organize workload, time management) Make meaningful contributions in class (experience competency) Understanding and reflecting on feedback (transparent teacher feedback)
Emotional engagement	Relevant content (interdisciplinary topics) Meaningful activities Relaxed in class (being prepared) Reduced inhibition, anxiety, stress, fear of failing (preparation, tactful teacher feedback) Less frustration (questions on content clarified in class) Freedom of speech without being judged
Behavioral engagement	Participate actively in class Interactivity
Social engagement	Good balance of individual activities at home and group work in class Group work positively affects group dynamics

Table 1: Engagement aspects mentioned in the interviews, DBR cycle 1

Course structure and content: All students perceived the course as overall well-structured and organized. However, particularly the part-time students had been overwhelmed with the complex Moodle course in the beginning, and it took them some time to successfully navigate it (cognitive and emotional disengagement). Oftentimes, educators expect their students to be digitally competent in all fields and often refer to them as Digital Natives; however, it cannot be assumed that students can transfer their personal digital competencies to their academic studies (Kopp et al., 2019). In all courses, self-regulation was appreciated in terms of students being able to choose topics they were interested in and the PCAs that were provided several weeks before the respective lesson. This was perceived as beneficial for time management and motivation, as well as for experiencing with and applying suitable learning strategies (cognitive and emotional engagement).

ICM and PCAs: All students unanimously agreed that it was necessary to prepare for classes in the IC, which then enabled them to make more significant contributions in the lessons (behavioral and cognitive engagement). Completing the PCAs seemed to counteract inhibition and anxiety in class since the lesson content was known in advance, the students could prepare adequately, and, as a result, experience competency in class (cognitive and behavioral engagement). Another positive aspect mentioned was that the educator could instantly explain and assist if questions arose during the more complex in-class tasks, rather than having to solve issues alone at home. An intriguing description of PCAs was provided by a student who perceived the work style in the ICM as more sensible than traditional homework due to the “working forward” approach (cognitive and emotional engagement). The course was described as interesting and fun due to its interactivity (emotional engagement), which is in line with Steen-Utheim and Foldnes’ (2018) findings: their students experienced collaboration as supportive to their learning and engagement.

Student-educator relationship: Equitable assessment according to transparent criteria and clear feedback made grading transparent and comprehensible to students, which they perceived as “special” as compared to other courses (emotional and cognitive engagement). This was not only important in terms of experiencing fairness (emotional

engagement) but also for understanding mistakes, appreciating feedback, and developing language competencies (cognitive engagement). Even though the workload was perceived as extremely high, the students' academic achievement was remarkable: An explanation provided is that the teacher modeling the engagement desired from the students (effort, interest, feedback, etc.) can motivate students to complete the – albeit high – workload (behavioral engagement). The students reported that they valued the educators' visible effort (emotional engagement), prompting them to mirror this effort, e.g., chose seats in the front rather than back rows (behavioral engagement) and complete assignments despite the considerable time investment. The educator's engagement seemed to have a significant effect on student engagement, attention, and course grades, as was also found by Shernof et al. (2017) and Blazar and Kraft (2017).

Group work: Whereas the part-time students pointed out the even balance of individual work at home and group work in class, the full-time students particularly enjoyed collaborating with peers, which in all groups reportedly impacted the overall group dynamics. Steen-Utheim and Foldnes (2018) state in this context how teamwork seems to trigger a shared group responsibility and contributes to a sense of belonging, both of which were shown to be directly related to student engagement.

DBR cycle 2

The second cycle focused on social engagement and the role and implications of PCAs. A questionnaire was designed according to the findings of DBR cycle 1. In addition to the four main categories, cognitive, behavioral, social, and emotional engagement, items on the importance of grades and knowledge (I1, I2) were included to measure whether these two aspects presented a possible trigger of cognitive engagement. Fredricks et al. (2004) suggest that students “may be strategic only when it is necessary to get good grades, not because they are motivated to learn” (65). Attitudes in the questionnaire were measured with a four-point Likert scale (strongly disagree/ somewhat disagree/ somewhat agree/ strongly agree), and quality-control questions were included (marked with an asterisk *). Opinions on whether the questions have been allocated to the ‘correct’ dimension are subjective and therefore might vary due to the intertwining and overlapping of dimensions. This overlapping is of particular relevance for the social dimension, which can relate to both students' behavior and emotions during collaborative group work and has been treated as part of other dimensions for this reason in earlier student engagement research (Fredricks et al., 2004; Peng, 2017).

The analysis showed that engagement scores in the ICM are overall high, as can be seen in Table 2. The extensive collaborative activities seem to foster social engagement, which aligns with Burke and Fedorek's (2017), and Vitta and Al-Hoorie's (2020) findings that social engagement is very high in the ICM compared to the traditional classrooms.

Variable	Item	Mean (\bar{x})	SD
	<i>Cognitive Engagement</i>		
C1	The instructions for the pre-session preparation were clear.	3.75	0.46
C2	The tasks for the pre-session preparation were early enough on Moodle and I could complete them in time.	3.75	0.46
C3	My study schedule allowed for enough time to prepare for the session.	3.88	0.35
C4	The preparation tasks were always relevant for the sessions.	3.88	0.35
C5	The preparation tasks were always useful for the sessions.	3.88	0.35
C6	I benefit from the pre-class preparations.	3.88	0.35
C7	I reflect more on the topic during the pre-class preparation than I would if we worked on the topics in class only.	3.00	1.20
C8*	The workload in this course is too high.	3.75	0.46
C9	I make connections between the things I have learned in this course.	3.50	0.76
	<i>Total</i>	3.69	0.53
	<i>Behavioral Engagement</i>		
B1	I always completed the pre-session preparation.	3.63	0.52
B2	I completed the assignments in a strategic (well-planned) way.	3.38	0.74
B3	I always checked the instructor's feedback on my assignments.	3.75	0.46
B4	I participated actively in class.	3.88	0.35
	<i>Total</i>	3.66	0.52
	<i>Social Engagement</i>		
S1*	I prefer to do more individual activities in class.	2.13	1.36
S2	The preparation allowed me to collaborate more effectively in the sessions.	3.75	0.46
S3	The preparation allowed me to participate more effectively in discussions during class.	3.88	0.35
S4	I felt as a member of the group in this course.	3.75	0.71
S5*	I wish for more support from my teacher.	3.75	0.46
S6	I liked the pair/group work in class.	3.63	0.52
S7	I have a good relationship with my colleagues.	4.00	0.00
S8	I have a good relationship with my teacher.	3.88	0.35
S9	The teacher held low expectations.	2.88	1.13
	<i>Total</i>	3.51	0.59
	<i>Emotional Engagement</i>		
E1*	The pre-class preparation was stressful.	3.63	0.52
E2*	The pre-class preparation was frustrating.	3.75	0.71
E3	The pre-class preparation makes me feel more confident in class.	3.38	0.52
E4	This course stimulated my enthusiasm for learning.	2.75	1.04
E5	I was interested in this course.	3.38	0.52
E6*	I felt anxious (scared) when talking in the group.	3.63	0.74
	<i>Total</i>	3.42	0.67
	<i>Other</i>		
I1	How important is achieving a good grade in this course to you?	3.38	0.74
I2	How important is expanding your English language knowledge in this course to you?	3.88	0.35

Table 2: Questionnaire on Student Engagement in the Inverted Classroom, DBR cycle 2 (n=11)

However, a discrepancy in social engagement was noticeable between part-time and full-time students: Of all dimensions, this one scored highest in the part-time group and lowest in the full-time group. A detailed analysis revealed that a preference for group activities is highly individual. Therefore, giving students the choice of group or individual work is suggested.

The findings in DBR cycle 2 underpin the assumption in DBR cycle 1 that the educator can affect student engagement, particularly emotional engagement, which is in turn linked to cognitive and behavioral engagement, as the correlations in Table 3 display. This finding is in line with the widely acknowledged stance that instructors and tasks have profound implications on student engagement (Hu & Li, 2017; Krause & Coates, 2008; Schmidt & Mindt, 2020).

English 1 and English 2	Cognitive Engagement	Behavioral Engagement	Social Engagement	Emotional Engagement	Importance grade	Importance knowledge
Cognitive Engagement	1					
Behavioral Engagement	-.015	1				
Social Engagement	-.465	-.132	1			
Emotional Engagement	.515	.565	-.414	1		
Importance grade	-.115	.271	-.256	.651	1	
Importance knowledge	-.598	.436	.502	.108	.204	1

Table 3: Correlation of engagement dimensions and importance, DBR cycle 2

The overall high student engagement score indicates that students benefited from the ICM with its pre-class assignments, which were generally considered useful and relevant (cognitive engagement). The students reported that they participated more actively and collaborated more efficiently in class (behavioral engagement). The results further suggest that students reflected more on study content in the home study sequences than they would in class (cognitive engagement), which is likely due to the lack of (time) pressure in the individual learning phase and the possibility to discuss content with other people outside of class, as some students reportedly did.

It was further found that the part-time students scored slightly lower than the full-time students in cognitive and behavioral engagement but higher in social and emotional engagement. An explanation could be that part-time students' professional experience generates livelier and more insightful discussions as well as a more fruitful exchange of knowledge.

Part-time students scored slightly higher on the PCA items than full-time students: They reportedly benefitted of the PCAs and their positive effect on in-class participation and collaboration. They further seemed to profit more from each other's knowledge, possibly also due to their professional experience and maturity. However, at the same time, they

experienced the PCAs as more stressful in terms of meeting deadlines due to their work and other responsibilities. Therefore, such groups may need to be granted more preparation time.

Even though self-regulation was generally appreciated, full-time students seemed to encounter challenges with time management and be more susceptible to procrastination than part-time students. Time management and similar skills are related to habits and behavior, which can and should be trained and developed in higher education, since procrastination can at worst, result in burnout, academic failure, and also affect students' well-being (Balkis, 2013; Wilson et al., 2021).

The social engagement category included items on relationships with peers and the educator. An analysis revealed a considerable discrepancy between part-time and full-time students, whereby part-time students scored higher in both categories (see Table 4). One explanation could be that part-time students have higher and more specific expectations due to their professional experience, which were met in this course during the intense exchange with their peers. However, the high SD for item S1 in both groups suggests that the preference for individual or group activities is highly personal and therefore difficult to generalize.

Variable	Item	English 1 part-time Mean (\bar{x})	English 2 full-time Mean (\bar{x})	Total Mean (\bar{x})	Total Std. Deviation (SD)
	<i>Social Engagement</i>				
S1*	I prefer to do more individual activities in class.	2.67	1.8	2.13	1.36
S2	The preparation allowed me to collaborate more effectively in the sessions.	4	3.6	3.75	0.46
S3	The preparation allowed me to participate more effectively in discussions during class.	4	3.8	3.88	0.35
S4	I felt as a member of the group in this course.	4	3.6	3.75	0.71
S6	I liked the pair/group work in class.	3.67	3.6	3.63	0.52
S7	I have a good relationship with my colleagues.	4	4	4	0.00
	<i>Total Peers</i>	3.72	3.40	3.52	
S5*	I wish for more support from my teacher.	4	3.6	3.75	0.46
S8	I have a good relationship with my teacher.	4	3.8	3.88	0.35
S9	The teacher held low expectations.	3.67	2.4	2.88	1.13
	<i>Total Teacher</i>	3.89	3.27	3.50	

*items reversed for analysis

Table 4: Social engagement relating to peers and teacher, DBR cycle 2 (n=11)

Course structure and content: The interviews revealed that the transparent Moodle course structure with the constantly available materials and grade reports fostered self-regulation (cognitive engagement). In general, the students perceived the PCAs as positive, as compared to traditional homework. They felt better prepared for the following

lesson and could actively participate in the in-class discussions and make more meaningful contributions (cognitive and behavioral engagement). During home study, they contemplated questions to ask or points to make in the next session (cognitive engagement), and some reportedly did additional research to be better prepared (behavioral engagement). This allowed them to profit more from the course in general.

The students preferred the formative assessment in the English courses to the summative assessment practised in most other subjects. This assessment form seemed to accommodate particularly part-time students who prefer tasks and assessments in 'small nuggets' rather than a final exam which requires (time-)intensive preparation. Pfennig (2024) found in this regard that the mild pressure of formative assessment is a good approach to meet the intended learning outcomes, also for unprepared students. Group work seemed to substantially contribute to the communicative nature of the course. Collaboration was perceived as more intense than in other subjects, resulting in the development of collaboration skills, as was also found by Müge (2017). Such activities fostered communication also during the breaks and led to students lingering after class, thus seeming to affect group dynamics in general (social engagement). Similarly, Zarrinabadi and Ebrahimi (2019) found in this regard that the ICM promotes dialogue in the classroom, particularly during collaborative peer dialogue with learners sharing perspectives, negotiating, and resolving dissimilarities.

The educator's respectful feedback contributed to students feeling less inhibited and afraid of making mistakes when communicating in class (emotional engagement). This is again in line with other studies where respect was found to foster a good student-educator relationship (Carvalho et al., 2021; Harbour et al., 2015; Wara et al., 2018).

DBR cycle 3

In addition to the four engagement dimensions, this cycle examined engagement in the PCAs further, since they seemed to pose a substantial challenge to students in the previous cycle. Furthermore, it was explored whether grading of PCAs was necessary: PCAs are tricky to assess since the main goal is for students to engage with the material rather than do the tasks correctly. Students should come to class prepared but also feel comfortable raising questions and sharing difficulties and challenges they encountered in the self-study phase.

The engagement scores in this cycle were again generally high, and in particular in the social engagement dimension (Table 5).

Variable	Item	Mean (\bar{x})	SD
	<i>Cognitive Engagement</i>		
C1	I reflect on learned content at home.	3.04	0.68
C2	I make connections between things I learn.	3.28	0.54
C3	Preparing for classes is necessary.	2.88	0.78
C4	I plan my time for home study well.	2.72	1.06
	<i>Total Cognitive Engagement</i>	3.03	0.56
	<i>Behavioral Engagement</i>		
B1	I usually prepare for classes.	3.24	0.66
B2	I always complete assignments and tasks.	3.72	0.54
B3	I usually check the instructor's feedback on my assignments/quizzes.	3.64	0.57
B4	I participate actively in class.	3.52	0.51
B5	I take notes on learning content at home.	2.32	0.90
	<i>Total Behavioral Engagement</i>	3.27	0.45
	<i>Social Engagement</i>		
S1	I prefer pair/group work to individual activities in class.	3.68	0.48
S2	I feel as a member of the group in this course.	3.80	0.41
S3	I have a good relationship with my peers (classmates).	3.88	0.33
S4	I prepare/study for this course together with my classmates.	2.52	0.71
S5	I profit from my peers' knowledge in class.	3.50	0.51
	<i>Total Social Engagement</i>	3.50	0.31
	<i>Emotional Engagement</i>		
E1*	I am worried about making mistakes in class.	2.80	0.96
E2	I am interested in this course.	3.20	0.65
E3*	I feel anxious (scared) when speaking in class.	3.08	0.86
E4*	I find home assignments stressful.	1.88	0.67
	<i>Total Emotional Engagement</i>	2.66	0.51
	<i>Teacher</i>		
T1*	I have a good relationship with my teacher.	3.48	0.59
T2	The teacher holds low expectations.	3.28	0.68
T3	My teacher supports me.	3.40	0.56
	<i>Total Teacher</i>	3.15	0.56
	<i>ICM</i>		
ICM1	Preparing for class (pre-class assignments) helped me to understand content in class better.	2.80	0.77
ICM2	Preparing for class (pre-class assignments) enabled me to make more meaningful contributions in class.	3.15	0.75
ICM3	I profit from my peers' knowledge.	3.40	0.60
ICM4*	I would profit more from a traditionally taught course (the teacher lecturing more, and me listening rather than actively contributing/presenting/discussing).	3.10	0.72
ICM5	I would have done the pre-class preparation also if it hadn't been graded.	2.35	0.99
	<i>Total ICM</i>	2.97	0.67
	<i>Importance</i>		
I1	Achieving good grades is important to me.	3.20	0.65
I2	Expanding my knowledge is important to me.	3.68	0.56
I3	The points I can receive for the assignments motivate me to complete them.	3.25	0.97

Table 5: Questionnaire on Student Engagement in the Inverted Classroom, DBR cycle 3, (n=43)

Significant correlations were found between behavioral and cognitive engagement and between behavioral and social engagement (Table 6). This leads to the conclusion that due to the interactive nature of the ICM, students are inclined to reflect more on content, thus understanding it better. Furthermore, collaborative tasks may compel students to participate more actively in class.

	Cognitive Engagement.	Behavioral Engagement.	Social Engagement.	Emotional Engagement.
Cognitive engagement	1			
Behavioral engagement	.737**	1		
Social engagement	.229	.618**	1	
Emotional engagement	-.001	.031	-.126	1

** . Correlation is significant at the 0.01 level (2-tailed)

Table 6: Correlation of the four student engagement dimensions, DBR cycle 3

Table 7 displays connections of engagement with the importance items: the importance of grade moderately correlates with cognitive, behavioral, and emotional engagement. However, it cannot be determined from this survey whether the importance and prospect of good grades motivate students to be more engaged or if intrinsic motivation induces good grades.

	I1- Achieving good grades is important to me.	I2- Expanding my knowledge is important to me.	I3- The points I can receive for the assignments motivate me to complete them.
Cognitive Engagement	.423*	.212	.476*
Behavioral Engagement	.272	.183	.426
Social Engagement	.000	.158	.035
Emotional Engagement	.153	.113	-.507*

*. Correlation is significant at the 0.05 level (2-tailed).

Table 7: Correlation of Engagement with Importance, DBR cycle 3

I2 moderately correlates with cognitive engagement, indicating that the importance of expanding knowledge goes hand in hand with interest and understanding, and reflecting on content.

A significant correlation was displayed between item I3 and cognitive engagement and a significant negative correlation with emotional engagement, suggesting that grading induces stress in students. Moreover, a moderate relationship with behavioral engagement was found. This could indicate that students are less emotionally engaged the more the points matter, which could be due to stress or anxiety, as suggested by Pfennig (2024). Another interpretation is that graded assignments motivate students to engage more with the content of assignments, which is also related to effort (cognitive

engagement). Students then perceive assignments as more meaningful and important (emotional engagement), which adds to intrinsic motivation.

The analysis further revealed a clearly lower mean for the items relating to home study, as compared to in-class study, in every engagement category (C1, C4, B1, B5, S4, E4), as illustrated in Table 7. Students apparently reflected on learned content at home (C1) but had difficulties with planning their time for home study well (C4). Furthermore, they seemed to usually prepare for classes (B1), but at the same time failed to take notes on learning content at home (B5). The latter two items featured the lowest scores in this section. It was also observed in other courses that students rarely took notes. Similar findings have been reported by Stacy and Cain (2015), who suggest that due to the digital learning materials being prevalently available at will, students seem to feel a reduced need for documentation. They emphasize the cognitive benefit of note-taking, which students should be made aware of. Another interesting aspect found is that students seemed to be highly emotionally engaged in the classroom but find home assignments stressful (E4), whereby it needs to be noted that this was the case for the part-time students even more than the full-time students. This could be due to the double load of work and study, students' cognitive shortcomings (unsuitable learning strategies or lack thereof, time management), or other factors, such as the nature of the assignments, tight deadlines, or general workload. Another explanation for home disengagement was put forward by Kostaki and Karayianni (2021), who found that frequent home distractions and technical issues (internet connection) can affect the completion of assignments and consequently considerably decrease student engagement.

	Mean (\bar{x})	Std. Deviation (SD)
Cognitive engagement class (C2,3)	3.08	0.40
Cognitive engagement home (C1,4)	2.88	0.71
Behavioral engagement class (B2,3,4)	3.63	0.34
Behavioral engagement home (B1,5)	2.78	0.68
Social engagement class (S1,2,3,5)	3.54	0.40
Social engagement home (S4)	2.52	0.71
Emotional engagement class (E1,2,3)	3.03	0.57
Emotional engagement home (E4)	1.80	0.58
Total engagement home	2.50	
Total engagement class	3.32	

Table 8: Engagement means for home and class study, DBR cycle 3

Even though the social engagement score was high in the classroom and students seemed to prefer group to individual activities, the lowest score in this category related to preparing for class together with peers (S4). The following interpretations are provided in this regard: 1) the students preferred individual home study as a balance to the collaborative activities in class, 2) poor self-regulation or social skills encumbered organizing group work outside of class.

The significant correlation between Social and Behavioral Engagement indicates that group work in PCAs stimulated their completion (Table 9). This is in line with Tanaka’s (2022) findings that group work can positively impact motivation and learning outcomes. Group work further demands generally more organization of work and better time management, which would counteract procrastination, as shown by Wilson et al. (2021).

	Cognitive engagement at home	Behavioral engagement at home	Social engagement at home	Emotional engagement at home
Cognitive engagement at home	1			
Behavioral engagement at home	.591**	1		
Social engagement at home	.128	.461*	1	
Emotional engagement at home	.142	.096	.263	1

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Table 9: Correlation of home study engagement

Significant correlations were also found with items of the Teacher category, as shown in Table 10. A good student-teacher relationship seems to be connected to academic achievement and the importance of grades. Teacher support correlated with grades, preparation for classes and importance of grades, indicating that the IC is perceived as a supportive learning environment, as also suggested by Stickel and Liu (2016). Similarly, Jasmi and Hin (2014) showed that educators’ support, care, and trust-building can considerably influence academic motivation and achievement.

	Grade	C3-Preparing for classes is necessary.	B5-I take notes on learning content at home.	I1-Achieving good grades is important to me.	I2-Expanding my knowledge is important to me.
T1-I have a good relationship with my teacher.	.553**			.617**	
T2-The teacher holds low expectations.			-.426*		.468*
T3-My teacher supports me.	.400*	.461*		.635**	
Teacher total				.505*	

* . Correlation is significant at the 0.05 level (2-tailed).

** . Correlation is significant at the 0.01 level (2-tailed).

Table 10: Correlations with items of the Teacher category, DBR cycle 3

Several significant correlations were found in the ICM items (Table 10). The ICM generally seemed to have a positive effect on cognitive engagement, albeit rather in class than at home. Mandatory and necessary class preparation obviously helped students understand content in class better and enabled them to make meaningful contributions in class. Social engagement in class was directly related to profiting from peers' knowledge, which obviously happened primarily during interactive activities. It further seems that the ICM accommodated students who considered it important to expand their knowledge.

	ICM1- Preparing for class (PCAs) helped me to understand content in class better.	ICM2-Preparing for class (PCAs) enabled me to make more meaningful contributions in class.	ICM3-I profit from my peers' knowledge.	ICM4*-I would profit more from a traditionally taught course.	ICM Total
C3-Preparing for classes is necessary	.681**	.611**			.712**
Cognitive Engagement					.505*
Cognitive Engagement general (not home)		.497*			
B1-I usually prepare for classes		.581**			
Behavioral Engagement at home			.530*		
Social Engagement			.453*		
Social Engagement general (not home)			.578**		
I2-Expanding my knowledge is important to me.				.466*	

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 10: Correlations pertaining to ICM items, DBR cycle 3.

Course structure and content: The course was overall perceived as organized and well-structured, whereby Moodle was explicitly mentioned as a helpful tool in that respect (cognitive engagement). Since all materials were available on the LMS, students found it easy to follow the course and find materials. The ICM, with its pre-class assignment, obviously aligns well with the nature of an ESP course: the preparation resulted in the students reflecting at home and subsequently sharing their thoughts in class or explaining ideas to their peers. This resulted in more interesting discussions (cognitive and behavioral engagement) and experiencing competence, which is also known to be an indicator of engagement (Steen-Utheim & Foldnes, 2018).

Students reported that they enjoyed the group work, which was required for most tasks. They stated that it was particularly helpful in the first semester in order to get to know their peers. Therefore, it positively affected group dynamics in the class and was

conducive to learning, which was also found in other studies (Gomez-Lanier, 2017; Steen-Utheim & Foldnes, 2018).

The ICM and the generally small groups compelled the students to participate actively in class (behavioral engagement). This active learning style was perceived as interesting and enjoyable (emotional engagement), yet also intense, which is in line with Stickel and Liu's (2016) findings. However, at the same time, the students reported that the active learning style significantly contributed to better understanding content (cognitive engagement).

Even though the students all agreed that the PCAs contributed to active class participation (behavioral engagement), it seems necessary to grade PCAs. This is in line with Stickel and Liu (2016), who found that many students failed to complete the PCAs if they were not graded. Pfennig (2024) also recommends assessing such assignments to ensure students' preparedness.

Conclusion

The aim of this research was to examine student engagement in the inverted ESP classroom in higher education. The findings in this study indicate that the ICM generally fosters student engagement, suggesting that this is a feasible and beneficial approach for teaching undergraduate Engineering students. Social engagement was very high in all courses, whereby the focus on group work particularly suited 1st-semester students in terms of getting to know each other and developing positive and strong group dynamics. The analysis revealed a diverse preference for group work, which is why giving students more choice in terms of group and individual work could be considered a suitable approach in the future.

Due to the PCAs, which require students to engage with content prior to the lesson, the students generally came to class prepared. They participated more actively, and tasks were completed more efficiently. Particularly, part-time students seemed to reflect on learning content in the home study sequences more than they would in class, but at the same time, they experienced the PCAs as more stressful in terms of meeting deadlines, which is why they may need to be granted more preparation time. Generally, engagement seemed to be lower in the home study phases than in class.

The scores for ICM preference as compared to a traditionally taught course were higher in part-time students. Part-time students further seemed to profit more from each other's knowledge than full-time students, probably due to their work experience and maturity. Generally, it seemed that full-time students wished for more guidance and support than part-time students. However, rather than accommodating those needs by providing more materials, it needs to be clearly communicated that independent and self-regulated learning is expected in higher education, which could also foster cognitive engagement. It can therefore be concluded that educators need to consider and accommodate the different needs and expectations of full-time and part-time students when designing and teaching a course.

Another finding was the disparity between low-home and high-classroom engagement. The findings in this study indicate that more attention and thought must be given to pre-class preparation and how to make such assignments more engaging and to foster and possibly teach self-regulation in students. A potential approach is to teach note-taking strategies that can facilitate preparation at home.

The analysis further revealed that the students mirror the educator's high engagement. They seem to play a significant role when it comes to emotional engagement, grades, the importance of grades, and preparing for class. In particular, high expectations, support, care, and feedback seem to play a crucial role.

This research provided insight into student engagement in the inverted ESP classroom. Aspects that emerged in its course to be examined in future studies include counteracting disengagement in home study phases, including students' self-regulation and teamwork, and meaningful assessment in the ICM.

In conclusion, it becomes clear that the ICM is a highly effective model for fostering engagement in higher education. However, there is no single strategy that works for all teaching and learning contexts, but educators need to design a course considering the individual needs of their students.

References

Alsancak Sirakaya, D., & Ozdemir, S. (2018). The Effect of a Flipped Classroom Model on Academic Achievement, Self-Directed Learning Readiness, Motivation and Retention. *Malaysian Online Journal of Educational Technology*, 6(1), 76–91. <https://eric.ed.gov/?id=ej1165484>

Alsowat, H. (2016). An EFL Flipped Classroom Teaching Model: Effects on English Language Higher-Order Thinking Skills, Student Engagement and Satisfaction. *Journal of Education and Practice*, 7(9), 108–121. <https://eric.ed.gov/?id=EJ1095734>

Balkis, M. (2013). The Relationship between Academic Procrastination and Students' Burnout. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, 28(28-1). <https://dergipark.org.tr/en/pub/hunefd/issue/7789/101829>

Bergmann, J., & Sams, A. (2012). *Flip your classroom: Reach every student in every class every day* (1st ed.). International Society for Technology in Education. <http://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=475951>

Blazar, D., & Kraft, M. A. (2017). Teacher and Teaching Effects on Students' Attitudes and Behaviors. *Educational Evaluation and Policy Analysis*, 39(1), 146–170. <https://doi.org/10.3102/0162373716670260>

Bormann, J. (2014). *Affordances of flipped learning and its effects on student engagement and achievement* [Master thesis, University of Northern Iowa]. RIS. <https://scholarworks.uni.edu/grp/137/>

Bosch, W. C., Hester, J. L., MacEntee, V. M., MacKenzie, J. A., Morey, M. T., Nichols, J. T., Pacitti, P. A., Schaffer, B. A., Tomascak, P. B., Weber, S. P., & Young, R. R. (2008). Beyond Lip-Service: An Operational Definition of. *Innovative Higher Education*, 33(2), 83–98. <https://eric.ed.gov/?id=EJ802193>

Bouchareb, A. (2024). *Increasing Introverted EFL Learners' Engagement through the Flipped Classroom Instructional Model* [Dissertation, Unpublished, Amar Telidji University of Laghouat]. Original source. https://www.researchgate.net/publication/384569715_Increasing_Introverted_EFL_Learners%27_Engagement_through_the_Flipped_Classroom_Instructional_Model

Burke, A. S., & Fedorek, B. (2017). Does “flipping” promote engagement? A comparison of a traditional, online, and flipped class. *Active Learning in Higher Education*, 18(1), 11–24. <https://doi.org/10.1177/1469787417693487>

Carvalho, C., Santos, N. N., António, R., & Martins, D. S. M. (2021). Supporting students' engagement with teachers' feedback: the role of students' school identification. *Educational Psychology*, 41(7), 863–882. <https://doi.org/10.1080/01443410.2020.1849564>

Chen, K.-S., Monrouxe, L., Lu, Y.-H., Jenq, C.-C., Chang, Y.-J., Chang, Y.-C., & Chai, P. Y.-C. (2018). Academic outcomes of flipped classroom learning: A meta-analysis. *Medical Education*, 52(9), 910–924. <https://doi.org/10.1111/medu.13616>

Filiz, O., & Kurt, A. A. (2015). Flipped learning: Misunderstandings and the truth [Ters-yüz öğrenme: Yanlış anlaşılmalılar ve doğrular]. *Eğitim Bilimleri Araştırmaları Dergisi*, 5(1), 215–229. <https://doi.org/10.12973/jesr>.

Fredricks, J. A. (2011). Engagement in School and Out-of-School Contexts: A Multidimensional View of Engagement. *Theory into Practice*, 50(4), 327–335.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School Engagement: Potential of the Concept, State of the Evidence. *Review of Educational Research*, 74(1), 59–109. <https://doi.org/10.3102/00346543074001059>

Fredricks, J. A., Filsecker, M., & Lawson, M. A. (2016). Student engagement, context, and adjustment: Addressing definitional, measurement, and methodological issues. *Learning and Instruction*, 43, 1–4. <https://doi.org/10.1016/j.learninstruc.2016.02.002>

Gomez-Lanier, L. (2017). Building Collaboration in the Flipped Classroom: A Case Study. In L. Gómez Chova, A. López Martínez, & I. Candel Torres (Eds.), *EDULEARN proceedings (Internet)*. *Edulearn 17: Conference proceedings* (Vol. 12). IATED Academy. <https://doi.org/10.20429/ijsoitl.2018.120207>

Groccia, J. E. (2018). What Is Student Engagement? *New Directions for Teaching and Learning*, 2018(154), 11–20. <https://doi.org/10.1002/tl.20287>

Harbour, K. E., Evanovich, L. L., Sweigart, C. A., & Hughes, L. E. (2015). A Brief Review of Effective Teaching Practices That Maximize Student Engagement. *Preventing School Failure: Alternative Education for Children and Youth*, 59(1), 5–13. <https://doi.org/10.1080/1045988X.2014.919136>

Hiver, P., Al-Hoorie, A. H., & Mercer, S. (Eds.). (2021). *Psychology of language learning and teaching. Student engagement in the language classroom*. Multilingual Matters.

Hoang Oanh, T. T. (2020). The Impact of a Flipped Classroom on Student Learning Achievements in EFL Classrooms. *Education, Language and Sociology Research*, 1(2), p13. <https://doi.org/10.22158/elsr.v1n2p13>

Hu, M., & Li, H. (2017). Student Engagement in Online Learning: A Review. In *2017 International Symposium on Educational Technology (ISET)*. IEEE. <https://doi.org/10.1109/iset.2017.17>

Jasmi, A. N., & Hin, L. C. (2014). Student-Teacher Relationship and Student Academic Motivation. *Journal for Interdisciplinary Research in Education (JIRE)*, 4(1), 1–8. <https://doi.org/10.7603/s40933-014-0006-0>

Kopp, M., Gröblinger, O., & Adams, S. (2019). Five Common Assumptions that Prevent Digital Transformation at Higher Education Institutions. In *INTED2019 Proceedings*. IATED. <https://doi.org/10.21125/inted.2019.0445>

Kostaki, D., & Karayianni, I. (2021). *Houston, we Have a Pandemic: Technical Difficulties, Distractions and Online Student Engagement*. <https://doi.org/10.31219/osf.io/6mrhc>

Krause, K.-L., & Coates, H. (2008). Students' engagement in first-year university. *Assessment and Evaluation in Higher Education*, 33(5), 493–505.

Li, Y. (2020). A Study on the Application of Flipped Classroom in ESP Teaching: Taking English for Science and Technology as an Example. *Cross-Cultural Communication*, 16(2), 57–60. <https://doi.org/10.3968/11738>

Li, Z., & Li, J. (2022). Using the Flipped Classroom to Promote Learner Engagement for the Sustainable Development of Language Skills: A Mixed-Methods Study. *Sustainability*, 14(10), 5983. <https://doi.org/10.3390/su14105983>

McNally, B., Chipperfield, J., Dorsett, P., Del Fabbro, L., Frommolt, V., Goetz, S., Lewohl, J., Molineux, M., Pearson, A., Reddan, G., Roiko, A., & Rung, A. (2017). Flipped classroom experiences: student preferences and flip strategy in a higher education context. *Higher Education*, 73(2), 281–298. <https://doi.org/10.1007/s10734-016-0014-z>

Moran, C. (2014). *Changing paradigms: A mixed methods study of flipping the English language arts classroom* [Dissertation, North Carolina State University, Raleigh, North Carolina]. RIS. <https://repository.lib.ncsu.edu/bitstream/handle/1840.16/9985/etd.pdf?sequence=1&isAllowed=y>

Müge, A. (2017). Perceptions of senior-year ELT students for flipped classroom: a materials development course. *Computer Assisted Language Learning*, 30(3-4), 204–222. <https://doi.org/10.1080/09588221.2017.1301958>

Nja, C. O., Orim, R. E., Neji, H. A., Ukwetang, J. O., Uwe, U. E., & Ideba, M. A. (2022). Students' attitude and academic achievement in a flipped classroom. *Heliyon*, 8(1), e08792. <https://doi.org/10.1016/j.heliyon.2022.e08792>

Nyman, F. (2024). “You’re not learning skills—You’re just realizing what you can do”: A preliminary study of self-regulation in higher education. *Frontiers in Education*, 9, Article 1418297, 1418297. <https://doi.org/10.3389/feduc.2024.1418297>

Obari, H., & Lambacher, S. (2015). Successful EFL teaching using mobile technologies in a flipped classroom. In F. Helm, L. Bradley, M. Guarda, & S. Thouèsny (Eds.), *Critical CALL: Proceedings of the 2015 EUROCALL Conference, Padova, Italy / edited by Francesca Helm, Linda Bradley, Marta Guarda, and Sylvie Thouèsny* (pp. 433–438). Research-publishing.net. <https://doi.org/10.14705/rpnet.2015.000371>

OECD. (2019). *OECD Future of Education and Skills 2030: OECD Learning Compass 2030*. OECD. https://www.oecd.org/education/2030-project/contact/OECD_Learning_Compass_2030_Concept_Note_Series.pdf

Peng, W. (2017). Research on Model of Student Engagement in Online Learning. *Eurasia Journal of Mathematics, Science and Technology Education*, 13(7), 2869–2882. <https://doi.org/10.12973/eurasia.2017.00723a>

Pfennig, A. (2024). The challenge of unprepared students in inverted classroom teaching scenarios. *10th International Conference on Higher Education Advances (HEAd'24)*, 1–8. <https://doi.org/10.4995/HEAd24.2024.17067>

Salem, A. A. M. S. (2018). Engaging ESP University Students in Flipped Classrooms for Developing Functional Writing Skills, HOTS, and Eliminating Writer's Block. *English Language Teaching*, 11(12), 177. <https://doi.org/10.5539/elt.v11n12p177>

Schmidt, R., & Mindt, I. (2020). Student engagement im Inverted Classroom, *Tagungsband zur Tagung Inverted Classroom and beyond*, 28–48. https://www.icmbeyond.net/wp-content/uploads/2020/01/ICM2020_Web.pdf#page=28

Shernof, D. J., Ruzek, E. A., Sannella, A. J., Schorr, R. Y., Sanchez-Wall, L., & Bressler, D. M. (2017). Student Engagement as a General Factor of Classroom Experience: Associations with Student Practices and Educational Outcomes in a University Gateway Course. *Frontiers in Psychology*, 8, 994. <https://doi.org/10.3389/fpsyg.2017.00994>

Sinatra, G. M., Heddy, B. C., & Lombardi, D. (2015). The Challenges of Defining and Measuring Student Engagement in Science. *Educational Psychologist*, 50(1), 1–13. <https://doi.org/10.1080/00461520.2014.1002924>

Stacy, E. M., & Cain, J. (2015). Note-taking and Handouts in The Digital Age. *American Journal of Pharmaceutical Education*, 79(7), 107. <https://doi.org/10.5688/ajpe797107>

Steen-Utheim, A. T., & Foldnes, N. (2018). A qualitative investigation of student engagement in a flipped classroom. *Teaching in Higher Education*, 23(3), 307–324. <https://doi.org/10.1080/13562517.2017.1379481>

Stickel, M., & Liu, Q. (2016). *The Effects of the Inverted Classroom Approach: Student Behaviours, Perceptions and Learning Outcomes*. The Higher Education Quality Council of Ontario. <https://doi.org/10.13140/RG.2.1.4033.8649>

Tanaka, M. (2022). Individual perceptions of group work environment, motivation, and achievement. *International Review of Applied Linguistics in Language Teaching*, 60(4), 1201–1225. <https://doi.org/10.1515/iral-2020-0183>

Vitta, J. P., & Al-Hoorie, A. H. (2020). The flipped classroom in second language learning: A meta-analysis. *Language Teaching Research*, 136216882098140. <https://doi.org/10.1177/1362168820981403>

Wara, E., Aloka, P. J. O., & Odongo, B. C. (2018). Relationship between Emotional Engagement and Academic Achievement among Kenyan Secondary School Students. *Academic Journal of Interdisciplinary Studies*, 7(1), 107–118. <https://doi.org/10.2478/ajis-2018-0011>

Wilson, R., Joiner, K., & Abbasi, A. (2021). Improving students' performance with time management skills. *Journal of University Teaching and Learning Practice*, 18(4). <https://doi.org/10.53761/1.18.4.16>

Yang, J. S. M. (2020). Promoting student engagement and preparation in flipped learning's pre-class activities: A systematic review. *ASCILITE Publications*, 125–133-125–133. <http://publications.ascilite.org/index.php/apub/article/view/419>

Zarrinabadi, N., & Ebrahimi, A. (2019). Increasing peer collaborative dialogue using a flipped classroom strategy. *Innovation in Language Learning and Teaching*, 13(3), 267–276. <https://doi.org/10.1080/17501229.2018.1455688>

Zimmerman, B. J. (2002). Becoming a Self-Regulated Learner: An Overview. *Theory into Practice*, 41(2), 64–70. https://doi.org/10.1207/s15430421tip4102_2