Learning in On-demand and Face-to-face Lesson Formats: Factors Influencing Spontaneous Preparation and Learning Strategies

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Abstract

This study investigated how instructional formats (on-demand versus face-to-face) affect students' voluntary preparation, learning strategies during lessons, and the factors influencing these variables. Participants were 473 university students enrolled in psychology courses. According to the results of the questionnaire survey, face-to-face classroom lessons yielded significantly higher levels of voluntary preparation and greater use of elaboration strategies during lessons. These differences may reflect increased opportunities for peer interaction and exchange of ideas in face-to-face settings. Across both formats, preparation positively predicted the use of elaboration and meta-cognitive strategies during lessons, indicating that preparation enhances deep processing during each lesson. Furthermore, students who endorsed non-cognitive beliefs that emphasise learning quantity were more likely to prepare for face-to-face lessons. Implications for course design and instructional planning are discussed, with recommendations for promoting preparation and deeper processing strategies in on-demand formats.

Keywords: preparation, on-demand, face-to-face, learning strategy, higher education

1. Introduction

1.1 Discussion on Online Classes

Spread of the COVID-19 pandemic led many universities to shift to online classes. Online classes can be broadly categorized into on-demand (asynchronous) and real-time (synchronous) formats. On-demand classes involve distributing video materials via the internet and submitting assignments. Conversely, real-time teaching uses video conferencing tools, such as Zoom, to conduct live classes in a two-way format, allowing interaction between teachers and students.

Real-time online classes enable interactions between teachers and students similar to face-to-face classroom lessons and are considered advantageous for recreating classroom experiences virtually. However, they also pose practical challenges, such as difficulty hearing due to internet connectivity issues or being unable to join. Therefore, implementing such classes is not always feasible, especially for courses with many students. A survey on remote classes during the COVID-19 pandemic (Katsuragi, 2021) reported that students' understanding in on-demand lessons was higher than in real-time online lessons; furthermore, many students supported the use of on-demand formats.

How do actual learning experiences then differ between on-demand lessons and face-to-face lessons conducted in physical classrooms without the use of any technology? A survey on university educators conducted before the widespread adoption of online classes revealed negative opinions, including that 'there is still insufficient knowledge' and 'instructors do not yet fully understand online education' (Smith, Ferguson, & Caris, 2002). Moreover, studies on students' perceptions and evaluations during the pandemic also reported that online classes were unfavourable, suggesting that online learning is generally less effective than face-to-face lessons (Adnan & Anwar, 2020; Maatuk, Elberkawi, Aljawarneh, Rashaideh, & Alharbi, 2022; Nasution, Surbakti, Zakaria, Wahyuningsih, & Daulay, 2021).

However, since current educators have accumulated knowledge and experience with online teaching, the criticism that 'university instructors do not understand online education' no longer applies. Additionally, previous studies that favoured face-to-face classroom lessons over online classes did not directly compare on-demand video-based lessons with face-to-face lessons (Adnan & Anwar, 2020; Burch, Heller, Burch, & Heller, 2016; Nasution et al., 2021). Therefore, when considering the future of education, comprehensively comparing whether on-demand or face-to-face lessons are more effective is necessary.

1.2 Previous Studies on On-Demand Lessons

With the proliferation of the internet, the development of e-learning systems has advanced; discussions on the effectiveness of on-demand lessons have been ongoing even before the COVID-19 pandemic. Takagi (2005) highlighted several advantages of on-demand e-learning, such as the ability to provide lecture videos and materials, flexibility of time and location, and easy access to external resources. Furthermore, Long, Abd Halim, and Abdul Hanid (2023) conducted a review after the pandemic and emphasised the advantages of videos, such as the ability to pause or rewind as needed and deepen understanding through repeated viewing (Adedoyin & Soykan, 2023). Brockfeld, Müller, and de Laffolie (2018) compared video lectures with face-to-face lessons and focused on various indicators, such as academic achievement and course satisfaction. They reported that 48% of students preferred face-to-face lessons, while 27% favoured video lectures. Regarding learning environment, concentration and audio clarity were rated higher in video lectures than in face-to-face lessons. However, no significant difference was observed in academic performance, suggesting that both formats could have comparable educational effects. Video-based lectures offer various benefits for students and instructors. Thus, they could serve as a supplement or partial replacement for traditional face-to-face lessons.

Omori et al. (2021) empirically investigated the educational effects of on-demand lessons via Learning Management Systems (LMS) that managed video uploads and assignments. Students watched videos, submitted quizzes and reports, and instructors provided feedback. Students exchanged questions and comments via LMS forums and emails. A comparison of the perceived satisfaction with face-to-face and on-demand lessons revealed higher satisfaction with the former. In addition, the study used text-mining techniques to analyse the strengths and weaknesses of both formats. The advantages of on-demand lessons included flexible timing and the possibility of repeated learning, whereas disadvantages included difficulty in hearing audio clearly, asking questions, and retaining content.

Alongside measuring satisfaction, empirical studies have also examined the relationship between on-demand lessons and academic achievement. Noetel et al. (2021) reviewed the educational effects of video-based materials in higher education and reported that substituting traditional methods with videos did not produce significant differences. Similarly, Handa (2021) analysed exam scores between online on-demand lessons and face-to-face lessons for high school mathematics. No significant difference was observed in regular examination scores, suggesting that both formats can have equivalent educational effects.

1.3 Focus on Learning Strategies

Comparison between on-demand and face-to-face lessons has become more frequent since the COVID-19 pandemic, and existing studies (Handa, 2021; Noetel et al., 2021) suggest that on-demand lessons can produce educational effects comparable to those of face-to-face classes. Since no significant differences have been observed in academic achievement, actively adopting on-demand lessons rather than traditional face-to-face instruction is natural.

However, previous studies (Brockfeld et al., 2018; Handa, 2021; Noetel et al., 2021) have primarily focused on dependent variables such as course satisfaction and understanding, without paying close attention to how learners study and process the content of lessons. While satisfaction and comprehension are important indicators of education, understanding how individual learners' approaches to processing information differ between on-demand and face-to-face lessons in greater detail is essential when considering future instructional methods.

Burch et al.'s (2016) study explicitly focused on how students learn the content. They compared not only exam scores but also student engagement and found that face-to-face lessons resulted in both higher emotional engagement (degree to which students are emotionally immersed in the content) and cognitive engagement (level of deep processing). However, their study was conducted before the COVID-19 pandemic. As educators and students became more accustomed to on-demand lessons during the pandemic, differences between on-demand and face-to-face lessons may have since evolved.

Therefore, this study focused on learning strategies – or how learners study the content of lessons – and examined the differences between the two instructional formats.

1.4 Learning Strategies During Lessons

In educational psychology, learning strategies refer to the various processes that students engage in during learning. Since Pintrich, Smith, Garcia, and McKeachie's study (1993), learning strategies have been examined across different fields of study and various academic domains (Bonney, Cortina, Smith-Darden, & Fiori, 2008; Elliot, McGregor, & Gable, 1999; Wolters, 2004). Generally, effective learning strategies tend to involve deep processing, such as elaboration, and meta-cognitive strategies, such as monitoring.

According to Pintrich et al. (1993), elaboration refers to activities where learners relate new material to their prior knowledge as they process information. An example of elaboration as a learning strategy used during a lesson may include 'listening to the lecture while relating the content to that previously learned' or 'taking notes in one's own words', as discussed by Shinogaya (2010). Research on note-taking has considered activities such as connecting lecture information with prior knowledge while taking notes as elaborations. Kiewra, Benton, Kim, Risch, and Christensen (1995) and Peverly et al. (2007) also revealed a positive relationship between note-taking during lessons and understanding of the material.

Conversely, meta-cognitive strategies involve checking and controlling one's understanding. Examples of meta-cognitive strategies during lessons include 'monitoring what parts are unclear' or 'thinking about what is important and what is not while listening the lecture' (Murayama, 2003). Previous studies on the relationship between learning strategies and academic performance have consistently reported that learners utilizing elaboration and meta-cognitive strategies achieve higher academic outcomes (Pintrich & De Groot, 1990; Pokay & Blumenfeld, 1990).

1.5 Preparation for Upcoming Lesson

This study focused on preparatory learning behaviours, specifically on preparation for upcoming lessons. Preparation in this study means 'briefly studying the content of an upcoming lesson beforehand to better understand the material that will be covered in the upcoming lesson'. For example, if an upcoming lesson covers psychological theories and research findings related to such theories, preparation would include reading the textbook or lecture handouts beforehand. Since learning does not occur solely during each lesson, learners should voluntarily prepare to deepen their understanding. Previous research on advance organizers highlights the theoretical background for the effectiveness of preparation (Ausubel, 1960). An advance organizer is an abstract and comprehensive piece of information related to the upcoming learning content, provided beforehand. Providing learners with an advance organizer facilitates better understanding when they subsequently learn the detailed content (Bromage & Mayer, 1986; Mayer & Bromage, 1980).

Research studies in the 1980s and 1990s examined how advance organizers deepened comprehension of learning content. In the 2000s, studies began investigating how advance organizers affect subsequent cognitive processing during learning. Titsworth and Kiewra (2004) reported that providing cues and relevant prior knowledge beforehand promotes more effective note-taking during subsequent learning.

Recently, studies have specifically examined the effects of preparation for upcoming lessons. Shinogaya (2010) investigated the relationship between strategies in preparation and learning strategies used by Japanese high school students during classroom lessons. Results revealed that preparing for English classes by reading texts and thinking of the meaning of sentences and unknown words led to meta-cognitive strategies, such as checking one's understanding during lessons, rather than merely copying content from the blackboard. Furthermore, it encouraged elaboration strategies, such as note-taking.

Shinogaya (2018) also examined the factors that influenced learners' voluntary preparation for upcoming lessons and focused on their beliefs surrounding learning and motivation. This study differentiated between cognitive beliefs, which emphasise deep processing, and non-cognitive beliefs, which do not. It also distinguished extrinsic and intrinsic motivation. The Path analysis revealed that cognitive beliefs and intrinsic motives were significantly and positively related to spontaneous preparation (gaining knowledge beforehand). Conversely, non-cognitive beliefs had a significant negative relationship with preparation. Additionally, extrinsic motives were significantly related to preparation. Thus, learners with high extrinsic motives may prepare in advance to avoid being unable to answer the questions posed by teachers during class.

Additionally, with the recent spread of flipped classroom approaches (Bergmann & Sams, 2012), research focusing on preparation for upcoming lessons has increased. A flipped classroom is a teaching approach that comprises individual learning outside the classroom and collaborative learning inside the classroom (O'Flaherty & Phillips, 2015). Empirical research on its effectiveness reported that by watching lecture videos related to content before lessons, interactions during classroom lessons become more active, enabling deep processing (Danker, 2015; Strayer, 2012).

Thus, previous studies have reported that by engaging in preparation and gaining a general framework of the upcoming content, students can deepen their cognitive processing during lessons and utilize meta-cognitive learning strategies. However, many teachers are not yet accustomed to flipped classrooms; incorporating flipped classrooms can pose a significant psychological burden (Lo & Hew, 2017). Therefore, incorporating the benefits of preparation without making significant changes to the overall teaching style is important.

Furthermore, research examining the differences in spontaneous preparation among learners, including flipped classrooms, and factors of preparation and learning strategies during on-demand and face-to-face lessons.

Environmental factors, including the classroom setting, affect learning strategies at home (Nolen & Haladyna, 1990; Wolters, 2004). Shinogaya (2014, 2017) reported that the extent to which students engage in preparation is influenced by the content of each lesson and the teaching approach adopted by individual instructors; furthermore, the frequency of preparation and learning strategies during lessons can vary depending on the lesson format.

Therefore, differences in instructional format, whether on-demand or face-to-face, can lead to variations in learners' spontaneous preparation, factors that affect preparation, and learning strategies used during lessons. We understand information by relating it to our own knowledge (Novak, 2002). Thus, preparation is considered an effective activity to deepen understanding in each lesson. However, since insufficient learners voluntarily engage in preparation, examining which instructional format—on-demand or face-to-face—better encourages learners' spontaneous preparation would be valuable for informing future educational practices.

1.6 Purpose

This study aimed to compare and examine how learners learn the contents of each lesson differed between on-demand and face-to-face lessons. Specifically, this study implemented both formats and examined university students enrolled in a Psychology course. By analysing learners' use of preparation, elaboration, and meta-cognitive strategies during lessons in each format, as well as factors that affect learners' spontaneous preparation for upcoming lessons and learning strategies during lessons, this study sought to investigate the differences in their learning between on-demand and face-to-face lessons.

2. Methods

2.1 Participants

Participants were university students aged 18–21 years who attended a private university in Tokyo, Japan. A questionnaire survey was administered to 473 students enrolled in the Psychology course.

2.2 Course Overall Flow

Table 1 presents the titles, formats, and topics of each lesson. As there were many enrolees, two separate classes covering the same content were held each week, and students registered for either class. Students in both classes attended lessons once a week for 14 weeks, covering topics related to social and clinical psychology. Most classes were conducted in a face-to-face format; however, sessions in Weeks 4, 6, 10, and 12 were delivered on-demand (video streaming). PowerPoint slides used during the lessons were provided as PDF files, uploaded to the LMS before each lesson, allowing students to use them as preparatory materials or view them during the lesson.

2.2.1 Face-to-Face Classroom Lessons

Face-to-face classroom lessons were structured to last 90 minutes each. During each lesson, explanations of relevant psychological theories and terminology related to the topic were provided using PowerPoint slides. Real-life examples were frequently employed to facilitate student understanding. For instance, in Week 2's lesson on 'Social Cognition', the concept of how we perceive events around us was explained, including how human information processing differs based on knowledge frameworks called schemas. When explaining such content, examples such as 'How would you interpret the story of A being involved in a traffic accident?' or 'What would you think if B scored 100 points on a test?' based on students' prior knowledge regarding the individuals (person schemas), were used to illustrate how perspectives differ based on the existing knowledge. Furthermore, to avoid purely didactic transmission of knowledge, a slide titled 'Let Us Think' was presented approximately every 20 minutes. This slide posed questions related to the lesson content, and students could discuss their opinions with nearby classmates. For example, in the social cognition dealing with 'attribution' (causes of events), students imagined failing a test and discussed their ideas on what may have caused that poor result with classmates nearby.

Table 1. Content converted in each lesson

Week	Titles	Formats	Contents	Example of 'Let us think about it'
1	Orientation	Face-to-face	Teaching methods and evaluation strategies	—
2	Social cognition	Face-to-face	Social cognition and attribution errors	Causes when I receive a poor score on a test
3	Self	Face-to-face	Self-concept, self-esteem, self-disclosure and self-Presentation	Example of attributing success to one's connection with others
4	Attitude	On-demand	Attitudes and determinants of persuasiveness	Everyday example that illustrates the theory of cognitive dissonance
5	Social influence	Face-to-face	Conformity Following Authority	Everyday example of conforming to others' actions or statements
6	Interpersonal attraction	On-demand	Means of information transmission Determinants of attractiveness	Daily examples related to 'mere exposure effect'
7	Help behaviour	Face-to-face	Classification and determinants of Help-Behaviours	Factors that determine the occurrence of help behaviour when a stranger asks for directions in a city
8	Attack behaviour	Face-to-face	Theories of aggressive behaviour and methods to suppress aggression	Deliberate strategies to suppress aggressive behaviour
9	Group and individual	Face-to-face	Social facilitation and social inhibition	Conditions that trigger social facilitation
10	Mass-communication	On-demand	The influence of mass media and its processes	Daily examples where individuals feel they are influenced by the media
11	Mental disorder	Face-to-face	Diagnostic criteria and Classification of mental disorders	Reasons why, in the past, there were differences between countries in the prescribing amounts of psychiatric medications
12	Psychotherapy 1	On-demand	Psychoanalysis	Problems of psychoanalysis
13	Psychotherapy 2	Face-to-face	Behaviour therapy Cognitive therapy	Problems of behaviour therapy
14	Reflection	Face-to-face	Reflecting various topics and research findings	—

After each lesson, students submitted a mandatory assignment reflecting on the learned content, titled 'What I understood' and 'What I did not understand'. Additionally, as an indicator of voluntary information-seeking behaviour, students could submit an optional assignment titled 'Things I looked up'. Submission period was set to one week from the lesson date.

2.2.2 On-Demand Lessons

For the weeks of on-demand lessons, videos were created that combined voice explanations with PPT slides, similar to the face-to-face lessons. The videos were uploaded to Google Drive and links were posted on the LMS. Students were instructed to watch the videos. To align the video structure and flow with that of face-to-face lessons, 'Let Us Think' slides were inserted approximately every 20 minutes. These slides presented questions related to the content, encouraging students to pause the video and consider their own opinions. For example, regarding the theory of cognitive dissonance—specifically, how it explains behaviours where individuals try to avoid contradictions between their thoughts and actions—the video first explained the theory. Subsequently, students were asked to think about daily examples of behaviours that can be explained by cognitive dissonance; thus, students were prompted to consider specific examples from daily life. Unlike in face-to-face lessons, each video was approximately 60 minutes as students did not need to exchange opinions with peers during the 'Let Us Think' segments.

Additionally, after each lesson, students submitted mandatory assignments reflecting on what they understood ('What I understood') and what they did not ('What I did not understand'), similar to face-to-face lessons. They could also optionally submit 'Things I looked up' as an indicator of voluntary information-seeking behaviour. Videos were made available for one week after each lesson, and the assignment submission period was set to one week.

2.3 Measurement of the Variables

After the 14th week, at the end of all lessons, a questionnaire survey was conducted to measure how students learned the content of lessons. The survey measured their learning motives, beliefs about learning, learning strategies (elaboration and meta-cognitive strategy) used during lessons, as well as voluntary preparation prior to lessons. To help remind students how they learned in the lessons, the teacher asked the students to image the 12th lesson for the on-demand class and 13th lesson for the face-to-face class. It was administered using the LMS's online questionnaire feature.

The survey clearly stated that the purpose was to examine how students learned and that it would utilize the findings for future course improvements. Regarding ethical considerations, students were explained that 'participation was voluntary', 'there were no right or wrong answers, and responses were not related to grades', 'collected data would be statistically analysed, and personal information will not be leaked externally', and 'results may be presented at academic conferences or published in academic papers'. Lastly, 'whether or not they consent to the use of their data would have no impact whatsoever on their grades'. Participants were asked to consent to the use of their response data.

2.3.1 Learning Motives

To assess the quality of motivation towards the psychology course, the enrolees' intrinsic motives and extrinsic motives were measured, similar to Shinogaya (2018). Five items were listed for both types of learning motives. For intrinsic motives, example items included 'I enrolled in this course because learning psychology is interesting' and 'I enrolled in this course because learning psychology is useful for my future job'. For extrinsic motives, example items included 'I enrolled in this course because my friend recommended to do so' and 'I enrolled in this course to collect credits needed for graduation from university'. Participants rated items on a 6-point Likert scale ranging from 1 (not true to me at all), 2 (not true to me), 3 (somewhat not true to me), 4 (somewhat true to me), 5 (true to me), to 6 (strongly true to me).

2.3.2 Beliefs about Learning

Learning beliefs were measured via items from Uesaka, Seo, and Ichikawa (2009) and Shinogaya's (2018) studies. However, since this study focused on university students taking a psychology class, minor modifications were made to the items, such as replacing 'Mathematics' with 'Psychology'. Cognitive beliefs refer to the extent to which students place importance on deep processing in learning and was measured with five items (e.g., 'Understanding relations among each fact is important in learning', 'It is better to be inventive in how I study'.) Non-cognitive beliefs refers to the extent students place importance on rote memorization and total volume of studying. It was measured with five items (e.g., 'If I can memorize properly, I can say that I understand', 'Repeating the same thing will help me learn it'). Participants rated items on a 6-point Likert scale ranging from 1 (not true to me at all), 2 (not true to me), 3 (somewhat not true to me), 4 (somewhat true to me), 5 (true to me), to 6 (strongly true to me).

2.3.3 Learning Strategies During Lessons

Elaboration refers to a learning strategy in which learners relate new information to prior knowledge. Examples include 'connecting what I have learned previously' and 'taking notes in my own words'. Based on questionnaire items used by Shinogaya (2010, 2018), this study developed three items: 'I listened to professor's explanation while

considering connections to what I have previously learned', and 'I took notes on the slides while listening'. To measure these strategies, students separately rated how much they used each strategy during face-to-face and on-demand lessons on a 6-point Likert scale ranging from 1 (not true to me at all), 2 (not true to me), 3 (somewhat not true to me), 4 (somewhat true to me), 5 (true to me), to 6 (strongly true to me).

Meta-cognitive strategies include monitoring one's understanding of and focusing on important information. Based on questionnaire items used by Murayama (2003) and Shinogaya (2010), this study developed seven items, including 'I listened to the professor's explanation while identifying points of confusion about the class content' and 'I distinguished between what seemed important and what did not while attending the class'. Students separately rated the extent to which they engaged in these activities during face-to-face and on-demand lessons respectively on a 6-point Likert scale ranging from 1 (not true to me at all), 2 (not true to me), 3 (somewhat not true to me), 4 (somewhat true to me), 5 (true to me), to 6 (strongly true to me).

2.3.4 Preparation for Upcoming Lesson

Shinogaya (2018) used items, such as 'I read the textbook beforehand' and 'I check points I cannot understand in the textbook beforehand', to measure preparation for middle school mathematics learning. In this study, since PPT slides were distributed as materials in advance, questionnaire items were revised to include three items: 'I read the slides beforehand', and 'I check points I cannot understand in the slides beforehand'. Students separately rated each item on the extent to which they engaged in these activities before they took face-to-face lessons and on-demand lessons respectively on a 6-point Likert scale ranging from 1 (not true to me at all), 2 (not true to me), 3 (somewhat not true to me), 4 (somewhat true to me), 5 (true to me), to 6 (strongly true to me).

3. Results

3.1 Calculation of Scale Scores

Data from 357 participants who agreed to informed consent was analysed. For each variable, the omega coefficient was calculated for the subscales to check the reliability of each subscale. Sufficiently high values were obtained in all cases (0.66–0.86). Therefore, the scales had adequate reliability. Average scores of the questionnaire items constituting learning motives (intrinsic motives and extrinsic motives), beliefs about learning (cognitive beliefs and non-cognitive beliefs), learning strategies during lessons (elaboration and meta-cognitive) in on-demand and face-to-face formats, and preparation in on-demand and face-to-face formats were calculated and used as scale scores. Table 2 presents the scores for learning motives and beliefs about learning.

Table 2. Descriptive scores of motives and beliefs

	ω	mean	SD
Intrinsic motives	0.72	5.11	0.62
Extrinsic motives	0.69	3.23	1.07
Cognitive beliefs	0.70	4.99	0.53
Non-cognitive beliefs	0.73	3.68	0.85

3.2 Comparison of Variable Scores

Table 3 presents the descriptive statistics of learning strategies during lessons (elaboration and meta-cognitive strategy), and preparation and results of a within-subjects analysis of variance (ANOVA) conducted to compare the mean scores of each variable between on-demand and face-to-face lessons. Analysis revealed significant differences in the scores for elaboration ($F(1, 355) = 6.67$, $p < .05$, $\eta^2_g = 0.002$) and preparation ($F(1, 355) = 13.58$, $p < .01$, $\eta^2_g = 0.003$); both scores were higher in face-to-face lessons. However, no significant difference was observed in meta-cognitive strategies between the two formats ($F(1, 355) = 0.17$, n.s., $\eta^2_g = 0.000$).

Table 3. Results of the ANOVA on learning strategies and understanding of lessons

	On-demand			Face-to-face				
	ω	mean	SD	ω	mean	SD	F (1, 355)	η^2_g
Learning strategies during lessons								
Elaboration	0.66	4.58	0.72	0.72	4.65	0.73	6.67**	0.002
Meta-cognitive	0.75	4.61	0.61	0.83	4.60	0.66	0.17	0.000
Preparation	0.81	3.81	1.08	0.86	3.92	1.10	13.58***	0.003

*** $p < .01$, ** $p < .05$

3.3 Examination of Predictive Factors for Preparation

This study investigated the factors that influenced preparation in on-demand and face-to-face lessons. Using scores of preparation in both formats as the dependent variables, a multiple regression analysis was conducted with four independent variables: intrinsic motives, extrinsic motives, cognitive beliefs, and non-cognitive beliefs, as in Shinogaya's study (2018). Table 4 presents the results. Intrinsic motives were positively related to preparation in both formats—on-demand ($\beta = .422$, $p < .01$) and face-to-face ($\beta = .441$, $p < .01$). Additionally, non-cognitive beliefs had a significant positive correlation with preparation only in face-to-face classes ($\beta = .240$, $p < .01$).

Table 4. Multiple regression analysis with preparations

	On-demand	Face-to-face
Intrinsic motives	.422***	.441***
Extrinsic motives	.088	.091
Cognitive beliefs	.280	.182
Non-cognitive beliefs	.131	.240***
adj R^2	.122***	.126***

Note. *** $p < .01$, ** $p < .05$

3.4 Prediction of Learning Strategies During Lessons

This study also examined the differences between the two formats in factors of learning strategies during lessons. According to previous research studies (Danker, 2015; Shinogaya, 2010; Strayer, 2012), preparation may impact learning strategies during lessons. Hierarchical multiple regression analysis was conducted to divide the effects of factors such as learning motives and beliefs about learning, and the effects of preparation. Step 1 included intrinsic motives, extrinsic motives, cognitive beliefs, and non-cognitive beliefs as independent variables. In Step 2, scores of preparation and each learning strategy used during lessons were additionally included as the independent and dependent variables, respectively. Table 4 presents the results.

Table 5. Multiple regression analysis with learning strategies in each lesson

	On-demand				Face-to-face			
	Elaboration		Meta-cognitive		Elaboration		Meta-cognitive	
	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2
Intrinsic motives	.382***	.315***	.330***	.266***	.405***	.330***	.393***	.303***
Extrinsic motives	- .134***	- .148***	- .04	- .053	- .073**	- .088**	.004	-.013
Cognitive beliefs	.319***	.275***	.330***	.288***	.389***	.358***	.380***	.343***
Non-cognitive beliefs	- .053	- .074	- .002	- .022	- .102**	- .143***	-.037	-.086**
Preparation		.158***		.150***		.171***		.204***
adj R^2	.315***	.363***	.311***	.372***	.353***	.409***	.358***	.457***

Note. *** $p < .01$, ** $p < .05$

In the analysis predicting elaboration during lessons, significant positive relationships were observed with intrinsic motives (β = .315, p < .01) and cognitive beliefs (β = .275, p < .01) for on-demand lessons in Steps 1 and 2. Conversely, extrinsic motives had a significant negative relationship (β = -.148, p < .01) in both steps. Non-cognitive beliefs did not exhibit a consistent significant relationship (β = -.074, n.s.). Preparation scores entered in Step 2 also revealed a significant positive relationship (β = .158, p < .01). In face-to-face lessons, intrinsic motives (β = .330, p < .01) and cognitive beliefs (β = .358, p < .01) had significant positive relationships in Steps 1 and 2. Conversely, extrinsic motives (β = -.088, p < .05) and non-cognitive beliefs (β = -.143, p < .01) had significant negative relationships. Preparation scores in Step 2 also exhibited a significant positive relationship (β = .171, p < .01).

When meta-cognitive strategies were used as the dependent variable, intrinsic motives (β = .266, p < .01) and cognitive beliefs (β = .288, p < .01) had significant positive relationships in on-demand lessons. Conversely, extrinsic motives (β = -.053, n.s.) and non-cognitive beliefs (β = -.022, n.s.) did not. Preparation scores in Step 2 exhibited a significant positive relationship (β = .150, p < .01).

In face-to-face lessons, intrinsic motives (β = .303, p < .01) and cognitive beliefs (β = .343, p < .01) had significant positive relationships in both steps; conversely, non-cognitive beliefs had a significant negative relationship (β = -.086, p < .05). Extrinsic motives did not show a significant relationship (β = -.014, n.s.); however, preparation scores entered in Step 2 had a significant positive relationship (β = .204, p < .01).

4. Discussion

4.1 Differences in Learning Inside and Outside of Lesson

This study compared preparation prior to lessons and learning strategies used during lessons in on-demand and face-to-face formats. Results indicated a significant difference in elaboration during lessons and spontaneous preparation before lessons between the two formats. Prior research revealed that learners' preparation was influenced by the teacher's instructional style. Shinogaya (2014, 2017) reported that in learning English, teachers' detailed explanations of English word meanings promoted preparation such as 'looking up word meanings'. Additionally, Shinogaya and Onoda (2022) demonstrated that increasing opportunities for peer discussion at the beginning of each face-to-face lesson enhanced students' preparation, as it encouraged students to organize their thoughts beforehand.

In this study, both the on-demand and face-to-face lessons were conducted by the same instructor with the same lesson structure. Specifically, both formats explained psychological theories and previous findings via examples and incorporated 'Let Us Think' slides every 20 minutes. Thus, students could consider related questions and reflect on their own opinions. The major difference was the interaction with peers during the lesson. In face-to-face lessons, students exchanged opinions with nearby peers during the 'Let Us Think' segments; conversely, in on-demand lessons, students paused the video and thought of the questions alone, without peer discussion. This difference in interaction likely affected elaboration during lessons, which involves relating new information to prior knowledge. In this study, elaboration was measured through items such as 'I listened to the professor's explanation while considering connections to what I have previously learned', and 'I took notes on the slides while listening'. Previous research (e.g., Onoda, Kawakita, & Akita, 2018) found that writing thoughts on sticky notes beforehand enhanced the quantity and

quality of interactions. Since face-to-face lessons require students to actively note their ideas and discuss with peers, this may have facilitated greater use of elaboration compared with on-demand lessons.

Regarding meta-cognitive strategies, no significant differences were observed between the two formats. These strategies were measured through items, such as 'I listened to the professor's explanation while identifying points of confusion about the class content' and 'I distinguished between what seemed important and what did not while attending the class'. Although students expressed their opinions during 'Let Us Think' activities, such activities tend to promote elaboration, not necessarily meta-cognition. Thus, no difference was observed. However, the type of activities and questions posed may influence the use of meta-cognitive strategies. For example, if classroom activities involve discussing points students did not understand or find important—rather than activating prior knowledge—face-to-face interactions may promote greater use of meta-cognitive strategies, as students need to clarify questions in preparation for peer discussions. Future research should vary questions and activities during class and explore how different activity designs affect learning strategies in both formats.

4.2 Effects of Factors on Spontaneous Preparation

In addition to analysing the differences in variable scores, the influences of factors on preparation were also examined. Results of the multiple regression analysis revealed that in both on-demand ($\beta = .422$, $p < .01$) and face-to-face classes ($\beta = .441$, $p < .01$), intrinsic motives had a significant positive correlation with preparation for upcoming lessons. The concept of intrinsic motivation in this study aligned closely with autonomous motivation in the Self-Determination Theory (Deci & Ryan, 2012). Previous research on the Self-Determination Theory reported that autonomous motivation led to deeper processing, voluntary learning, and improved academic performance (Black & Deci, 2000; Hsu, Wang, & Levesque-Bristol, 2019; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004). Shinogaya (2018) also indicated that learners with higher intrinsic motives tended to engage more frequently in preparation, such as reading the textbook in advance for upcoming lessons. Therefore, this study's finding that intrinsic motives promote preparation is consistent with those of prior studies.

Interestingly, regarding the relationship between beliefs and preparation, different results emerged for the on-demand and face-to-face lessons. Specifically, only in face-to-face lessons did non-cognitive beliefs have a positive relationship with preparation. This indicated that learners with higher non-cognitive beliefs tend to prepare more for upcoming lessons. This may be related to the amount of information a learner can retain. A major advantage of on-demand lessons is that students can repeatedly watch the videos (Adedoyin & Soykan, 2023; Long et al., 2023). In this study, students could view the uploaded class videos multiple times. Conversely, in face-to-face lessons, students only had a single opportunity to listen to the professor's explanation and think of the topic deeply. Non-cognitive beliefs, such as 'If I can memorize properly, I can say that I understand', and 'Repeating the same thing will help me learn it', reflect a focus on memorization and workload rather than deep understanding or processing. Thus, learners with high non-cognitive beliefs may be more likely to engage in preparation to maintain their study volume during face-to-face lessons.

In contrast, cognitive beliefs did not exhibit a significant relationship with preparation in either format. This differed from Shinogaya's study (2018), which observed a positive relationship between cognitive beliefs and preparation; however, Shinogaya's study involved lessons primarily centred on lectures. Conversely, this study's lessons combined lectures with activities aimed at deepening understanding through repeated thinking. Results suggest that the determinants of learners' spontaneous preparation may vary based on the lesson content and format. Furthermore, learners' study behaviours outside the classroom are influenced by teachers' instructional approaches (Nolen & Haladyna, 1990; Wolters, 2004). Further research studies should explore how instructional design influences preparation in different lesson formats.

4.3 Effects of Factors on Learning Strategies During Lessons

Results revealed that intrinsic motives had a significant positive correlation with both elaboration and meta-cognitive strategy. In contrast, extrinsic motives had no significant relationship or negative correlation. Previous studies reported that autonomous motivation was associated with deeper cognitive processing and voluntary learning behaviours across various learning environments, including online settings (Hsu et al., 2019; Vansteenkiste et al., 2004). These findings were consistent with those of existing literature. Additionally, cognitive beliefs had significant positive relationships with elaboration and meta-cognitive strategies in both on-demand and face-to-face lessons. Since cognitive beliefs emphasise the importance of deep processing, previous studies similarly reported their relationships with deep processing strategies. Thus, these results align with those of previous findings.

A key finding of this study was that preparation was significantly positively related to elaboration and meta-cognitive strategies in both on-demand and face-to-face classes. The foundational theory of advance organizers (Ausubel, 1960) and theory of meaningful reception learning suggest that pre-acquiring knowledge regarding the content enhances understanding. Titsworth and Kiewra (2004) found that receiving cues related to the upcoming lesson content beforehand facilitated note-taking during class. Note-taking involves information processing, such as connecting new information with prior knowledge; hence, it is considered as elaboration (Peverly et al., 2007). Additionally, Shinogaya (2010, 2018) reported that preparation promoted the use of elaboration and meta-cognitive strategy during classroom lessons. These findings aligned with those of previous studies and suggest that the process of relating new information to existing knowledge, whether in on-demand or face-to-face lessons, can foster deeper and meta-cognitive learning strategies during lessons.

This study compared spontaneous preparation before lessons, learning strategies during lessons, and factors of learning across different formats. Results demonstrated that preparation was effective in enhancing learning strategies during lessons, regardless of the lesson format. Based on human learning mechanisms, preparation is undoubtedly a vital activity. Prior studies have explored the effects of flipped classrooms based on preparation and examined the effectiveness of preparation for upcoming lessons (Danker, 2015; Gross, Pietri, Anderson, Moyano-Camihort, & Graham, 2015; Yilmaz & Baydas, 2017). However, in flipped classrooms, challenges, such as increased workload for instructors, make it difficult to consider this teaching style readily adoptable for educators (Lo & Hew, 2017). Therefore, the finding that preparation benefits learning in both formats suggests that incorporating preparation into various teaching styles can be highly beneficial.

5. Conclusion

This study compared on-demand and face-to-face formats from the perspective of preparation for upcoming lessons and learning strategies during lessons. Although discussions surrounding on-demand lessons existed before COVID-19, the pandemic accelerated their adoption across many educational settings. Previous studies have highlighted the advantages of on-demand instruction, such as flexible scheduling and the ability to review materials repeatedly. These studies also demonstrated that on-demand online lessons can produce learning outcomes comparable to those of face-to-face lessons in physical classrooms, suggesting that they can serve as an effective alternative when face-to-face lessons are not feasible.

With accumulating evidence supporting the effectiveness of on-demand courses, society is now prompted to reconsider whether traditional face-to-face lessons should be maintained. Based on previous findings, such as Handa (2021) who reported no significant differences in knowledge or skills acquisition, on-demand lessons that offer flexibility in time and location and allow both teachers and learners to save commuting time may become a central method of future education.

Nevertheless, drawing such conclusions is premature. This study found that with regards to how students learn, face-to-face lessons facilitate deeper processing, namely elaboration during lessons. Additionally, learners tended to engage more in preparation for upcoming lessons when they attended face-to-face lessons. Such differences in learning behaviours before each lesson, depending on the lesson format, offer important insights.

However, this study has some limitations. First, the data analysed was based on self-reports via questionnaires; actual behavioural indicators and comprehension levels were not measured. Future studies should analyse behavioural data, such as the notes learners take during lessons, following approaches used by Kiewra et al. (1995) and Titsworth and Kiewra (2004). Additionally, recording learner discussions with peers or administering quizzes after each lesson could provide further detailed insights into students' understanding.

Second, although this study focused on comparing on-demand and face-to-face lesson formats within a specific subject (psychology), the results may vary depending on the content, structure, and questions posed for discussion. Therefore, future research should consider different academic disciplines and course designs to systematically compare how students learn the content of lessons.

To determine the most effective educational strategies, evaluating how students learn is essential. Furthermore, determining methods to leverage the strengths of various lesson formats is crucial. The author hopes that this study will serve as a stepping stone toward this goal.

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