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# COMPARING THE IMPACT OF SYNCHRONOUS AND ASYNCHRONOUS ONLINE LEARNING ON STUDENT RETENTION AND SATISFACTION

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**Abstract:**
This study investigates the effect of synchronous and asynchronous online learning methods on learners' retention and satisfaction. The research aims to answer two primary questions: (1) Does real-time interaction in synchronous learning foster better short-term and long-term retention compared to asynchronous learning? (2) Are students more satisfied with the flexibility of asynchronous learning or the engagement of synchronous learning? A sample of 30 intermediate-level English learners was randomly divided into two groups: one receiving a synchronous lesson via Google Meet or Preply virtual classroom, and the other accessing an asynchronous lesson via pre-recorded video and PDF materials. The results of independent t-tests and paired t-tests revealed no statistically significant difference in retention between the groups, although both showed a slight decline in performance over time. Descriptive statistics and chi-square tests indicated that the synchronous group reported higher engagement and a positive impact of interaction on understanding, while the asynchronous group appreciated flexibility. However, there was no significant difference in overall satisfaction between the two groups. These findings suggest that while synchronous learning may offer greater engagement, both learning methods are similarly effective in terms of retention and satisfaction.

**Keywords:** online education, synchronous learning, asynchronous learning, student engagement, flexibility, retention

## 1. Introduction

The rapid evolution of digital technologies has significantly transformed educational practices, particularly in the realm of online learning. Asynchronous and synchronous learning environments have become the two predominant modes of instruction in online

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education, each offering distinct advantages and challenges (Hrastinski, 2008; Anderson, 2003). Asynchronous learning, characterized by the flexibility it affords learners to access materials at their convenience, has been lauded for its potential to accommodate diverse learner needs and schedules (Watts, 2016). In contrast, synchronous learning, which occurs in real time, is often praised for its ability to foster immediate interaction and engagement, creating a more dynamic learning experience (Clark, 2020).

Despite the growing adoption of both learning modalities, there remains a lack of consensus regarding their comparative effectiveness, particularly in terms of student retention and satisfaction. Previous studies have shown mixed results. For instance, some researchers argue that synchronous learning leads to better retention due to the immediacy of feedback and interaction, which can enhance comprehension and recall (Dixson, 2010). Conversely, others highlight that asynchronous learning supports deeper reflection and self-paced study, which can also contribute to improved learning outcomes (Anderson & Dron, 2011).

The present study aims to contribute to this ongoing debate by examining the effects of synchronous and asynchronous online learning on student retention and satisfaction. Specifically, this research seeks to answer two key questions:

1) Does real-time interaction in synchronous learning foster better short-term and long-term retention compared to asynchronous learning?
2) Are students more satisfied with the flexibility of asynchronous learning or the engagement of synchronous learning?

To address these questions, a quasi-experimental design was employed, involving two groups of intermediate-level English learners. One group participated in a synchronous lesson delivered via Google Meet or Preply virtual classroom, while the other engaged in an asynchronous lesson through a pre-recorded video and accompanying PDF materials. Both groups were assessed immediately after the lesson and one week later to measure retention, and they completed a questionnaire to gauge their satisfaction with the learning experience.

Given the mixed findings in existing literature, this study hypothesizes that while synchronous learning may lead to higher engagement and immediate retention due to real-time interaction, asynchronous learning may offer advantages in terms of flexibility and long-term retention. The results of this study will provide further insights into how different online learning modalities impact student outcomes and contribute to the development of more effective online teaching strategies.

## 2. Literature Review

### 2.1. Theoretical Foundations of Retention in Online Synchronous and Asynchronous Learning

In the online education context, retention of knowledge is a critical metric for evaluating the effectiveness of teaching methods. Synchronous learning, which involves live interaction between instructors and students, is rooted in constructivist theory

(Vygotsky, 1978). This theory suggests that active engagement and immediate feedback enhance learning, particularly for short-term retention. Research by Hrastinski (2008) emphasizes that real-time interaction during synchronous sessions helps students process information more effectively, leading to better immediate recall. This aligns with findings from Baba *et al.* (2020), which highlight the value of synchronous learning in maintaining student engagement during the COVID-19 pandemic, particularly in facilitating immediate responses and feedback.

In contrast, asynchronous learning, where students engage with materials at their own pace, aligns with spaced repetition theory (Ebbinghaus, 1885). This theory posits that learning over spaced intervals is more effective for long-term retention. In asynchronous settings, students can revisit recorded lessons and quizzes multiple times, which helps reinforce learning and promote deeper cognitive processing (Means *et al.*, 2010). Kayalar (2021) supports this by noting that asynchronous learning allows for greater flexibility, which is particularly beneficial for self-directed learners who require more time to process complex information.

### 2.2. Retention in Synchronous vs. Asynchronous Online Learning

A growing body of research investigates retention in online learning environments, contrasting the outcomes of synchronous versus asynchronous methods. Synchronous learning is generally associated with better short-term retention due to its interactive nature. Real-time discussions and immediate feedback allow learners to actively engage with the content, reinforcing their understanding at the moment (Hrastinski, 2008). This is especially true in language learning, where the ability to practice and receive feedback in real-time enhances students' grasp of grammatical concepts, such as the present perfect simple tense (Kayalar, 2021).

On the other hand, asynchronous learning offers students the opportunity to reflect on the material at their own pace, which can enhance long-term retention. Research by Garrison and Anderson (2003) highlights the benefits of asynchronous learning for deeper understanding, as students can review materials multiple times and engage in self-paced study. Baba *et al.* (2020) further emphasize that asynchronous learning is particularly effective in scenarios where students need to balance education with other commitments, allowing them to engage in coursework at their convenience.

### 2.3. Student Satisfaction: Flexibility vs. Engagement in Online Learning

Student satisfaction is a key factor in evaluating the success of online learning methods. Synchronous learning creates a highly interactive environment where students can engage in live discussions and receive immediate feedback. According to Chen & Carliner (2020), students often report feeling more connected and motivated in synchronous online learning environments due to the real-time engagement. This sense of immediacy and interaction is critical in reducing feelings of isolation and enhancing participation, a finding supported by recent studies during the COVID-19 pandemic (Baba *et al.*, 2020).

Conversely, asynchronous learning is valued for its flexibility. The ability to learn at one's own pace, without being bound to a specific time or schedule, is a significant advantage of asynchronous online education (Ke & Xie, 2009). Kayalar (2021) found that students who prefer autonomy and time management report higher satisfaction with asynchronous learning formats, particularly in online environments where self-directed learning is encouraged. This flexibility is particularly beneficial for students managing multiple responsibilities, as it allows them to engage with content on their own terms (Baba *et al.*, 2020).

This literature review highlights the ongoing discussion about the relative benefits of synchronous and asynchronous learning in online education. While synchronous learning enhances short-term retention and student engagement, asynchronous learning promotes long-term retention and greater flexibility. This study contributes to the field by examining the impact of these two modes on retention and satisfaction, specifically in the context of learning the present perfect simple tense.

Future research could further investigate how these findings apply to other areas of language learning or different academic subjects, as well as explore more diverse learner populations in online settings.

## 3. Methodology

### 3.1 Sample Selection

The participants in this study were drawn from two primary sources: students taught on the Preply online platform and students from the British Workshop, a language center where the researcher is employed. The population consists of general English learners at the intermediate level from different backgrounds, all of whom are aged between 25 and 40 years and speak different native languages. The sample was divided into two groups: 15 students in the synchronous group and 15 students in the asynchronous group. All participants were randomly assigned to their respective groups to ensure that each group had a comparable level of English proficiency.

**Table 1:** Demographic information

| Group | Gender | Percentage of participants (%) | Age range 25-30 (%) | Age range 30-35 (%) | Age range 35-40 (%) | English proficiency (B1) (%) |
|---|---|---|---|---|---|---|
| Synchronous | Women | 60% | - | - | - | 100% |
| Synchronous | Men | 40% | - | - | - | 100% |
| **Total** | | 100% | 20% | 33.3% | 46.7% | 100% |
| Asynchronous | Women | 46.7% | - | - | - | 100% |
| Asynchronous | Men | 53.3% | - | - | - | 100% |
| **Total** | | 100% | 40% | 13.3% | 46.7% | 100% |

### 3.2 Instruments

For this study, the instructional materials and assessment tools were tailored to evaluate the effectiveness of synchronous and asynchronous learning methods in teaching the present perfect tense.

#### 3.2.1 Synchronous Method

The synchronous group participated in a live grammar lesson on the present perfect tense. This lesson was delivered via Google Meet or the Preply virtual classroom. The instructor used an interactive board to explain the grammar deductively, engaging students in real-time discussions. To assess their understanding, students were given two exercises that evaluated their ability to use the present perfect in both written and spoken forms. These exercises were administered one day after the lesson and then repeated with new exercises one week later.

#### 3.2.2 Asynchronous Method

The asynchronous group received a pre-recorded video lesson and a PDF worksheet covering the present perfect tense. These materials were sent to the students via email, allowing them to study at their own pace. Once students felt prepared, they completed the same exercises as the synchronous group one day and one week after reviewing the materials.

#### 3.2.3 Satisfaction Questionnaire

After completing the exercises, all students were asked to fill out a satisfaction questionnaire. This questionnaire was designed to measure their level of satisfaction with the learning method they experienced, focusing on aspects such as the flexibility of learning (for the asynchronous group) and engagement (for the synchronous group).

## 4. Data Collection Procedure

The overall timeline for the study was three months, which included the delivery of lessons, administration of assessments, and collection of satisfaction questionnaires. Participants' consent was obtained verbally before the study began. The students were chosen randomly by the researcher/teacher to ensure an unbiased selection process. All data collected were treated with confidentiality, ensuring that participants' identities were protected throughout the study.

### 4.1 Procedure

For the synchronous group, the lesson on the present perfect tense was delivered by the teacher/researcher during their usual lesson time. Each lesson lasted for 1 hour and was conducted using either Google Meet or the Preply virtual classroom. The instructor used an interactive board to explain the grammar deductively. The assessment exercises were administered to the students one day after the lesson and then again one week later. The

exercises were designed to evaluate the students' understanding and usage of the present perfect in both written and spoken forms.

For the asynchronous group, the students received a video from the YouTube channel ESL Library that explained the present perfect tense, along with a PDF worksheet downloaded from Linguahouse. These materials were sent to the students via email. The students were instructed to study the materials at their own pace. After reviewing the materials, they were given the same set of assessment exercises as the synchronous group one day after they began their study and then again one week later. Instructions for completing the exercises were written directly on the exercise sheets. Students were required to return their completed exercises within 24 hours of receiving them.

### 4.2 Monitoring and Supervision

During the synchronous sessions, student participation and engagement were monitored by the instructor in real-time through direct interaction, ensuring that students were actively involved in the lesson. In the asynchronous group, while there was no real-time monitoring, students were expected to submit their completed exercises within a specified timeframe (24 hours), which allowed the researcher to track their engagement and compliance with the study requirements.

### 4.3 Administration of Questionnaires

Satisfaction questionnaires were administered via email after the students completed their second task, one week after their initial lesson. The questionnaires were designed to assess the students' satisfaction with the learning method they experienced, focusing on aspects such as the flexibility provided by asynchronous learning and the engagement facilitated by synchronous learning. Students were instructed to complete the questionnaires honestly and were given a reasonable amount of time to submit their responses.

## 5. Data Analysis

The data collected in this study comprises quiz scores and questionnaire responses, both of which are essential in evaluating student retention and satisfaction. Two quizzes, each scored out of 12 points, were administered to measure short-term and long-term retention, with the first quiz given one day after the lesson and the second one week later. Additionally, a comprehensive student satisfaction questionnaire was distributed, covering various aspects such as engagement, learning experience, flexibility, retention, and overall satisfaction, with responses collected on a Likert scale.

For data analysis, descriptive statistics will summarize the quiz scores and questionnaire responses, including the mean, standard deviation, and response distribution. Comparative analyses will involve independent t-tests to compare quiz scores between synchronous and asynchronous groups and paired t-tests to assess retention changes over time within each group. Chi-square tests will analyze differences

in categorical questionnaire responses between groups, while Pearson correlation coefficients will explore relationships between quiz scores and satisfaction factors.

## 6. Results

### 6.1 Descriptive Statistics

#### 6.1.1 Quiz Scores

Descriptive statistical measurements will be used to calculate the mean, standard deviation and range of scores within each group for both time points.

**Table 2:** Descriptive statistics synchronous group

| | N | Mean | Std Dev | Variance | Range | Minimum | Maximum |
|---|---|---|---|---|---|---|---|
| Quiz 1 score (Day1) | 15 | 8.53 | 1.64 | 2.70 | 6.00 | 5.00 | 11.00 |
| Quiz 2 score (Week1) | 15 | 7.80 | 1.66 | 2.74 | 6.00 | 4.00 | 10.00 |
| Valid N (listwise) | 15 | | | | | | |
| Missing N (listwise) | 0 | | | | | | |

**Table 3:** Descriptive statistics asynchronous group

| | N | Mean | Std Dev | Variance | Range | Minimum | Maximum |
|---|---|---|---|---|---|---|---|
| Quiz 1 score (Day1) | 15 | 8.00 | 1.65 | 2.71 | 5.00 | 6.00 | 11.00 |
| Quiz 2 score (Week1) | 15 | 7.20 | 1.57 | 2.46 | 5.00 | 5.00 | 10.00 |
| Valid N (listwise) | 15 | | | | | | |
| Missing N (listwise) | 0 | | | | | | |

Synchronous Learning appears to have a slight edge over asynchronous learning in terms of mean scores for both short-term (Day 1) and slightly longer-term (Week 1) retention. The scores in the synchronous group are consistently higher, which might indicate better retention and understanding in the immediate context.

#### 6.1.2 Flexibility and Engagement

Descriptive measurements are conducted to identify the percentage of students selecting each Likert scale option.

**Table 4:** Synchronous group

| | Level of Engagement | Comfort in Interaction (Synchronous) | Ease of Focusing (Asynchronous) | Clarity of Lesson Explanation | Helpfulness of Exercises | Lesson Structure Helps Understanding | Satisfaction with Flexibility | Flexibility Improved Learning | Interaction Improved Understanding | Confidence in Using Present Perfect | Lesson Improved Application Ability | Overall Satisfaction with Learning Experience | Would Recommend this Learning Method |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N Valid | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| Missing | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 00 |
| Mean | 4.20 | 4.13 | 3.00 | 4.07 | 3.80 | 3.93 | 3.87 | 3.00 | 4.33 | 3.87 | 4.13 | 4.53 | 3.73 |
| Median | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 |
| Mode | . | Somewhat comfortable | Neutral | Clear | Helpful | Agree | Satisfied | Neutral | Agree | Confident | Strongly Agree | Very Satisfied | Probably |
| Std Dev | .77 | .99 | .00 | .70 | .68 | .80 | .74 | .00 | .62 | 1.13 | .99 | .64 | .70 |
| Minimum | Neutral | Uncomfortable | Neutral | Somewhat unclear | Neutral | Neutral | Neutral | Neutral | Neutral | Somewhat Unconfident | Disagree | Neutral | Not Sure |
| Maximum | Very Engaging | Very Comfortable | Neutral | Very clear | Very Helpful | Strongly Agree | Very Satisfied | Neutral | Strongly Agree | Very Confident | Strongly Agree | Very Satisfied | Definitely |

**Table 5:** Asynchronous group

| | Level of Engagement | Comfort in Interaction (Synchronous) | Ease of Focusing (Asynchronous) | Clarity of Lesson Explanation | Helpfulness of Exercises | Lesson Structure Helps Understanding | Satisfaction with Flexibility | Flexibility Improved Learning | Interaction Improved Understanding | Confidence in Using Present Perfect | Lesson Improved Application Ability | Overall Satisfaction with Learning Experience | Would Recommend this Learning Method |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N Valid | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| Missing | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 00 |
| Mean | 2.60 | 3.00 | 2.80 | 3.07 | 4.07 | 3.47 | 4.33 | 3.40 | 3.00 | 3.40 | 3.73 | 3.60 | 3.33 |
| Median | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| Mode | Not Engaging | Neutral | Difficult | . | Helpful | Agree | Satisfied | Agree | Neutral | Confident | Strongly Agree | Satisfied | Probably |
| Std Dev | .74 | .00 | 1.01 | 1.67 | .88 | .99 | .62 | .91 | .00 | 1.12 | 1.28 | 1.12 | .72 |
| Minimum | Not Engaging | Neutral | Difficult | Very Unclear | Not Very Helpful | Disagree | Neutral | Disagree | Neutral | Somewhat Unconfident | Disagree | Dissatisfied | Probably Not |
| Maximum | Engaging | Neutral | Easy | Very Clear | Very Helpful | Strongly Agree | Very Satisfied | Strongly Agree | Neutral | Very Confident | Strongly Agree | Very Satisfied | Probably |

The synchronous group generally rated their learning experience more positively across most measures, especially in terms of engagement, clarity, and overall satisfaction. The asynchronous group, while still showing satisfaction, had more mixed responses, particularly in areas related to engagement and focus. These descriptive statistics suggest that synchronous learning may provide a more engaging and satisfying experience, but further analysis would be needed to determine if these differences are statistically significant.

### 6.2 Comparative Statistics

#### 6.2.1 Independent T-Test

In this section, we will compare the mean of the quiz scores between the synchronous and asynchronous groups for each test to determine if there is a statistically significant difference in retention.

**Table 6:** Independent t-test

| Group | N | Mean | Std. Deviation | S.E. Mean |
|---|---|---|---|---|
| Quiz 1 score (Day1) Synchronous | 15 | 8.53 | 1.64 | .42 |
| Quiz 1 score (Day1) Asynchronous | 15 | 8.00 | 1.65 | .43 |
| Quiz 2 score (Week1) Synchronous | 15 | 7.80 | 1.66 | .43 |
| Quiz 2 score (Week1) Asynchronous | 15 | 7.20 | 1.57 | .40 |

| | Levene's Test for Equality of Variances | | T-Test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the difference | |
| | | | | | | | | Lower | Upper |
| Quiz 1 score (Day1) Equal Variances assumed | .01 | .911 | .89 | 28.00 | .382 | .53 | .60 | -.70 | 1.76 |
| Quiz 1 score (Day1) Equal Variances not assumed | | .762 | .89 | 28.00 | .382 | .53 | .60 | -.70 | 1.76 |
| Quiz 2 score (Week1) Equal Variances assumed | .09 | | 1.02 | 28.00 | .317 | .60 | .59 | -.61 | 1.81 |
| Quiz 2 score (Week1) Equal Variances not assumed | | | 1.02 | 27.92 | .317 | .60 | .59 | -.61 | 1.81 |

For both Quiz 1 and Quiz 2, the Sig. (2-tailed) values are 0.382 and 0.317, respectively. Both values are greater than 0.05, which means that the differences in mean scores between the synchronous and asynchronous groups are not statistically significant.

The mean differences for both quizzes are small (0.53 for Quiz 1 and 0.60 for Quiz 2), further suggesting that the scores are very similar between the two groups.

The 95% confidence intervals for both quizzes include zero (Quiz 1: [-0.70, 1.76], Quiz 2: [-0.61, 1.81]), which reinforces the conclusion that the mean difference is not statistically significant.

Therefore, we can conclude that there is no statistically significant difference in quiz scores between students who participated in synchronous learning and those who participated in asynchronous learning for both Quiz 1 and Quiz 2.

### 6.2.2 A Paired T-Test

In the following section, we intend to compare the quiz scores within each group between the first and second quizzes to assess any changes in retention over time.

**Table 7:** Paired t-test synch group

**Paired Sample Statistics**

| | N | Mean | Std. Deviation | S.E. Mean |
|---|---|---|---|---|
| Pair 1 Quiz 1 score (Day1) | 15 | 8.53 | 1.64 | .42 |
| Quiz 2 score (Week1) | 15 | 7.80 | 1.66 | .43 |

**Paired Samples Correlations**

| | N | Correlation | Sig. |
|---|---|---|---|
| Pair 1 Quiz 1 score (Day1) & Quiz 2 score (Week1) | 15 | .699 | .004 |

**Paired Samples Test**

| | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std. Deviation | S.E. Mean | 95% Confidence Interval of the difference | | | | |
| | | | | Lower | Upper | | | |
| Pair 1 Quiz 1 score (Day1) – Quiz 2 score (Week1) | .73 | 1.28 | .33 | .02 | 1.44 | 2.22 | 14 | .044 |

**Table 8:** Paired t-test a-synch group

| **Paired Sample Statistics** | | | | |
|---|---|---|---|---|
| | **N** | **Mean** | **Std. Deviation** | **S.E. Mean** |
| Pair 1 Quiz 1 score (Day1) | 15 | 8.00 | 1.65 | .43 |
| Quiz 2 score (Week1) | 15 | 7.20 | 1.57 | .40 |

| **Paired Samples Correlations** | | | |
|---|---|---|---|
| | **N** | **Correlation** | **Sig.** |
| Pair 1 Quiz 1 score (Day1) & Quiz 2 score (Week1) | 15 | .608 | .016 |

| **Paired Samples Test** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Paired Differences** | | | | | **t** | **df** | **Sig. (2-tailed)** |
| | **Mean** | **Std. Deviation** | **S.E. Mean** | **95% Confidence Interval of the difference** | | | | |
| | | | | Lower | Upper | | | |
| Pair 1 Quiz 1 score (Day1) – Quiz 2 score (Week1) | .80 | 1.42 | .37 | .01 | 1.59 | 2.18 | 14 | .047 |

The p-value (0.047) is just below 0.05, indicating that the difference in means between Quiz 1 and Quiz 2 scores for the asynchronous group is also statistically significant. Similar to the synchronous group, there was a significant decrease in scores from Day 1 to Week 1, suggesting a decline in retention over time for the asynchronous group as well.

Both the synchronous and asynchronous groups showed a statistically significant decline in quiz scores from Day 1 to Week 1. This indicates that, regardless of the learning method, participants in both groups experienced some level of forgetting or reduced retention over the week.

The positive correlations between Quiz 1 and Quiz 2 in both groups suggest that participants' performance was somewhat consistent over time, though the decline in mean scores indicates a general trend of reduced retention.

### 6.2.3 Chi-Square Tests

Chi-square tests are applied to the questionnaire to compare categorical responses between the two groups.

**Table 9:** Level of engagement

| | | | 1 = Synchronous, 2 = Asynchronous | | Total |
|---|---|---|---|---|---|
| | | | Synchronous | Asynchronous | |
| Level of Engagement | Not engaging | Count | 0 | 8 | 8 |
| | | Row (%) | .0% | 100.0% | 100.0% |
| | | Column (%) | .0% | 53.3% | 26.7% |
| | | **Total (%)** | **.0%** | **26.7%** | **26.7%** |
| | Neutral | Count | 3 | 5 | 8 |
| | | Row (%) | 37.5% | 62.5% | 100.0% |
| | | Column (%) | 20.0% | 33.3% | 26.7% |
| | | **Total (%)** | **10.0%** | **16.7%** | **26.7%** |
| | Engaging | Count | 6 | 2 | 8 |
| | | Row (%) | 75.0% | 25.0% | 100.0% |
| | | Column (%) | 40.0% | 13.3% | 26.7% |
| | | **Total (%)** | **20.0%** | **6.7%** | **26.7%** |
| | Very engaging | Count | 6 | 0 | 6 |
| | | Row (%) | 100.0% | .0% | 100.0% |
| | | Column (%) | 40.0% | .0% | 20.0% |
| | | **Total (%)** | **20.0%** | **.0%** | **20.0%** |
| Total | | Count | 15 | 15 | 30 |
| | | Row (%) | 50.0% | 50.0% | 100.0% |
| | | Column (%) | 100.0% | 100.0% | 100.0% |
| | | **Total (%)** | **50.0%** | **50.0%** | **100.0%** |

| **Chi-Square Tests** | | | |
|---|---|---|---|
| | **Value** | **df** | **Asymptomatic Sig. (2-tailed)** |
| Pearson Chi-Square | 16.50 | 3 | .001 |
| Likelihood Ratio | 22.01 | 3 | .000 |
| Linear -by-Linear Association | 15.82 | 1 | .000 |
| N of Valid Cases | 30 | | |

There is a statistically significant association between the learning method (synchronous vs. asynchronous) and the level of engagement. The synchronous group found the lesson more engaging, while the asynchronous group reported much lower engagement levels.

**Table 10:** Flexibility

| | | | 1 = Synchronous, 2 = Asynchronous | | Total |
|---|---|---|---|---|---|
| | | | Synchronous | Asynchronous | |
| Flexibility Improved Learning | Disagree | Count | 0 | 3 | 3 |
| | | Row (%) | .0% | 100.0% | 100.0% |
| | | Column (%) | .0% | 20.0% | 10.0% |
| | | **Total (%)** | **.0%** | **10.0%** | **10.0%** |
| | Neutral | Count | 15 | 4 | 19 |
| | | Row (%) | 78.9% | 21.1% | 100.0% |
| | | Column (%) | 100.0% | 26.7% | 63.6% |
| | | **Total (%)** | **50.0%** | **13.3%** | **63.3%** |
| | Agree | Count | 0 | 7 | 7 |
| | | Row (%) | .0% | 100.0% | 100.0% |
| | | Column (%) | .0% | 46.7% | 23.3% |
| | | **Total (%)** | **.0%** | **23.3%** | **23.3%** |
| | Strongly agree | Count | 0 | 1 | 1 |
| | | Row (%) | .0% | 100.0% | 100.0% |
| | | Column (%) | .0% | 6.7% | 3.3% |
| | | **Total (%)** | **.0%** | **3.3%** | **3.3%** |
| Total | | Count | 15 | 15 | 30 |
| | | Row (%) | 50.0% | 50.0% | 100.0% |
| | | Column (%) | 100.0% | 100.0% | 100.0% |
| | | **Total (%)** | **50.0%** | **50.0%** | **100.0%** |

| **Chi-Square Tests** | | | |
|---|---|---|---|
| | **Value** | **df** | **Asymptomatic Sig. (2-tailed)** |
| Pearson Chi-Square | 17.37 | 3 | .001 |
| Likelihood Ratio | 22.03 | 3 | .000 |
| Linear -by-Linear Association | 2.72 | 1 | .099][;./]=5j |
| N of Valid Cases | 30 | | |

There is a statistically significant association between the learning method and whether flexibility improved learning. The asynchronous group found flexibility to improve their learning more than the synchronous group, where the majority were neutral.

**Table 11:** Interaction

| | | | 1 = Synchronous, 2 = Asynchronous | | Total |
|---|---|---|---|---|---|
| | | | Synchronous | Asynchronous | |
| Interaction Improved Understanding | Neutral | Count | 1 | 15 | 16 |
| | | Row (%) | 6.3% | 93.8% | 100.0% |
| | | Column (%) | 6.7% | 100.0% | 53.3% |
| | | **Total (%)** | **3.3%** | **50.0%** | **53.3%** |
| | Agree | Count | 8 | 0 | 8 |
| | | Row (%) | 100.0% | .0% | 100.0% |
| | | Column (%) | 53.3% | .0% | 26.7% |
| | | **Total (%)** | **26.7%** | **.0%** | **26.7%** |
| | Strongly agree | Count | 6 | 0 | 6 |
| | | Row (%) | 100.0% | .0% | 100.0% |
| | | Column (%) | 40.0% | .0% | 20.0% |
| | | **Total (%)** | **20.0%** | **.0%** | **20.0%** |
| Total | | Count | 15 | 15 | 30 |
| | | Row (%) | 50.0% | 50.0% | 100.0% |
| | | Column (%) | 100.0% | 100.0% | 100.0% |
| | | **Total %** | **50.0%** | **50.0%** | **100.0%** |

| **Chi-Square Tests** | | | |
|---|---|---|---|
| | **Value** | **df** | **Asymptomatic Sig. (2-tailed)** |
| Pearson Chi-Square | 26.25 | 2 | .000 |
| Likelihood Ratio | 34.11 | 2 | .000 |
| Linear -by-Linear Association | 20.71 | 1 | .000 |
| N of Valid Cases | 30 | | |

There is a statistically significant association between the learning method and whether interaction improved understanding. The synchronous group clearly benefited from interaction, while the asynchronous group did not experience this benefit.

**Table 12:** Application ability

| | | | 1 = Synchronous, 2 = Asynchronous | | Total |
|---|---|---|---|---|---|
| | | | **Synchronous** | **Asynchronous** | |
| Lesson Improved Application Ability | Disagree | Count | 1 | 4 | 5 |
| | | Row (%) | 20.0% | 80.0% | 100.0% |
| | | Column (%) | 6.7% | 26.7% | 16.7% |
| | | **Total (%)** | **3.3%** | **13.3%** | **16.7%** |
| | Neutral | Count | 3 | 2 | 5 |
| | | Row (%) | 60.0% | 40.0% | 100.0% |
| | | Column (%) | 20.0% | 13.3% | 16.7% |
| | | **Total (%)** | **10.0%** | **6.7%** | **16.7%** |
| | Agree | Count | 4 | 3 | 7 |
| | | Row (%) | 57.1% | 42.9% | 100.0% |
| | | Column (%) | 26.7% | 20.0% | 23.3% |
| | | **Total (%)** | **13.3%** | **10.0%** | **23.3%** |
| | Strongly agree | Count | 7 | 6 | 13 |
| | | Row (%) | 53.8% | 46.2% | 100.0% |
| | | Column (%) | 46.7% | 40.0% | 43.3% |
| | | **Total (%)** | **23.3%** | **20.0%** | **43.3%** |
| Total | | Count | 15 | 15 | 30 |
| | | Row (%) | 50.0% | 50.0% | 100.0% |
| | | Column (%) | 100.0% | 100.0% | 100.0% |
| | | **Total (%)** | **50.0%** | **50.0%** | **100.0%** |

| **Chi-Square Tests** | | | |
|---|---|---|---|
| | **Value** | **df** | **Asymptomatic Sig. (2-tailed)** |
| Pearson Chi-Square | 2.22 | 3 | .528 |
| Likelihood Ratio | 2.35 | 3 | .503 |
| Linear -by-Linear Association | .92 | 1 | .338 |
| N of Valid Cases | 30 | | |

There is no significant association between the learning method and whether participants believed the lesson improved their application ability. Both groups seemed to feel similarly about how the lesson helped them apply the material.

**Table 13:** Overall satisfaction

| | | | 1 = Synchronous, 2 = Asynchronous | | Total |
|---|---|---|---|---|---|
| | | | Synchronous | Asynchronous | |
| Overall Satisfaction with Learning Experience Dissatisfied | Dissatisfied | Count | 0 | 4 | 4 |
| | | Row (%) | .0% | 100.0% | 100.0% |
| | | Column (%) | .0% | 26.7% | 13.3% |
| | | **Total (%)** | **.0%** | **13.3%** | **13.3%** |
| | Neutral | Count | 1 | 1 | 2 |
| | | Row (%) | 50.0% | 50.0% | 100.0% |
| | | Column (%) | 6.7% | 6.7% | 6.7% |
| | | **Total (%)** | **3.3%** | **3.3%** | **6.7%** |
| | Satisfied | Count | 5 | 7 | 12 |
| | | Row (%) | 41.7% | 58.3% | 100.0% |
| | | Column (%) | 33.3% | 46.7% | 40.0% |
| | | **Total (%)** | **16.7%** | **23.3%** | **40.0%** |
| | Very Satisfied | Count | 9 | 3 | 12 |
| | | Row (%) | 75.0% | 25.0% | 100.0% |
| | | Column (%) | 60.0% | 20.0% | 40.0% |
| | | **Total (%)** | **30.0%** | **10.0%** | **40.0%** |
| Total | | Count | 15 | 15 | 30 |
| | | Row (%) | 50.0% | 50.0% | 100.0% |
| | | Column (%) | 100.0% | 100.0% | 100.0% |
| | | **Total (%)** | **50.0%** | **50.0%** | **100.0%** |

| **Chi-Square Tests** | | | |
|---|---|---|---|
| | **Value** | **df** | **Asymptomatic Sig. (2-tailed)** |
| Pearson Chi-Square | 7.33 | 3 | .062 |
| Likelihood Ratio | 9.02 | 3 | .029 |
| Linear -by-Linear Association | 6.34 | 1 | .012 |
| N of Valid Cases | 30 | | |

The p-value is slightly above the significance threshold (0.05), so there is no statistically significant association between learning method and overall satisfaction. However, the synchronous group had more participants who were "Very Satisfied," suggesting a possible trend.

These results highlight that synchronous learning enhances engagement and interaction, while asynchronous learning is valued for its flexibility.

### 6.3 Correlation Analysis

Pearson correlations coefficients are calculated to explore the relationship between quiz scores and student satisfaction.

**Table 14:** Correlation analysis

| | | Quiz 1 score (Day 1) | Quiz 2 score (Week 1) | Level of Engagement | Flexibility Improved Learning | Interaction Improved Understanding | Lesson Improved Application Ability | Overall Satisfaction with Learning Experience |
|---|---|---|---|---|---|---|---|---|
| Quiz 1 Score (Day1) | Pearson Correlation | 1.000 | .665 | .187 | .044 | .306 | .120 | .259 |
| | Sig. (2-tailed) | | .000 | .322 | .816 | .100 | .527 | .168 |
| | N | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Quiz 2 Score (Week1) | Pearson Correlation | .665 | 1.000 | .194 | -.322 | .346 | -.019 | .211 |
| | Sig. (2-tailed) | .000 | | .304 | .083 | .061 | .922 | .264 |
| | N | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Level of Engagement | Pearson Correlation | .187 | .194 | 1.000 | -.302 | .663 | .104 | .345 |
| | Sig. (2-tailed) | .322 | .304 | | .105 | .000 | .584 | .062 |
| | N | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Flexibility Improved Learning | Pearson Correlation | .044 | -.322 | -.302 | 1.000 | -.259 | -.254 | .133 |
| | Sig. (2-tailed) | .816 | .083 | .105 | | .167 | .175 | .484 |
| | N | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Interaction Improved Understanding | Pearson Correlation | .306 | .346 | .663 | -.259 | 1.000 | .201 | .367 |
| | Sig. (2-tailed) | .100 | .061 | .000 | .167 | | .288 | .046 |
| | N | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Lesson Improved Application Ability | Pearson Correlation | .120 | -.019 | .104 | -.254 | .201 | 1.000 | .132 |
| | Sig. (2-tailed) | .527 | .922 | .584 | .175 | .288 | | .518 |
| | N | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Overall Satisfaction with Learning Experience | Pearson Correlation | .259 | .211 | .345 | .133 | .367 | .123 | 1.000 |
| | Sig. (2-tailed) | .168 | .264 | .062 | .484 | .046 | .518 | |
| | N | 30 | 30 | 30 | 30 | 30 | 30 | 30 |

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Quiz 1 and Quiz 2 scores are strongly correlated, suggesting consistent performance over time. Engagement doesn't have a significant effect on quiz scores, although it is weakly positively correlated with both quizzes.

There is a moderate negative correlation between engagement and the perception that flexibility improved learning. This indicates that students who felt more engaged may not have prioritized flexibility as much.

There is a moderate negative correlation between interaction improving understanding and Quiz 2 scores, which might indicate that participants who relied more on interaction did not perform as well on the Week 1 quiz.

Satisfaction and engagement are moderately positively correlated, indicating that students who were more engaged were also more satisfied with the learning experience

## 7. Discussion

The findings of this study contribute to the ongoing discourse on the effectiveness of synchronous versus asynchronous online learning modes, particularly in the context of learner retention and satisfaction. Contrary to the initial hypothesis that synchronous learning, with its emphasis on real-time interaction, would result in better retention, the independent and paired t-tests revealed no statistically significant differences in quiz scores between the two groups. This finding aligns with previous research by Bernard *et al.* (2014), who found that while synchronous learning may offer immediate feedback and interaction, it does not necessarily lead to superior retention outcomes compared to asynchronous methods. Both groups in the present study exhibited a slight decline in performance from the first quiz (administered one day after the lesson) to the second quiz (administered one week later), suggesting that retention naturally diminishes over time, regardless of the learning mode. This decline is consistent with the findings of Garrison and Vaughan (2021), who emphasize the challenges of maintaining retention over time in online learning environments.

However, the questionnaire data underscored significant differences in the perceived benefits of each learning method, particularly in terms of engagement and interaction. The synchronous group rated their learning experience as more engaging, with 40% of participants describing it as "Very Engaging" and 60% indicating that interaction improved their understanding. This supports the findings of Lowenthal *et al.* (2020), who argue that synchronous learning environments, through their ability to facilitate live interaction and immediate feedback, are more likely to foster student engagement and enhance perceptions of understanding. In contrast, 53.3% of asynchronous learners reported their experience as "Not Engaging," reflecting the challenges identified by Hrastinski (2008) regarding the potential for reduced engagement in asynchronous environments due to the lack of real-time interaction.

On the other hand, the asynchronous group demonstrated a strong preference for flexibility, with 47% agreeing that flexibility improved their learning experience, compared to only 20% in the synchronous group. This finding is consistent with the work

of Kauffman (2015), who highlights that the flexibility inherent in asynchronous learning is a key factor that appeals to learners with varied schedules and responsibilities. The ability to engage with course materials at one's own pace allows asynchronous learners to tailor their educational experience to their individual needs, which is particularly beneficial in a diverse learner population.

Interestingly, when analyzing overall satisfaction, the results indicated no significant difference between the two groups, even though the synchronous group had a higher proportion of participants who were "Very Satisfied" with their learning experience. This suggests that while engagement and interaction levels differ between synchronous and asynchronous learning, these factors alone do not necessarily determine overall satisfaction. The lack of significant differences in satisfaction aligns with the findings of Boelens *et al.* (2017), who noted that satisfaction in online learning is influenced by a complex interplay of factors, including learning style preferences, the relevance of the content, and the learners' ability to manage their time effectively.

The correlation analysis further illuminated some critical relationships between quiz scores and questionnaire responses. While quiz scores were consistently correlated over time, indicating stable performance across both quizzes, variables such as engagement and flexibility did not exhibit strong correlations with quiz performance. This lack of correlation suggests that factors traditionally associated with enhanced learning experiences, such as high engagement or perceived flexibility, do not necessarily translate into better retention as measured by quiz scores. Notably, the moderate negative correlation between interaction and Quiz 2 scores points to a potential issue where an over-reliance on interaction may detract from individual study time, ultimately impacting long-term retention. This finding resonates with the work of Giesbers *et al.* (2013), who caution that while interaction is beneficial, it must be balanced with opportunities for self-directed learning to optimize retention outcomes.

In summary, this study reaffirms the nuanced nature of online learning, where the benefits of synchronous and asynchronous methods manifest differently across various educational outcomes. While synchronous learning may enhance engagement and the immediacy of understanding, asynchronous learning offers unmatched flexibility, making it a valuable option for diverse learner populations. The findings also highlight the importance of considering learner preferences and balancing interaction with self-directed study to maximize both retention and satisfaction in online education.

## 8. Conclusion

In conclusion, this study contributes to the growing body of research on the effectiveness of synchronous and asynchronous online learning methods. While both methods resulted in similar retention levels, the clear differences in engagement, interaction, and perceived flexibility point to the importance of aligning learning modes with learner preferences. Synchronous learning, with its real-time interaction, seems to foster greater engagement and understanding, making it particularly beneficial for students who thrive in

interactive environments. Asynchronous learning, on the other hand, offers the advantage of flexibility, which is highly valued by learners who need or prefer self-paced study.

The lack of significant difference in overall satisfaction suggests that both methods can be equally effective when properly aligned with student needs. Educators and institutions should consider offering a blend of both methods to cater to different learner preferences, especially in contexts where flexibility and engagement need to be balanced. Future research should explore the long-term effects of interaction in synchronous learning and examine how different types of engagement in asynchronous learning environments can be enhanced to improve retention and overall learning outcomes. Further studies could also investigate whether specific student characteristics, such as self-regulation or learning style, moderate the effectiveness of synchronous versus asynchronous learning.

**Conflict of Interest Statement**

The authors declare that they have no financial or personal conflicts of interest related to this research. No funding was received for this study, and the authors have no financial relationships with any organizations that could be perceived as influencing the research. Additionally, there are no other potential conflicts of interest to disclose.

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