

Associating Synchronous and Asynchronous Remote Teaching Formats with Student Situational Interest and Motivation

**Elizabeth Simmermeyer¹, Stefanie Walsh³,
and Elizabeth Karcher¹**
Purdue University
West Lafayette, IN



MaryGrace Erickson²
University of Wisconsin
Madison, WI

Abstract

In response to the global COVID-19 pandemic, instructors across the world faced the uncertainty and challenge of retaining student engagement after transitioning from face-to-face to emergency remote instruction. Yet, few studies have evaluated student interest and motivation in the various learning formats during emergency remote learning conditions. The current study examines student situational interest and situational motivation with three emergency remote teaching formats. In Fall 2020, a previously face-to-face introductory animal science course was taught fully-remote. Each week, students participated in a 50-minute synchronous lecture (SLec), 50 minutes of asynchronous lecture (ALec), and a 70-minute synchronous lab (Lab). We assessed situational interest and situational motivation in SLec, ALec, and Lab during weeks 6 and 10. Using linear mixed effects modeling, students demonstrated greater situational interest, attention demand, instant enjoyment, novelty, and total interest in SLec and Lab compared with ALec. Intrinsic motivation was higher and external regulation was lower in Lab and SLec compared with ALec. Students reported greater amotivation and decreased identified regulation with the ALec compared with Lab. Our results, although limited to one course, suggest that synchronous remote formats are associated with greater student interest and intrinsic motivation compared with asynchronous formats.

Keywords: interest, motivation, online, asynchronous, synchronous

In March 2020, the global COVID-19 pandemic resulted in the transition to emergency remote instruction in universities across the United States. Although temporary, this change in instruction delivery resulted in challenges for both students and educators (Rahiem, 2020). Educators faced challenges such as weak online teaching platforms and a lack of remote teaching experience (Ali, 2020). Students were also expected to continue their learning even with sudden changes in their learning format and social norms, leading to increased anxiety (Arribathi et al., 2021). However, while the pandemic had a large negative impact around the world, educators were provided the opportunity to learn how students responded to new teaching formats (Williamson et al., 2020).

Pandemic aside, online learning has increased in popularity over the past several years. Online courses provide students with flexibility to learn while working and focusing on other responsibilities such as family (Dhawan, 2020), which may explain why a majority of online students are adult learners (Okech et al., 2014). While online students possess high motivation, they also exhibit higher levels of frustration, lower interest, and increased confusion about course work (Okech et al., 2014). To combat this, educators can design instruction to maximize interactive and collaborative learning, which can contribute to a positive relationship between student interest and motivation

¹Purdue University, Department of Animal Sciences, West Lafayette, IN

²University of Wisconsin—Madison, Department of Animal and Dairy Sciences, Madison, WI

³Purdue University, Krannert School of Management, West Lafayette, IN

Author contact information: Elizabeth Simmermeyer – esimmer@purdue.edu, MaryGrace Erickson – merickson3@wisc.edu, Stefanie Walsh – walsh88@purdue.edu,

Corresponding Author: Elizabeth Karcher – ekarcher@purdue.edu

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(Nieuwenhuyse, 2021).

When transitioning to new teaching formats, educators can ensure students continue to perform well academically, by encouraging positive interest in the subject matter. Interest can take many forms when attention is focused on a particular topic over time (Harackiewicz et al., 2016). In this academic context, instructors strive for their students to develop an interest in the subject as this leads to a meaningful and voluntary learning experience (Schiefele, 1991). Hidi & Renninger (2006) theorized two major forms of interest. The first one, individual interest, is when a student has a desire to learn about or be involved in a particular subject. In contrast, situational interest is developed through external stimuli sparking an interest in the subject (Schiefele, 1991). Over time, situational interest will then lead to a more sustained, individual interest (Harackiewicz et al., 2016).

When situational interest is triggered, maintained, and repeated continuously, individual interest develops (Hidi & Renninger, 2006). In addition, individual interest is directly related with intrinsic motivation. Intrinsic motivation occurs when students complete tasks due to their own interest and pure enjoyment in the task (Ryan & Deci, 2000). Because “motivation produced,” students complete classroom activities and tasks, which is essential to a positive education (Ryan & Deci, 2000). Students with high intrinsic motivation and autonomy tend to perform better academically (Deci et al., 1991). When interest is developed, students are intrinsically motivated to learn material for their own satisfaction rather than for external rewards or feelings (Deci et al., 1991).

The purpose of our study was to examine student individual interest, situational interest, and situational intrinsic motivation in various remote teaching formats. By examining interest and motivation, we can learn more about the effectiveness and benefits of various remote teaching formats.

Our study was guided by the following three questions:

1. Does students' individual interest change from the beginning to end of the semester?
2. Does students' situational interest and situational motivation differ between synchronous lecture, asynchronous lecture, and synchronous laboratory?
3. Does a relationship exist between students' individual interest and their situational interest and motivation in animal science?

Methods

Context and Participants

This study was conducted during the fall 2020 semester in a 16-week course, “Introduction to Animal Agriculture.” Prior to 2020, the course was taught in-person with two fifty-minute lectures and a two-hour lab each week. Approximately one month before the start of classes, the course instructors received notification that university policies required the course to be taught remotely for the fall 2020 semester. There were 161 students enrolled in the course of which 63.5% were first-year students and 75.9%

were Animal Sciences majors.

The 3-credit course utilized three remote teaching formats. Each Tuesday, students completed 50 minutes of asynchronous materials which consisted of online modules created using Storyline 360© Software (Articulate 360, New York, NY; ALec). After completion of each module, students completed an online assessment using Qualtrics® Survey Software (Qualtrics Inc, Provo, UT). On Thursdays, students joined a 50-minute synchronous class discussion and lecture (SLec) via WebEx. During Friday laboratory sessions, students joined their assigned section synchronously for 45-minutes to complete learning activities and participate in a question and answer session (Lab). Prior to each lab session, students were assigned to complete a packet that consisted of watching videos, reading articles, and content questions. After each session, students were required to take a 10-question multiple choice quiz administered via Brightspace (D2L Corporation, Canada). Two graduate laboratory coordinators and 11 undergraduate TAs (2-3 per laboratory section) facilitated the activities and led group discussions.

Study Design and Instrumentation

All procedures for this study were approved by the university's Institutional Review Board (IRB-2020-1208). This study utilized self-report measures in the form of questionnaires to quantify individual interest, situational motivation, and situational interest. Questionnaires were administered via the Qualtrics platform (Qualtrics Inc, Provo, UT) at four time points during the semester (weeks 2, 6, 10, and 14) and completed at the end of each class session.

Student situational interest and situational motivation were measured during weeks 6 and 10 of the semester. Individual interest was measured during weeks 2 and 14. For ALec, students were provided the link to the questionnaire via Brightspace after completing the online modules but before completing the online quiz. For SLec and Lab, the link to the questionnaire was provided in the chat box via WebEx during the last ten minutes of class. In Lab, students were provided time to complete the questionnaire before starting their weekly online quiz. In week 6, the topic was Beef Management and week 10 was Poultry Management.

Individual Interest

Student individual interest was measured using the Individual Interest Questionnaire (IIQ; Linnenbrink-Garcia et al., 2010). The IIQ is composed of 8 questions that measure students' attitudes and feelings towards one particular subject on a scale of 0 (low) to 70 (high; Rotgans, 2015). Demographic information was collected in week 2, and included 15 questions regarding prior experience in animal agriculture, major, and grade classification.

Situational Interest

Situational interest was measured using the Situational Interest Scale (SIS; Chen et al., 1999), which evaluates students' exploration intention, instant enjoyment, novelty,

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attention, challenge, and total interest in the subject. Novelty is the uniqueness of the activity, while challenge is the complexity and demand level of the activity. Students' instant perception of the activity can be described by exploration intention, or the level of curiosity that the activity causes. Attention demand describes students' attention, focus, concentration, and engagement in a task. When students experience instant enjoyment, they find the activity enjoyable and appealing, which leads them to continue participation. Total interest, the last subscale, measures how interesting and fun the activity is for students (Chen et al., 1999). Students responded to statements on a five point Likert scale ranging from strongly disagree (1) to strongly agree (5)(Chen et al., 1999).

Situational Motivation

Situational motivation was measured using the Situational Intrinsic Motivation Scale (Guay et al., 2000; SIMS), which evaluates intrinsic motivation, external regulation, identified regulation, and amotivation for completing a task. Students exhibit intrinsic motivation when they enjoy the challenge and complete the task for the sake of learning. In contrast, students can be extrinsically motivated, or motivated by something other than the satisfaction of learning. For example, in external regulation, students may receive an award for completion of a task. In contrast, in identified regulation, a student completes an activity in order to reach an end goal bigger than the individual activity. When students are amotivated, they are unwilling to complete the task at all (Ryan & Deci, 2000). Students responded to statements on a seven point Likert scale ranging from not at all in agreement (1) to completely in agreement (7).

Statistical Analysis

We completed all analyses utilizing R version 4.0.3 (R Core Team, 2020). Before the analysis, we verified that the individual interest, situational interest and subscales (attention demand, challenge, exploration intention, instant enjoyment, novelty, total interest), and situational motivation subscales (intrinsic motivation, external regulation, identified regulation, and amotivation) were internally consistent with Cronbach's alpha exceeding 0.70 (Tavakol & Dennick, 2011). All Cronbach's alphas for subscales in situational interest and situational motivation exceeded 0.70 and ranged from 0.77 and .96. Individual interest had a value of 0.91 at week 2 and 0.93 at week 14.

A paired t-test was completed to compare individual interest between weeks 2 and 14. We modeled situational interest subscales and situational motivation subscales with separate linear mixed effects models in lmer (Bates et al., 2015). We used an ANOVA test to evaluate Type III sums of squares (Girden, 1992). Each mixed effect model included the following fixed effects: timepoint (categorical; 1 or 2); learning format (categorical; synchronous lecture, asynchronous lecture, or lab); average pre-test individual interest (continuous, grand-mean-centered); and demographic variables hometown, classification, and major

concentration (categorical). We specified an interaction term between the learning format and the timepoint and an interaction term between the learning format and average pre-test individual interest. Each model included "student" as a random effect. Significance was declared at $p \leq 0.05$.

Results

Individual Interest

Individual interest was 59.56 ± 10.23 at the beginning of the semester and 58.79 ± 12.92 at the end of the semester, showing no significant difference from week 2 to 14 ($n = 120$; 74.5%; $p = .37$). These numbers indicate that students started the semester self-reporting a greater interest in the subject, and this interest remained high during the semester.

Situational Interest Subscales and Time Points

Response rates for situational interest varied from 57.8% to 90.7% (Table 1). Timepoints were averaged for this comparison. Pairwise comparisons of estimated marginal means indicated that students demonstrated greater situational interest, attention demand, instant enjoyment, and total interest in SLec and Lab compared with ALec (Table 2). Students also reported experiencing greater novelty in SLec and Lab compared with ALec.

Table 1.

Response rates for situational interest and situational motivation surveys.

Time Point	Learning Format	Situational Interest	Situational Motivation
T1	Asynchronous Lec	87.5%	87.0%
T1	Synchronous Lec	57.8%	57.1%
T1	Synchronous Lab	71.4%	71.4%
T2	Asynchronous Lec	90.7%	90.1%
T2	Synchronous Lec	63.4%	63.4%
T2	Synchronous Lab	83.2%	83.2%

Note. Response rates for the situational interest and situational motivation surveys in asynchronous lecture (ALec), synchronous lecture (SLec), and synchronous laboratory (Lab) at T1 (week 6) and T2 (week 10) in a 16-week animal science introductory course ($n = 161$ students).

At week 6 (time point 1), overall situational interest was statistically greater in the Lab compared with the ALec and SLec (Table 3). At week 10 (time point 2), situational interest was greater in SLec compared with ALec and Lab. When comparing situational interest at each time point for each learning format, interest in ALec, SLec and Lab was greater at week 10 compared with week 6.

Situational Intrinsic Motivation

Response rates for situational motivation varied from 57.1% to 90.1% (Table 1). Timepoints were averaged for this comparison. Intrinsic motivation was greater in SLec

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Table 2.

Estimated marginal means of situational interest in three remote learning formats

Situational Interest Scale	Asynchronous Lec	Synchronous Lec	Synchronous Lab
Exploration Intention	3.68	3.75	3.80
Instant Enjoyment	3.27 ^a	3.79 ^b	3.78 ^b
Novelty	3.39 ^a	3.55 ^b	3.47 ^{ab}
Attention Demand	3.30 ^a	3.65 ^b	3.51 ^b
Challenge	2.54 ^a	2.48 ^{ab}	2.36 ^b
Total Interest	3.24 ^a	3.67 ^b	3.64 ^b
Situational Interest	3.22 ^a	3.47 ^b	3.41 ^b

Note. Estimated marginal means of situational interest for students ($n = 161$) enrolled in an introductory animal science course across three learning formats: asynchronous lecture, synchronous lecture, and synchronous lab. The Situational Interest Scale is a Likert scale with 5 corresponding to strongly agree and 1 corresponding to strongly disagree. Superscripts within rows represents significant differences ($p \leq 0.05$)

Table 3.

Estimated marginal means at week 6 (T1) and week 10 (T2) for situational interest

Situational Interest Scale	Asynchronous Lec	Synchronous Lec	Synchronous Lab
Time point 1	3.33 ^a	3.37 ^a	3.61 ^b
Time point 2	3.10 ^a	3.57 ^b	3.21 ^a

Note. Estimated marginal means for three learning formats at weeks 6 (T1) and 10 (T2) of the 16-week introductory animal science course for overall situational interest. The Situational Interest Scale is a Likert scale with 5 corresponding to strongly agree and 1 corresponding to strongly disagree. Superscripts (a, b, ab) within rows represents significant differences ($p \leq 0.05$). A multiplicity correction test based on Tukey's Honest Significant Difference was performed.

Table 4.

Estimated marginal means for intrinsic motivation subscales

Situational Motivation Scale	Asynchronous Lec	Synchronous Lec	Synchronous Lab
Intrinsic Motivation	3.78 ^a	4.50 ^b	4.44 ^b
Identified Regulation	4.81 ^a	4.97 ^{ab}	4.98 ^b
External Regulation	4.74 ^a	4.41 ^b	4.48 ^b
Amotivation	2.31 ^a	2.19 ^{ab}	2.11 ^b

Note. Estimated marginal means for animal science introductory course students across three learning formats averaged at weeks 6 and 10 of the 16-week semester for situational intrinsic motivation subscales (intrinsic motivation, identified regulation, external regulation, and amotivation) using the SIMS scale (Anchored scale: 1 = not at all in agreement, 7 = complete in agreement). Superscripts (a, b, ab) within rows represents significant differences ($p \leq 0.05$). A multiplicity correction test based on Tukey's Honest Significant Difference was performed.

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(4.50 ± 0.19) and Lab (4.44 ± 0.18) compared with ALec (3.78 ± 0.18 ; $p < .0001$). Additionally, external regulation was greater in ALec (4.74 ± 0.20) than SLec (4.41 ± 0.20 ; $p = .0001$) and Lab (4.48 ± 0.20 ; $p = .002$; Table 4). Students reported greater amotivation and decreased identified regulation with the ALec compared with Lab. Synchronous formats are more likely to intrinsically motivate students. In contrast, an asynchronous format where a student is expected to complete various activities may cause greater external regulation resulting in a more forced and controlled motivation.

Impact of Covariates on Situational Interest

Pre-course individual interest impacted amotivation, identified regulation, intrinsic motivation, and situational interest. Students in our cohort who started the semester with greater individual interest consistently had higher situational interest at weeks 6 and 10. A student's classification also appeared to impact their situational interest, identified regulation, and intrinsic motivation. There was no effect of concentration or hometown on situational interest or situational motivation (Table 5).

Table 5.

Results of five linear mixed models

Predictors	Amotivation		External Regulation		Identified Regulation		Intrinsic Motivation		Situational Interest	
	F	p	F	p	F	p	F	p	F	p
Timepoint	8.18	0.004	0.07	0.789	30.87	<0.001	11.79	0.001	16.00	<0.001
Learning environment	3.73	0.025	10.36	<0.001	4.14	0.016	41.00	<0.001	18.16	<0.001
Pre-test individual interest	4.45	0.037	0.82	0.368	24.16	<0.001	22.86	<0.001	16.98	<0.001
Hometown	0.21	0.889	1.69	0.171	0.93	0.430	0.57	0.638	1.20	0.313
Classification	0.20	0.896	2.18	0.094	8.20	<0.001	6.56	<0.001	8.34	<0.001
Concentration	2.07	0.152	0.26	0.614	1.53	0.218	1.12	0.292	1.48	0.225
Timepoint*Learning Environment	7.42	0.001	0.27	0.761	10.68	<0.001	21.27	<0.001	21.98	<0.001
Environment*Pre-test individual interest	0.58	0.559	0.39	0.680	1.44	0.239	0.58	0.559	0.28	0.754

Random Effects					
σ^2	0.56	0.59	0.51	0.81	0.20
T_{00}	0.90 _{ID}	1.15 _{ID}	0.55 _{ID}	0.83 _{ID}	0.16
ICC	0.61	0.66	0.52	0.51	0.46
N students	133 _{ID}	133 _{ID}	133 _{ID}	133 _{ID}	133
Observations	631	631	631	631	632
Marginal R ² / Conditional R ²	0.057 / 0.637	0.071 / 0.685	0.258 / 0.645	0.275 / 0.642	0.251 / 0.593

Note. F values are from Type III sums of squares in anova() output in R. These are presented along with variance components (under the random effects part of the table) taken from the lmer() output.

Discussion

The high student individual interest in the course is consistent with others who have reported high levels of individual interest in students in an introductory animal science course at the beginning and end of the course, regardless of pedagogical interventions (Erickson et al., 2021). We anticipated that individual interest would be high because, by definition, individual interest is defined as the predeveloped state of interest that a person possesses in a subject based on previous experiences (Rotgans & Schmidt, 2017). Similar to the Erickson et al. (2021) study, a high percentage of students in our study were pursuing a degree in animal science. They can be assumed to have a personal value in the subject, which positively correlates with individual interest (Schraw et al., 2001).

Students in our study completed activities in three different learning formats (ALec, SLec, and Lab). The six subscales of situational interest (attention demand, challenge, exploration intention, instant enjoyment, novelty, total interest) can be used to describe how each learning format activity impacted student situational interest (Deci,

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1992). In our study, situational interest, total interest, attention demand, and instant enjoyment were greater in SLec and Lab compared with ALec. Synchronous learning formats allow for more direct student and instructor engagement because the class is meeting in real time and promotes student and instructor engagement (Perets et al., 2020). In this setting, educators can lecture, lead discussion, and engage with students as they would during a face-to-face course (Skylar, 2009). Our students also reported greater challenge in the ALec format compared with SLec. Students in asynchronous courses have more time to reflect and digest material, but can often experience misunderstandings due to lack of communication (Giesbers et al., 2013). With synchronous learning, students are able to communicate and ask questions through engagement with instructors (Giesbers et al., 2013). Engagement in synchronous activities can lead to positive engagement in the classroom due to a social presence, which students desire (Lee et al., 2020). During COVID-19, students often found it hard to engage in online settings. However, a study by Perets et al. (2020) showed that students felt that instructor engagement and synchronous peer engagement were important elements of the online learning format. Social presence, defined as affective expression, open communication, and group cohesion, is correlated to student satisfaction with remote learning (Erickson & Wattiaux, 2021).

Evaluating situational motivation provides another opportunity to understand student interactions with their learning format. We found that students' reported intrinsic motivation was significantly higher in the synchronous teaching formats compared to ALec. This is consistent with a study by Lin et al. (2017) where students in an asynchronous online course had lower intrinsic motivation than students in a synchronous face to face course. Students in our course demonstrated greater external regulation in ALec compared with SLec and Lab. One explanation for this might be that students were required to complete a quiz at the end of each asynchronous learning module. Identified regulation was also greater in Lab compared with ALec. This could be due to the nature of an asynchronous learning format which gives students more autonomy and control over what and how they learn. However, this also requires students to increase their self-regulation and complete all learning tasks on their own, which is not always the case in online formats (Barnard et al., 2009). Lastly, students demonstrating amotivation have no motivation or willingness to complete the activity (Ryan & Deci, 2000). For our students, amotivation was greater in ALec compared with Lab. Students in an asynchronous format have limited communication with instructors and interaction with peers, which can lead to a decrease in overall motivation (Barnard et al., 2009). In order to increase intrinsic motivation in online teaching formats, educators can provide students with proper communication methods and autonomy while also ensuring that students reach learning objectives.

Students in our study also exhibited differences in situational interest and motivation between the Beef Management unit and Poultry Management unit in weeks 6 and 10, respectively. This difference in interest

and motivation levels could be due to common external experiences such as exam weeks. Additionally, this difference may be attributed to the topics that were covered each week. Students may find more interest in one species or topic over another, which may cause differences in interest levels (Hartnett et al., 2014). This could be based on their prior experiences or individual interest in a particular species or topic (Erickson et al., 2021). In our study, students with higher individual interest prior to the course, showed greater situational interest at time points 1 and 2. This differs from Erickson et al. (2021) who reported that students with low individual interest prior to the course reported higher situational interest. This could be due to differences in learning formats (i.e. face-to-face vs. online) as well as other factors like content covered and teaching style. Lastly, first year students had significantly higher situational interest than other students. First year students may be exposed to the subject for the first time, increasing their curiosity and willingness to engage in the class which could ultimately lead to situational and individual interest (Harackiewicz et al., 2016).

Summary

This study was conducted in an introductory animal science course where surveys were administered four times during the semester to a convenience sample of students enrolled in the course. Interest and motivation levels could differ depending on course subject, the curriculum covered, and the topic for each time point. This particular study took place in a course that utilized three different learning formats. However, results may differ in courses that are strictly asynchronous or synchronous. In addition, the study was conducted during a global pandemic, potentially causing more distractions and disruptions for students. Future studies could analyze multiple types of courses across disciplines in different colleges. Studies could also look at how learning formats differ across courses when the course is solely asynchronous or solely synchronous. The study could be repeated when there is not a global pandemic occurring.

Educators can benefit from this study by taking into consideration how students' interest and motivation varied between learning formats. Based on previous literature and studies, instructors can create blended learning formats that will provide students with benefits of asynchronous learning and synchronous learning. As mentioned previously, students learn in different ways and may be motivated by various forms. Although online learning can be a challenge, educators can increase student engagement by providing students with the ability to communicate and interact with peers and the instructor.

In conclusion, students' motivation and interests differ between synchronous and asynchronous learning formats. Generally speaking, students had higher interest and intrinsic motivation in synchronous learning formats compared to asynchronous formats. Instructors can utilize the results of this study to inform the design of their courses and increase students' motivation to learn which can lead to greater situational and individual interest.

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