International Journal for the Scholarship of Teaching and Learning

Volume 16 | Number 2 Article 13

May 2022

The Effect of Flipped Instruction on Special Education Preservice Teachers' Perceptions

Cynthia C. Massey
Georgia Southern University, cynthiamassey@georgiasouthern.edu

Selcuk Dogan
Georgia Southern University, sdogan@georgiasouthern.edu

Edward Anthony Muhammad
Georgia Southern University, emuhammad@georgiasouthern.edu

Eric Hogan
Georgia Southern University, ehogan@georgiasouthern.edu

Cindy N. Head
Heard County Schools, Georgia, cindy.head@heard.k12.ga.us

See next page for additional authors

Recommended Citation

Massey, Cynthia C.; Dogan, Selcuk; Muhammad, Edward Anthony; Hogan, Eric; Head, Cindy N.; and Kim, Jackie (2022) "The Effect of Flipped Instruction on Special Education Preservice Teachers' Perceptions," *International Journal for the Scholarship of Teaching and Learning*: Vol. 16: No. 2, Article 13.
Available at: https://doi.org/10.20429/ijsotl.2022.160213

The Effect of Flipped Instruction on Special Education Preservice Teachers' Perceptions

Abstract

This study analyzes the flipped instruction model used in three special education educator preparation courses to examine which components preservice teachers perceived most contributed to their content knowledge, motivation, and engagement (n=50). Weekly pre-class asynchronous assignments included the use of educational technology tools such as an interactive e-textbook site, Perusall, and online academic activities such as Khan Academy to strengthen their content knowledge. This allowed more time for a student-centered approach during synchronous instruction to incorporate tools such as Nearpod, Pear Deck, Flipgrid and digital badges to strength-en their motivation and engagement. Data were collected through a post-course survey; results indicate that preservice teachers perceived this model was motivating, engaging, and contributed significantly to their content knowledge. They also identified hands-on activities during class as a significant component of their learning. This article discusses the project, limitations, and implications for future flipped instruction research in special education educator preparation programs.

Keywords

flipped instruction, higher education, special education preservice teachers, educational technology, educator preparation programs

Cover Page Footnote

none

Authors

Cynthia C. Massey, Selcuk Dogan, Edward Anthony Muhammad, Eric Hogan, Cindy N. Head, and Jackie Kim

The Effect of Flipped Instruction on Special Education Preservice Teachers' Perceptions

Cynthia C. Massey[1], Selcuk Dogan[1], Edward Anthony Muhammad[1], Eric Hogan[1], Cindy N. Head[2], and Jackie Kim[1]

[1] Georgia Southern University
[2] Heard County Schools, Georgia

Received: 21 January 2022; Accepted: 28 March 2022

This study analyzes the flipped instruction model used in three special education educator preparation courses to examine which components preservice teachers perceived most contributed to their content knowledge, motivation, and engagement (n=50). Weekly pre-class asynchronous assignments included the use of educational technology tools such as an interactive e-textbook site, Perusall, and online academic activities such as Khan Academy to strengthen their content knowledge. This allowed more time for a student-centered approach during synchronous instruction to incorporate tools such as Nearpod, Pear Deck, Flipgrid and digital badges to strengthen their motivation and engagement. Data were collected through a post-course survey; results indicate that preservice teachers perceived this model was motivating, engaging, and contributed significantly to their content knowledge. They also identified hands-on activities during class as a significant component of their learning. This article discusses the project, limitations, and implications for future flipped instruction research in special education educator preparation programs.

Teacher shortage is a topic that has moved to the forefront of K-12 schools (kindergarten through twelfth grade) across the United States, specifically in the high-needs field of special education (Holdheide & Demonte, 2016; Sindelar, 2019; U. S. Department of Education, 2021). The field of special education is dedicated to the provision of specially designed instruction for students who qualify based on a disability that impacts their ability to learn (IDEA, 2004). This instruction is designed to meet the unique needs of a student with a disability at no cost to the parent/guardian and in the setting most appropriate for the student to learn (IDEA, 2004). The shortage of special education teachers is reflected in similar declines in enrollment at universities across the country (Dewey et al., 2017; Thongmak, 2019). As college professionals race to analyze this decreasing commitment to the field, course instructors' work to redesign content to better motivate, engage, and strengthen student learning (Newman et al., 2016; Onodipe et al., 2020; Thongmak, 2019). One way to address this is for faculty to shift towards a more active, student-centered learning environment. This should engage, yet challenge, preservice teachers to master required content in order to meet the rigorous demands of the students they will serve (Clark et al., 2018; Freeman et al., 2014; Onodipe et al., 2020; Thongmak, 2019; Weimer, 2016). Current SoTL (Scholarship of Teaching and Learning) discourse identifies the need to investigate the effects of active-learning pedagogies, including flipped instruction, on student engagement (Clark et al., 2018), as well as the need to measure the effect of flipped instruction across various disciplines (Gomez-Lanier, 2018). Although the search was not exhaustive, there is not any known research analyzing the effectiveness of the flipped instruction model with special education preservice teachers.

LITERATURE REVIEW

This project was created to address preservice teachers' discontentment with the traditional instruction delivery model used in a special education educator preparation course. The course focused on assessment methods for students with mild disabilities in grades K-12. To evaluate their discontentment, the instructor investigated the contributory factors and discovered the source was their perceived lack of engagement with the content, struggle to apply the material learned, and ability to complete difficult assignments outside of class. The instructor, then, consulted the TPACK and SAMR frameworks and the flipped classroom model to investigate an improved instructional approach.

The TPACK Model

The instructor first consulted the Technological Pedagogical and Content Knowledge (TPACK) Model which identifies three types of knowledge that educators should understand in order to implement educational technology in their courses more purposely (Mishra & Kohler, 2006). These include teachers' content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK), which, when combined, provide students with a more relevant and motivating classroom experience (Koehler et al., 2014; Mishra & Koehler, 2006; Shulman, 1986). An example of this in the assessment course was an assignment that addressed the legislative history of special education. The assignment in the traditional course involved an assigned reading, lecture with discussion, and an outside written assignment. After shifting to a flipped

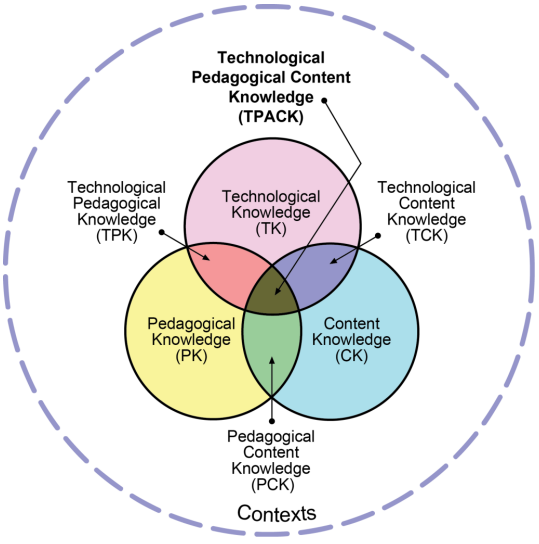

***Figure 1*. TPACK Model.**
Note: Reproduced by permission of the publisher, © 2012 by tpack.org.

model, the in-class assignment required preservice teachers to (a) work in heterogeneous groups to expand their knowledge base (research-based pedagogy), (b) create an interactive timeline presentation of events (technology) and (c) develop a multifaceted product with hyperlinks connected to their reflection, necessary documents, pictures, or videos to support their research. Additionally, the instructor discussed the TPACK model's value and application at the K-12 level (see Figure 1).

The SAMR Model

The instructor next considered the learners in the course, the majority of which were 'Gen Z' students born between 1997 and 2012. This generation is accustomed to 21st century technology incorporated in their daily lives and often have experience in social networking (Killian & Woods, 2018). For this population, educational technology should be an important consideration (Killian & Woods, 2018; Thongmak, 2019). Therefore, the instructor evaluated available technology using the Substitution, Augmentation, Modification, and Redefinition (SAMR) Model (see Figure 2) which provides a linear progression through four levels of technological integration (Hamilton et al., 2016; Tunjera & Chigona, 2020). The first level is the use of technology to simply replace traditional means (e.g., e-text versus print). The fourth level involves new technology to accomplish tasks that would otherwise not be possible. This model encourages educators to make intentional choices that vary along the continuum, which the instructor did, as well as educated preservice teachers on how this tool could be used within their future K-12 classroom (Hamilton et al., 2016; Tunjera & Chigona, 2020).

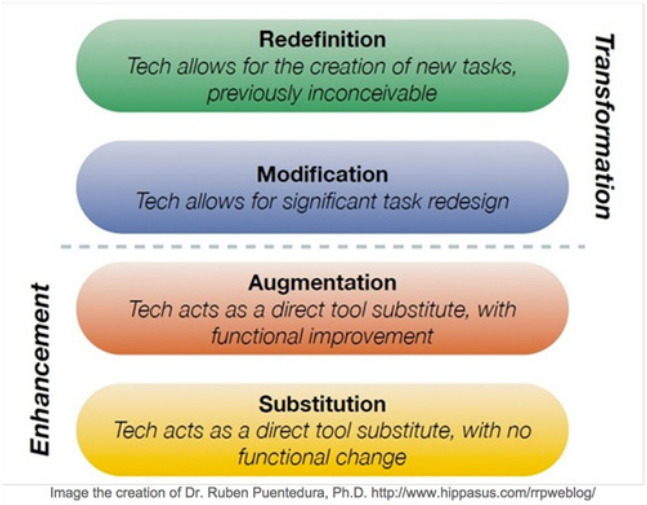

Figure 2. **SAMR Model.**

FLIPPED INSTRUCTION

Current research states the traditional model involves more time spent passively learning, which is not the most effective way to meet preservice teachers' student learning outcomes (Killian & Woods, 2018; Lee et al., 2017; Yough et al., 2019; Zheng et al., 2020). More recent pedagogy indicates higher education instructors should motivate and challenge the younger generation in order to recruit and retain the highest caliber of future educators (Carver-Tomas & Darling-Hammond, 2017; Holdheide & Demonte 2016; Johnston & Martelli, 2017; Killian & Woods, 2018; Newman et al., 2016; Sindelar, 2019). Consequently, the instructor consulted the Flipped Learning Network (FLN) which is an online community that recommends four necessary "pillars" to achieve student engagement, shown in Figure 3. These pillar describe the flipped educator as one who is *flexible,* has a *learner-centered classroom,* chooses rigorous, *intentional content* and is a reflective *professional educator* (FLN, 2014; He et al., 2019). The FLN (2014) also states that when instructors flip student learning they purposefully shift the direct instruction portion of class to asynchronous instruction time, thus allowing more in-class time to review difficult or confusing content, facilitate discussions, complete in-class assignments, demonstrate competencies, and engage in activities that allow for the application of knowledge learned. All of these have the intended purpose of deepening students' understanding of the content and include the ability for preservice teachers to interact with novel content in a supported environment (FLN, 2014; Gomez-Lanier., 2018; Hamdan et al., 2013; Lee et al., 2017; Sun & Xie, 2020; Walvoord & Anderson, 2011; Zainuddin et al., 2020; Zheng et al., 2020).

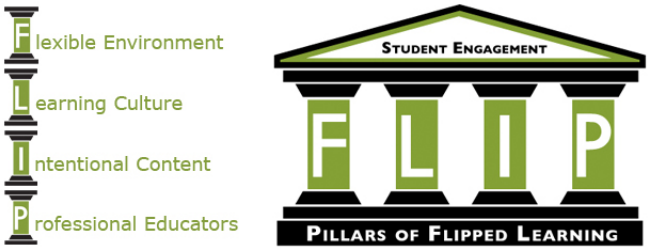

Figure 3. **Flipped Instruction Model**
The Flipped Learning Network, https://flippedlearning.org/syndicated/11-indicators-of-excellence-in-instruction-flipped-or-otherwise/

As shown in Figure 4, the TPACK, SAMR, and flipped instruction models were examined to better educate Gen-Z special education preservice teachers, as well as analyze their motivation and content acquisition, both needed areas of research (Clark et al., 2018; Gomez-Lanier, 2018; Johnston & Martelli, 2017; Kaczorowski et al., 2019; Killian & Woods, 2018; Yough et al., 2019).

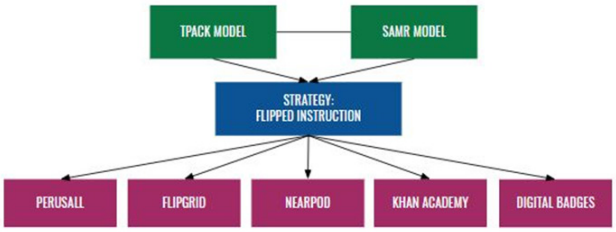

Figure 4. **Integrated Image of the Three Models**

BACKGROUND AND COURSE DESIGN

In the fall of 2019, the primary researcher began teaching an *Assessment in Special Education* course via traditional means. This course was taken by juniors in the first semester of a Special Education Bachelor of Science in Education (BSED) program; therefore it was understood that these new preservice teachers did not have the background knowledge necessary to rush through the underpinnings of the course. Approximately six weeks into the semester, after several informal meetings with students struggling with the

content and assignments, the instructor consulted the university's Faculty Center (FC). Upon their suggestion, two members from their department informally surveyed, then interviewed the class. Afterwards, through continued conversations with the FC and university mentors, the primary researcher began investigating improved instruction models which led to flipped instruction as a potential alternative for the next course. Although research suggests that flipped instruction is effective in higher education (FLN, 2014; Graziano, 2017; Kaczorowski et al., 2019), it does not identify the specific components of the model that influence preservice teacher motivation and content mastery which this study investigated (Killian & Woods, 2018; O'Flaherty & Phillips, 2015; Sun & Xie, 2020; Thongmak, 2019; Yough et al., 2019; Zheng et al., 2020).

Once determined that the flipped instruction model would be used, the instructor attended training through the university's FC on a web-based program, *Perusall* (Lukoff, 2015). This website lends itself to a flipped model as it allows instructors to link e-textbooks or upload other digital material to the site (e.g. PowerPoint, journal articles, etc.), then develop asynchronous assignments centered upon the content. The instructor determined this website would (1) be a more affordable textbook option for preservice teachers and better support the statewide university system's initiative to offer no-cost/low-cost textbooks, (2) allow preservice teachers to read the text electronically and embed responses throughout the reading and, (3) encourage asynchronous social interaction with classmates as they build on each other's comments.

The instructor also embedded video discussion board assignments via a website called *Flipgrid*. *Flipgrid* allows educators to create digital classrooms and post questions to their class. Students, then, post video recorded responses or can respond to others, which is similar to current social media sites. Additionally, students submitted handwritten *notes guides* each week in both courses, and in Math Methods, completed *Khan Academy* assignments to improve math skills (Luo et al., 2018; Mueller & Oppenheimer, 2014; 2018). These assignments worked to ensure preservice teachers covered the necessary content prior to attending class.

Class time began with the instructor answering questions regarding pre-class assignments and reviewing difficult or confusing concepts; this typically lasted approximately thirty minutes. If brief presentations were needed in class to expound on content, they were typically delivered via alternative means such as *Nearpod* or *Pear Deck*. Both are websites that allow teachers to embed interactive, formative assessment measures within presentations. These informal evaluation measures encourage active learning, ensure students grasped the content, and challenge their understanding (Schmitz et al., 2019). With both of these sites, student's responses can be displayed in real-time allowing questions to be answered immediately, and points validated. These tools were intended to be more engaging and provide active learning opportunities. Preservice teachers spent the remainder of class time participating in targeted activities such as group discussions, hands-on activities, collaborative and individual projects, presentations, assessment activities, and reflection assignments, all designed to increase their content knowledge and encourage engagement.

To further increase motivation and recognize mastery of micro-skills, in the third Math Methods course the instructor began administering *digital badges* to students. These are a gaming element in which students are awarded electronic images of badges earned for accomplishing predetermined tasks (Thongmak, 2019; Zainuddin et al., 2020). In this course, preservice teachers helped create the digital badge skills to be earned, first through a class discussion then an online opinion survey. Preservice teachers were awarded digital badges as certain accomplishments were mastered throughout the course. The instructor recognized these during weekly 'housekeeping time' at the beginning of class, through electronic learning management system (LMS) news posts, and weekly electronic agendas.

At the conclusion of the Math Methods and after IRB approval, an additional question was added to the survey used in this study to gauge the effect of specific components within the flipped course including those described in this section.

THE PRESENT STUDY

The purpose of this study was to analyze preservice teachers' perceived effectiveness of a flipped instruction model in a special education educator preparation program, and to better understand which components contributed to their knowledge, motivated the preservice teachers, and increased their engagement.

This study sought to answer four research questions:

What were special education preservice teacher's perceptions of flipped instruction in an educator preparation program?

Which variables predict these preservice teachers reported levels of content knowledge?

What activities did these preservice teachers perceive had the greatest effect on content knowledge?

What component(s) of this course were helpful for special education preservice teacher learning?

METHODS

Participants and Procedures

This study was conducted with 50 preservice teachers in three special education courses over three semesters. The researchers obtained IRB approval to investigate the effect of flipped instruction using asynchronous pre-course, technology-driven assignments, combined with interactive in-class discussions, assignments, and activities aimed at analyzing the potential increase in preservice teacher engagement and content acquisition. A researcher who was not the course instructor recruited, obtained informed consent, and maintained records until after each course ended and grades were posted.

The first course was *Assessment in Special Education* taught during the Spring of 2020 to preservice teachers enrolled in a dual certification educator preparation program, which is a major that includes both elementary and special education classes (n = 9). The second was an *Assessment in Special Education* course taught during the Fall of 2020 to preservice teachers majoring in special education only (n = 21). The third was a course taught to the same juniors in the special education educator preparation program who were enrolled in a *Math Methods in Special*

Education course during the Spring of 2021 (n = 20). Prior to enrollment, all preservice teachers involved in the study met the entrance requirements for the dual or special education program established by the university. Each class was scheduled for two hours and forty-five minutes and lasted sixteen weeks. Preservice teachers ranged in age from 19-25 with the majority being 21 or younger (82%). Additionally, 94% of the preservice teachers identified as female, 6% male, 92% Caucasian, 4% African American, and 4% Hispanic (see Table 1).

***Table 1*. Demographic Information**

Measure	Average or Percent (n = 50)
Current GPA	3.47 avg. (scale of 0-4)
Comfort with University 1's Learning Management System (LMS)	3.42 avg. (scale of 1-4)
Number of flipped courses taken before	1.6 avg.
Female	94% (n = 47)
Male	6% (n = 3)
21 years or younger	82% (n = 41)
African American	4% (n = 2)
Hispanic	4% (n = 2)
White/Caucasian	92% (n = 46)
Senior	2% (n = 1)
Junior	90% (n = 45)
Sophomore	8% (n = 4)

MEASURES

Special education preservice teachers enrolled in each of the three courses were recruited to participate in the study which included a survey with eleven questions (adapted from He et al., 2019). The first nine were Likert-scale type questions, listed below. For coding purposes, each question has a short title listed in bold.

1. **Preparation time -** I typically spend approximately ___ minutes each week completing pre-class assignments: (a) 0 minutes, (b) 15 minutes, (c) 30 minutes, and (d) an hour or more.
2. **Feeling prepared -** At the beginning of each class, I felt well prepared to discuss the content to be covered. Preservice teacher choices were (a) strongly agree, (b) agree, (c) disagree, and (d) strongly disagree.
3. **This course** consisted of (a) 100% lecture, (b) 75% lecture/25% interactive, (c)50% lecture/50% interactive, and (d) 25% lecture/75% interactive.
4. **Preference -** What I prefer most in a college course is (a) 100% lecture, (b) 75% lecture/25% interactive, (c) 50% lecture/50% interactive, and (d) 25% lecture/75% interactive.
5. **Amount of preparation -** Regarding assigned readings, chapters, or PowerPoints, when preparing for this class prior to my arrival, I: (a) normally did not prepare for class prior to arrival, (b) only prepared enough to pass the quizzes/test(s), and (c) ensured I understood the assigned weekly material well enough to discuss it with others.
6. **Content knowledge -** As I am nearing the end of the course, with regards to my knowledge of the course content there has been: (a) little or no change, (b) understanding of the basics (c) a much deeper than basic understanding, and (d) confidence I could teach the content to novices.
7. **Engagement -** This course engaged me in thought-provoking conversations and useful hands-on activities: (a) strongly agree, (b) agree, (c) disagree, and (d) strongly disagree.
8. **Student-centered -** This course felt like it was a student-centered learning environment: (a) strongly agree, (b) agree, (c) disagree, and (d) strongly disagree.
9. **Satisfaction of knowledge -** I am satisfied with the knowledge I gained from this course: (a) strongly agree, (b) agree, (c) disagree, and (d) strongly disagree.

The last two questions were open-ended to further understand preservice teachers' perception.

1. What components were most helpful to you as a learner?
2. Do you have any additional comments you would like to share?

The preservice teachers in the Spring 2021 Special Education Math Methods course were also asked one additional question with ten items for their consideration. This question asked them to rank the value of specific components in the course that they felt contributed to their content knowledge.

1. If one (1) is not at all effective and ten (10) is extremely effective, rate how effective you felt the following course activities/assignments were to your understanding of the content: (a) hands-on, in-class activities, (b) the interactive assignments completed outside on the lawn, (c) *Perusall* reading, (d) interactive *Nearpod* presentation, (e) support *Zoom* sessions, (f) face-to-face sessions, (g) digital badges earned, (h) student presentations over content, (i) *Flipgrid* discussion assignment, (j) required time spent improving math skills on *Khan Academy* (math course only).

DATA ANALYSIS

Quantitative data

There were two analysis techniques used for the quantitative data. To present the general tendency we used descriptive statistics (frequency and percent) of each question and reported count data of each measurement level. For more advanced analysis, we used multiple linear regression to predict the effect of the six previously described variables on preservice teachers' perceived content knowledge in SPSS 23. We tested all assumptions, and no major issues were observed. Missing variables were eliminated from each individual analysis.

Qualitative data

The open-ended questions were chosen as an alternative to the close-ended survey questions to ensure the researchers had not overlooked a contributing component within the flipped instruction survey questions. These two questions were intended to encourage preservice teachers to look more comprehensively at the topic at hand and provided them the space and freedom to address contributing factors not addressed in the forced-choice questions. For the first open-ended question, a thematic analysis was employed to capture any emergent themes emanating from the preservice teachers' open-ended responses. Specifically, the analytic method described by Auerbach and Silverstein (2003) was deemed appropriate for use. In their approach, thematizing

Table 2. **Frequency and Percent**				
Preparation Time				
	0-15 minutes	15 minutes	30 minutes	1 hour or more
Frequency	3	15	25	7
Percent	6	30	50	14
Feeling Prepared				
	Strongly Disagree	Disagree	Agree	Strongly disagree
Frequency	3	15	25	7
Percent	6	30	50	14
This Course				
	100% lecture	75% lecture/ 25% interactive	50% lecture/ 50% interactive	25% lecture/ 75% interactive
Frequency	1	2	34	13
Percent	2	4	68	26
Preference				
	100% lecture	75% lecture/ 25% interactive	50% lecture/ 50% interactive	25% lecture/ 75% interactive
Frequency	1	6	25	18
Percent	2	12	50	36
Amount of Preparation				
	Normally, did not prepare for class prior to arrival	Only prepared enough to pass the quizzes/tests	Ensured I understood the assigned weekly material well enough to discuss it with others	
Frequency	4	10	36	
Percent	8	20	72	
Content Knowledge				
	Little or no change	Basic understanding	Better than basic	Well enough to teach others
Frequency	0	8	27	15
Percent	0	16	54	30
Engagement (*one student did not reply)				
	Strongly Disagree	Disagree	Agree	Strongly agree
Frequency	0	1	18	30
Percent	0	2	37	61
Student-Centered				
	Strongly Disagree	Disagree	Agree	Strongly agree
Frequency	0	0	14	36
Percent	0	0	28	72
Satisfaction of Knowledge				
	Strongly Disagree	Disagree	Agree	Strongly agree
Frequency	0	1	14	36
Percent	0	2	28	70

data is a three-stage approach where 'making the text manageable' involves explicitly stating research concerns and selecting relevant text for analysis; hearing what was said involves grouping together related passages and organizing repeating ideas into coherent categories; and developing theory involves grouping themes into more abstract concepts then creating a theoretical narrative that tells the participants' stories (Auerbach & Silverstein, 2003).

RESULTS

Research Question 1

Question one investigated special education preservice teacher's perceptions of flipped instruction in an educator preparation program.

- To assess course time organization, preservice teachers were asked about their preferred learning style. Half of the participants (50%) reported a preference for 50% lecture/50% interactive courses, and 68% felt their flipped course consisted of this combination.
- To assess preservice teachers' perception of course rigor, they were asked about the amount of preparation time spent each week, in which 72% reported they felt prepared to discuss course content with others.
- When asked about content knowledge gained, 54% reported their content knowledge was better than basic, and 30% felt it was strong enough to teach to others.
- Preservice teachers were asked about active engagement within the course to develop a deeper understanding of the content. To this point, 96% agreed or strongly agreed that the course engaged them in thought-provoking conversations and useful hands-on activities.
- Lastly, 100% agreed or strongly agreed that the course provided a student-centered learning environment, and 98% reported satisfaction with the knowledge gained from the course.

By evaluating preservice teachers' responses to these questions, research question number one was answered for the researchers. The majority of preservice teachers felt the pre-course assignments prepared them for class, the content knowledge obtained through the course was, at minimum, better than basic, and perceived the course to be student-centered.

Table 3. **Descriptive Statistics for Variables**				
	Variable	***N***	***M***	***SD***
Q2	Preparation time	50	2.72	.78
Q3	Feeling Prepared	50	4.08	.82
Q4	This course was	50	3.18	.70
Q6	My preference is	50	3.2	.73
Q5	Amount of Preparation	50	2.64	.63
Q7	Content Knowledge	50	3.14	.67
Q8	Engagement	50	4.57	.61
Q9	Student Centered	50	4.72	.45
Q11	Satisfaction of Knowledge	50	4.66	.59

Key:
Q2: Minutes per week spent preparing for class prior to arrival.
Q3: Feeling prepared at the beginning of class.
Q5: I prepared enough to get by or well enough to teach the content.
Q6: Preferred teaching style (lecture vs. hands-on)
Q8: Course felt like a student-centered environment.
Q9: Course was thought-provoking and hands-on.

Research Question 2

Question two evaluated which variables predict special education preservice teachers' perceived content knowledge. The study included standard multiple regression analysis of preservice teacher responses obtained from the post-course survey. The

dependent variable was perceived content knowledge, and the predictors analyzed were (a) preference for instructional method, (b) feeling of being prepared to discuss content, (c) perceived engagement in thought provoking conversations and useful hands-on activities, (d) degree to which course was student-centered, (e) preference and (f) satisfaction of knowledge gained.

A multiple linear regression was calculated to predict the impact of the six previously described variables on preservice teachers' perceived content knowledge. The model accounts for 54.8% of the variance (see Table 4). The F-value (3.006) is higher than the p-value (0.16) indicating that the terms used improved the fit (see Table 5). Therefore, the one-way ANOVA was conducted and is provided in Table 6. This answered research question number two and revealed that preservice teacher engagement was the only significant predictor of preservice teachers' perceived content knowledge, (β = .505, b=.541, p = .001).

***Table 4.* Model Summary**

Model	*R*	*R2*	Adjusted *R2*	Mean Square	Std. Error of the Estimate
1	Regression	.548a	.300	.201	.58709

Predictors (Constant), Q2, Q3, Q5, Q6,Q8, Q9

***Table 5.* Results of ANOVA, Simple Regression Analysis**

Model		Sum of Squares	*df*	Mean Square	*F*	Sig.
1	Regression	6.217	6	1.036	3.006	.016 b
	Residual	14.476	42	.345		
	Total	20.694	48			

Dependent variable: Q7 (content knowledge). Predictors: Q2, 3, 5, 6, 8, 9

***Table 6.* Standard Multiple Regression of Specific Variables on Student's Self-Reported Q7: Content Knowledge**

Q#	Variable Summary	*t*	*B*	β	*p*-value
Q2	Preparation time in minutes	-.075	-.008	-.010	.940
Q3	Prepared at start of class	1.173	.126	.158	.247
Q5	Confidence in knowledge	.239	.033	.032	.813
Q6	Preference	3.406	.541	.505	.001*
Q8	Engagement	.365	.079	.054	.717
Q9	Student centered	-1.426	-.171	-.192	.161

** p < 0.01*

Research Question 3

The third question examined descriptive statistics in the Special Education Math Methods Spring 2021 course to identify which activities preservice teachers perceived to be most valuable. Information describing means and standards deviations for each component is summarized in Table 7. The data indicates that participants reported the *hands-on* component most often with a mean of 9.30 and standard deviation of 1.21. Class held *face-to-face* (as opposed to *Zoom*) and interactive assignments outside on the lawn were the second and third highest rated items with means of 8.85 and 8.8 and standard deviations of 1.66 and 1.74, respectively. *Flip Grid* and *Zoom* were the two lowest rated items with means of 5.60 and 5.80 and standard deviations of 3.17 and 2.63, respectively.

***Table 7.* Specific Components that Contributed to Content Knowledge**

	N	Min	Max	Mean	*SD*
Hands-On	20	6	10	9.30	1.21
Outside	20	5	10	8.80	1.74
Perusall	20	1	10	6.70	2.83
Nearpod	19	1	10	6.84	2.79
Zoom	20	1	10	5.80	2.63
Face 2 Face	20	5	10	8.85	1.66
Digital Badges	20	0	10	6.95	3.59
In Class	20	2	10	7.10	2.71
Flip Grid	20	0	10	5.60	3.17
Khan Academy	20	2	10	6.65	3.31

Note:A mean score of 10.0 = extremely effective; 7.0 = very effective; 5.0 = moderately effective; 3.0 = slightly effective; 0.00 not effective at all.

Research Question 4

The fourth research question addressed which specific components contributed to preservice teachers' learning and was assessed via two open-ended questions. These questions were (1) what components of this course were most helpful to you as a learner and (2) invited preservice teachers to share any additional comments.

In the first open-ended question, out of 50 possible responses, 37 preservice teachers responded and their comments were analyzed (see Table 8). In the second open-ended question, 12 preservice teachers responded and also investigated (See Table 9). In total, 49 responses were analyzed.

Each of the open-ended responses for question one was deemed a relevant passage and thus included in the analysis. The coding of each response and subsequent grouping of related passages produced several repeating ideas of what preservice teachers felt was most helpful in the course. These repeating ideas were grouped into five categories: the hands-on nature of the course, teacher attributes, course structure and pedagogy, real world skill development, and assignments. Analyzing and interpreting the relationships between these categories, we theorized three major themes emanating from the responses.

According to our findings, there were three areas that were most helpful. Pedagogical aspects of the course were expressed in comments like "*I loved the flipped instruction*", "*the hands-on activities were the most beneficial*", and "*the 50-50 lecture versus group work*". The acquisition of practical skills that would be used in the real world was also seen to be helpful to preservice teachers. Statements such as, "*understanding how to write IEPs*'" and "*being able to actually give the assessments in class*" were examples of useful tools that preservice teachers benefited from learning and applying in the course. There were also personal characteristics of the instructor that preservice teachers noted as helpful in their learning. Particularly, preservice teachers made note of the commitment the teacher made to their learning by pointing out that the instructor "*was always helpful*", and "*went above and beyond every class*" and appreciating "*the way she broke everything down*". Taken together, our analysis of preservice teacher responses to question one revealed that the most helpful components of the course was a balanced mixture of the pedagogical, practical, and personal.

For question two a similar process was undertaken. While the total number of responses provided for question two was much smaller than question one (12 and 37 respectively), mean-

ingful findings still emerged. While question one asked about the specific components of the course preservice teachers deemed most helpful, question two on the other hand asked for any comments in general preservice teachers would like to make. Interestingly, our thematizing of question two responses revealed themes similar to those revealed in question one. Nine of the 12 responses naturally fit within the pedagogical, practical, and personal themes that emerged in question one. For example, the additional comments provided for question two that were pedagogical in nature referenced how preservice teachers "*loved the way the course was organized and taught*", "*enjoyed the flipped instruction*", and thought "*the digital badges were really cool*". Additional comments referring to practical aspects of the course were found in offerings such as "*I really enjoyed this class and learning more about how to teach math ot [sic] my students*" and additional comments related to personal characteristics of the teacher were found in comments like "*great professor*", "*best teacher*", and "*you are an awesome teacher. So glad I have you again*".

To ensure qualitative rigor, researcher triangulation was employed as a means of assuring the quality of our findings. To do so, a second researcher conducted a separate analysis of the responses to questions one and two then engaged in quantitizing the frequency of recurring themes found in their analysis (see table 10). As seen from the table, the independent thematic findings of both researchers proved to be nearly identical and thus strengthened the qualitative findings of this study.

Table 8. **Responses to First Open-Ended Question**	
Spring 2021, Math Methods in Special Education	
Student 2	Hands-on activities and interactive assignments
Student 3	I think this class was helpful because <teacher> was always helpful when I had a question and always allowed us to do hands on activities when we could.
Student 4	The Khan Academy I really liked, it helped me feel a lot more confident about my math ability.
Student 7	The course was very engaging.
Student 8	I loved how interactive this course was this semester! Being engaged in class is so big and actually be excited to learn the material each week is a big deal as well, especially when getting into your major level classes. This class was fun and full of material that was well organized and clearly presented.
Student 10	The weekly assignments
Student 11	Doing the presentations and PowerPoints. It forced me to go more in depth with the information to be able to know what to talk about when presenting.
Student 12	I think the component that were the most helpful to myself as a learner was the Khan Academy assignments and the notebook checks. I think that kept me engaged and learning throughout the semester.
Student 13	I felt like the in class sessions where we got to work hands on were very helpful. I liked using manipulatives.
Student 14	Flipped instruction
Student 15	I liked the fact that <teacher>went above and beyond every class. She switched it up. We did class online, outside, and in the classroom.
Student 16	Doing a lot of hands on activities in the classroom and out of the classroom.
Student 17	The components that were helpful as a learner to me was learn variety of different strategies to use in the classroom.
Student 18	I think that the component that was most helpful was the Khan Academy assignments.
Student 19	Hands-on components and the overall learning environment.
Student 20	Hands-on activity, weekly assignments
Fall 2020, Assessment in Special Education	
Student 22	I really enjoyed the flipped instruction and the hands on activities during class to help my understanding
Student 23	Flipped instruction and the class discussions
Student 25	Actually looking at the tests <assessment protocols> and giving them to each other
Student 26	The way she broke everything down
Student 28	Different strategies I can use, better. Look at standards
Student 29	The professor was very helpful
Student 30	The hands-on approach
Student 31	Being interactive
Student 33	The 50-50 lecture versus groupwork
Student 34	The notes before each class period and the group projects
Student 36	The hands on activities were the most beneficial to me during this course.
Student 38	The interactive activities allowed me to put my knowledge into use
Student 39	Understanding how to write IEPs
Student 40	The flipped instruction
Student 41	I loved the flip instruction
Spring 2020, Assessment in Special Education	
Student 42	I really loved how hands on this class was. Being able to participate in my learning instead of simply sitting in class listening to lectures I feel like I was truly able to understand the content.
Student 43	Learning about the tests (assessment protocols) given
Student 44	The portfolio and interactive activities
Student 45	Being able to actually give the assessments in class. I feel like my first time in my job will not be as overwhelming.
Student 46	Just how helpful the teacher was to explain things to use or help us when we needed help. I also like how it was half lecture and half interactive. And it wasn't that many outside assignments!
Note: If a student did not respond, the entry was omitted. Additionally, if a student mentioned the course instructor by name, brackets and the word 'teacher' was inserted (e.g. <teacher>).	

Table 9. **Responses to the Second Open-Ended Question**	
Spring 2021, Math Methods in Special Education	
Student 3	I really enjoyed this class and learning more about how to teach math to my future preservice teachers.
Student 4	The digital badges were really cool, however I would start doing them maybe the first or second week of class, because I didn't really take it seriously till I got the first digital badge, then I was like, wow this is cool!
Student 11	I feel many people did not complete Kahn correctly, I would suggest not forcing hour a week
Fall 2020, Assessment in Special Education	
Student 22	Honestly, your class was great. I just had a very rough semester last year due to personal issues so I wasn't able to dedicate myself fully too the class. However, you are an incredible teacher, and I loved attending it.
Student 26	You are an awesome teacher. So glad I have you again.
Student 27	Great professor
Student 31	I wouldn't change any thing about this course
Student 32	Loved the way the course was organized and taught
Student 37	I enjoyed the flipped instruction.
Spring 2020, Assessment in Special Education	
Student 44	I was unsure how to answer one of the questions in this survey about what percentage of lecture vs interactive I prefer a course have. Typically, for core classes at least, I would prefer lecture, like in a history course or math but in some types of courses interactive is better, with some notable examples being assessment in SPED, methods courses, and SPED procedures.
Student 46	Just that it was great :)
Note: If a student did not respond, the entry was omitted. Additionally, if a student mentioned the course instructor by name, brackets and the word 'teacher' was inserted (e.g. <teacher>).	

Table 10. **Recurring Themes**		
Descriptions	**Q1 or Q2**	**Total**
Ability to administer test protocols in class prior to focus student	Q1	3
Engaging/interactive course	Q1	6
Flipped instruction	Q1	9*
	Q2	
Hands-on	Q1	10*
Helpful teacher	Q1	6
	Q2	
Khan Academy	Q1	3
Learn a variety of strategies	Q1	2
Well-organized/clearly presented	Q1	2

DISCUSSION

Siegfried Engelmann reminds educators that simply because we teach does not mean students learn (NIFDI, 2015). As teachers, it is important that we continually seek the most effective method to reach our current students. This is equally important in higher education as we are challenged to seek and maintain teachers, especially in the high-needs field of special education. The instructor in this study began this project to address students' discontentment with the instructional delivery method and to make adjustments that would better serve incoming preservice teachers. Through survey, research, and collaboration the instructor determined the flipped instruction model would better serve future special education preservice teachers. Data were collected and indicate *student engagement* significantly impacts preservice teachers' perception of the content knowledge gained. This study extends current research by identifying specific components within the flipped instruction model that influence preservice teachers' perceptions of effective instruction (Killian & Woods, 2018; O'Flaherty & Phillips, 2015; Sun & Xie, 2020; Thongmak, 2019; Yough et al., 2019; Zheng et al., 2020). The two open-ended survey questions provide additional insight into which components were most engaging. The qualitative outcomes support the quantitative findings which include (a) the flipped instruction model and (b) hands-on activities.

The Spring 2021 survey was adapted to analyze the specific components preservice teachers felt contributed to their understanding of the content. These participants reported having additional time in class to engage in experiential learning opportunities contributed most to their content knowledge. Based on the number of course objectives and the amount of time in class, the inclusion of additional hands-on activities would have only been possible through this model.

With a mean of 6.7, which falls between 'very effective' (7.0) and moderately effective (5.0), preservice teachers indicated *Perusall* was not the most significant factor that contributed to their content knowledge. However, this tool allowed class time to be spent participating in activities they did feel contributed most to their learning, such as "*having class outside on the lawn"*. This activity involved class time spent in pairs practicing administering a standardized assessment measure to each other, prior to administering this assessment tool to their focus learner in their field placement. Due to the amount of time student-centered activities often involve, these opportunities would not have been possible without this model.

LIMITATIONS AND FUTURE DIRECTIONS

Special education preservice teachers' responses regarding the flipped instruction model indicate that *hands-on* time was significant to their motivation, but the specific activities that were most effective need to be further examined. Also, the sample size in this study is relatively small, therefore, this study should be expanded to include a more robust set of special education preservice teachers before generalizing the findings.

Additionally, although the flipped instruction model was reported to improve content knowledge in the three courses described in this study, these subjects easily lend themselves to experiential learning. For example, flipped instruction allowed time in assessment class to develop instructional supports for K-12 students described in a given case study. In Math Methods, preservice teachers were able to practice research-based math strategies with classmates before applying them in their field placement. These types of activities might not be conducive to all courses.

Other limitations within this study involve the narrow scope of the demographic makeup within these courses. Most of the preservice teachers were Gen-Z aged (82%), female (94%) and Caucasian (92%) with relatively high GPAs (3.47), who described themselves as very comfortable with the university's LMS system (3.42/4.0) and have participated in at least one other flipped instruction course prior to this. A very different makeup within a course might render different results.

Going forward, targeted measurement of specific components within a flipped course would provide researchers with a better understanding of the active learning techniques that most contribute to preservice teachers' understanding. Within those measurements, analysis of minute aspects within a course might also indicate more significance. For example, do preservice teachers feel working in pairs is more effective than working in small or large groups, or are impromptu, spontaneous class conversations that address specific issues that arise more valuable than contrived teacher-guided discussion activities? Do preservice teachers value administering assessment protocols to each other more or less than administering them to individual students within their field placement? Are pre-determined math activities as effective as allowing preservice teachers space to explore, experiment and collaborate with each other? Do preservice teachers feel they learn better from peer presentations or the instructor presenting content? And specifically, during a period of a pandemic, when absenteeism and health issues cause excessive absences and the need for variable class schedules, such as face-to-face time and virtual, synchronous class time, is a flipped instruction model the best choice or would a more flexible, blended approach be more effective? Finally, do course test scores verify preservice teachers' reported sense of content mastery? Each of these areas should be examined in future research.

CONCLUSION

This study investigated the effectiveness of a flipped instruction model in three courses, two sections of *Assessment in Special Education* and one section of *Math Methods in Special Education and* provide evidence regarding preservice teachers' perception of engagement and content knowledge acquisition. Through the completion of pre-class asynchronous assignments, students were afforded more in-class time for the pedagogical practice of course content. With special education continuing to be a high-needs field, and best practices indicating that student-centered learning is more motivating for students, these three courses incorporated a flipped approach with enhanced educational technology tools. This worked to ensure the special education preservice teachers who enter these programs are more likely to exit with the necessary skills to educate and motivate the future students they will support in the K-12 realm.

REFERENCES

Auerbach, C., & Silverstein, L. B. (2003). *Qualitative data: An introduction to coding and analysis, volume 21*. NYU Press.

Clark, R., Kaw, A., Lou, Y., Scott, A., Besterfield-Sacre, M. (2018). Evaluating blended and flipped instruction in numerical methods at multiple engineering schools. *International Journal for the Scholarship of Teaching and Learning, 12*(1), 1-16. https://doi.org/10.20429/ijsotl.2018.120111

Carver-Tomas, D., & Darling-Hammond, L. (2017). Teacher turnover: Why it matters and what we can do about it. Learning Policy Institute.

Dewey, J., Sindelar, P. T., Bettini, E., Boe, E. E. Rosenberg, M. S., & Leko, C. (2017). Explaining the decline in special education teacher employment from 2005 to 2012. *Exceptional Children, 83*(3) 315-329. https://doi.org/10.1177/0014402916684620

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences, 111*(23), 1-6.

Gomez-Lanier, L. (2018). Building collaboration in the flipped classroom: A case study. *International Journal for the Scholarship of Teaching and Learning, 12*(2), 1-9. https://doi.org/10.20429/ijsotl.2018.120207

Graziano, K. J. (2017). Peer teaching in a flipped teacher education classroom. *TechTrends, 61*, 121-129.

Hamdan, N., McKnight, P., McKnight, K., & Arfstrom, K. (2013). *The flipped learning model: A white paper based on the literature review titled a review of flipped learning*. Flipped Learning Network. https://flippedlearning.org/wp-content/uploads/2016/07/WhitePaper_FlippedLearning.pdf

Hamilton, E. R., Rosenberg, J. M. & Akcaoglu, M. (2016). The substitution augmentation modification redefinition (SAMR) model: A critical review and suggestions for its use. *TechTrends* 60, 433–44. https://doi.org/10.1007/s11528-016-0091-y

He, W., Holton, A., Gu, M. W., Farkas, G. (2019). Differentiated impact of flipped instruction: When would flipped instruction work or falter? *International Journal of Teaching and Learning in Higher Education, (31)*1, 32-49.

Holdheide, L., & Demonte, J. (2016). Critical shortages in special education teachers: Sound familiar? https://www.air.org/resource/blog-post/critical-shortages-special-education-teachers-sound-familiar

Individuals with Disabilities Education Act, 20 U.S.C. § 1400 (2004).

Johnston, V., & Martelli, C. D. (2017). Flipped learning: Student perceptions and achievement in teacher education. *Teacher Education and Practice, 30*(4), 581-600.

Kaczorowski, T. L., Kroesch, A. M., White, M., & Lanning, B. (2019). Utilizing a flipped learning model to support special educators' mathematical knowledge for teaching. The *Journal of Special Education Apprenticeship, 8*(2), 1-15.

Killian, C. M., & Woods, A. M. (2018). Expanding learning opportunities in kinesiology through the use of flipped instruction. *Kinesiology Review, 7*, 332-338. https://doi.org/10.1123/kr.2018-0046

Koehler, M. J., Mishra, P., Kereluik, K., Shin, T. S., & Graham, C. R. (2014). The technological pedagogical content knowledge framework. In J. M. Spector, M.D. Merrill, J. Elen, & M. J. Bishop (Eds.), *Handbook of Research on Educational Communications and Technology* (4th ed., Vol 13, p. 260-263). Springer. https://doi.org/10.1007/978-1-4614-3185-5

Lee, J., Lim, C., & Kim, H. (2017). Development of an instructional design model for flipped learning in higher education. *Educational Technology Research and Development, 65,* 427-453. https://doi.org/10.1007/s11423-016-9502-1

Lukoff, B. (2015) *Perusall, LLC.* Brookline, MA. https://perusall.com/

Luo, L., Kiewra, K., Flanigan, A. E., & Peteranetz, M. S. (2018). Laptop versus longhand note taking: Effects on lecture notes and achievement. *Instructional Science*, 46(6), 947–971. https://doi.org/10.1007/s11251-018-9458-0

Mishra, P., & Koehler, M. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017-1054.

Mueller, P. A., & Oppenheimer, D. M. (2014). The pen is mightier than the keyboard: Advantages of longhand over laptop note taking. *Psychological Science*, 25, 1159–1168. https://doi.org/10.1177/0956797614524581

Mueller, P. A., & Oppenheimer, D. M. (2018). Corrigendum to: The pen is mightier than the keyboard: Advantages of longhand over laptop note taking *Psychological Science*, 29(9), 1565–1568. https://doi.org/10.1177/0956797618781773

NIFDI (2015). National institute for direct instruction: The gold standard in direct instruction. https://www.nifdi.org/84-bios/338-zig-engelmann

Newman, G., Kim, J., Lee, R. J., Brown, B. A., & Huston, S. (2016). The perceived effects of flipped teaching on knowledge acquisition. *The Journal of Effective Teaching, (16)*1, 52-71.

O'Flaherty, J., & Phillips, C. (2015). The use of flipped classrooms in higher education: A scoping review. *Internet and Higher Education, 25,* 85-95. https://dx.doi.org/10/1016.j.ihed-uc.2015.02.002

Onodipe, G., Robbins, M., Ayuninjam, G., Howse, T., Cottrell-Yongye, A., & Curry-Savage, J. (2020). Growth of pedagogical practice in an active multidisciplinary FLC on flipped instruction. *International Journal for the Scholarship of Teaching and Learning, 14*(2), 1-5. http://doi.org/10.20429/ijsotl.2020.140202

Schmitz, K., (2019). Quality or quantity: Completion rewards and formative assessments in flipped instruction classes. *International Journal for the Scholarship of Teaching and Learning, 13*(3), 1-8. http://doi.org/10.20429/ijsotl.2019.130304

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *American Educational Research Association, 15*(2), 4-14. https://doi.org/10.1017/CBO9781107415324.004

Sindelar, P. T. (2019). Special education teacher shortages. Paper presented at the annual Council for Exceptional Children Day on the Hill event, Arlington, VA.

Sun, Z., & Xie, K. (2020). How do preservice teachers prepare in the pre-class setting of a flipped undergraduate math course? A latent profile analysis of learning behavior and the impact of achievement goals. *The Internet and Higher Education, 46,* 1-13. https://doi.org/10.1016/j.ihed-uc.2020.100731

Tunjera, N., & Chigona, A. (2020). Teacher educators' appropriation of TPACK-SAMR models for 21st century preservice teacher preparation. *International Journal of Information and Communication Technology Education, 16*(3), 126-139.

Thongmak, M. (2019). The student experience of student-centered learning methods: Comparing gamification and flipped classroom. *Education for Information, 35,* 99-127. DOI 10.3233/EFI-180189.

U. S. Department of Education (2021). *Teacher Shortage Areas (TSA).* https://tsa.ed.gov/#/home/

Walvoord, B. E., & Anderson, V. J. (2011). *Effective grading: A tool for learning and assessmentin college*. John Wiley & Sons.

Weimer, M. (2016, March 9). *Active learning: In need of deeper exploration.* Faculty Focus: Higher Ed Teaching Strategies from Magna Publications.http://www.facultyfocus.com/articles/teaching-professor-blog/active-learning-in-need-of-deeper-exploration/

Yough, M., Merzdorf, H. E., Fedesco, H. N., & Cho, H. J. (2019). Flipping the classroom in teacher education: Implications for motivation and learning. *Journal of Teacher Education, 70*(5), 410-422. DOI: 10.1177/0022487117742885.

Zainuddin, Z., Haruna, H., Xiuhan, L., Zhang, Y., & Kai Wah Chu, S. (2020). A systematic review of flipped classroom empirical evidence from different fields: What are the gaps and future trends? *On the Horizon, 27*(2), 72-86. DOI: 10.1108/0TH-09-2018-0027

Zheng, X., Johnson, T. E., & Zhou, C. (2020). A pilot study examining the impact of collaborative mind mapping strategy in a flipped classroom: Learning achievement, self-efficacy, motivation, and preservice teachers' acceptance. *Educational Technology Research and Development, 68,* 3527-3545. https://doi.org/10.1007/s11423-020-09868-0