2023 Annual Conference & Exposition
Baltimore Convention Center, MD | June 25 - 28, 2023

The Harbor of Engineering
Education for 130 Years

ASEE

Paper ID #37248

Exploring Transformative Learning from a Summer Bridge Program

Ms. Sukeerti Shandliya, University of Cincinnati

Sukeerti Shandliya is a doctoral student in Engineering and Computing Education and a GRA in the Department of Engineering and Computing Education at the University of Cincinnati. Her research interests include engineering workforce development, DEI in STEM, experiential learning, development of global competencies and cultural competencies in higher education and the workforce. She has completed her bachelor's in Electronics and Communications Engineering from Banasthali University, India, and has an MBA from NIT Trichy, India.

Mr. Gibin Raju, University of Cincinnati

Gibin Raju is a second-year doctoral student pursuing Engineering Education in the Department of Engineering and Computing Education at the College of Engineering and Applied Sciences. His research interests are focused on spatial skills, cognitive stress, cognitive load, stem accessibility issues, workforce development, engineering pathways, STEM education, ID/ODD, and education practices.

Dr. So Yoon Yoon, University of Cincinnati

So Yoon Yoon, Ph.D., is an assistant professor of the Department of Engineering Education in the College of Engineering and Applied Science (CEAS) at the University of Cincinnati. She received her Ph.D. in Gifted Education, and an M.S.Ed. in Research Methods and Measurement with a specialization in Educational Psychology, both from Purdue University, IN, in the United States. She also holds an M.S. in Astronomy and Astrophysics and a B.S. in Astronomy and Meteorology from Kyungpook National University, South Korea. Her work centers on engineering education research as a psychometrician, program evaluator, and data analyst, with research interests in spatial ability, creativity, engineering-integrated STEM education, and meta-analysis. As a psychometrician, she has revised, developed, and validated more than 10 instruments beneficial for STEM education practice and research. She has authored/co-authored more than 70 peer-reviewed journal articles and conference proceedings and served as a journal reviewer in engineering education, STEM education, and educational psychology. She has also served as a co-PI, an external evaluator, or an advisory board member on several NSF-funded projects.

Dr. Cedrick Kwuimy, University of Cincinnati

Dr. Kwuimy is currently an Assistant Professor - Educator in the Department of Engineering & COmputing Education - CEAS at the University of Cincinnati. He graduated from the University of Yaounde 1 in Cameroon with a focus on applied nonlinear dynamics and applied physics. Prior to joining the University of Cincinnati, Dr. Kwuimy was Research Fellow at the African Institute for Mathematical Sciences (AIMS) in South Africa, and at the Villanova Center for Analytics of Dynamic Systems (VCADS) in PA. Dr. Kwuimy is research in engineering education aims to support students journey through transformative learning experiences.

Exploring Transformative Learning from a Summer Bridge Program

Exploring Transformative Learning from a Summer Bridge Program

Abstract

Summer bridge programs are designed to increase students' academic readiness and promote their social integration into college. Transformative learning experiences have the potential to support these outcomes. This paper uses Mezirow's Transformative Learning Theory to explore the extent to which summer bridge programs are transformative. Data were collected from a cohort of 30 incoming first-year engineering students who participated in summer 2022 at a Midwestern public university. The findings show that transformative learning was evident during the program. Using transformative learning outcomes as an indicator of effectiveness in summer bridge programs is beneficial because they provide *in-situ* assessment factors, unlike the current *ex post facto* assessment methods. This approach would be beneficial for the current cohort of summer bridge participants instead of just improving future programs.

Keywords: *Summer bridge programs, transformative learning*

Introduction

Over the past decades, many colleges and universities have been struggling with student attrition and have been working to develop programs to improve students' retention. Studies indicate that students who do not persist in college have a higher tendency to drop out of college by the end of their first year [1]. During the last fifty years, nearly half of all students who entered a two- or four-year university withdrew without obtaining a degree [2]. The high drop-out rate is attributable to a lack of academic and social integration, and institutional factors [1]. Researchers have developed summer bridge programs to strengthen retention and persistence among first-year engineering students.

Summer bridge programs occur during the summer preceding students' first semester of college and typically last about 4-7 weeks. There is a major gap in how the outcomes of the summer bridge programs are assessed or evaluated. These outcomes are generally assessed using self-reported data on participants' perceived levels of academic preparation and post-participation performance during the first and second semesters in college [3]. An unaddressed issue is the non-consideration of the overall students' experience, and the lack of in-situ feedback to better support students throughout the program. This traditional approach to assessing summer bridge program outcomes hides the impact of personal and inhibiting institutional factors on students' experience in summer bridge programs [3] [4]. Hence, this approach informs mainly the structuration of the program for future cohorts.

Mezirow's Transformative Learning Theory offers a framework to assess students' journey through the summer bridge program and provide *in-situ* feedback to better support participants throughout the program. *In-situ* feedback refers to feedback that is collected and provided in real-time, within the actual learning environment. To operationalize the Mezirow theory for summer bridge programs, it is crucial to explore the nature of the transformative potential of summer bridge programs. Mezirow's theoretical framework of transformative learning theory

suggests that learning outcomes could be met by igniting students' revision of their frame of reference. Students' frame of reference encompasses their habits of mind, cognitive, and emotional components, and is shaped by the student's life experiences and prior experiences, schooling, personal interest, and influences of socializers [5]. It can be modified through a transformative learning experience.

Transformative Learning Theory posits that learning occurs when a learner encounters a perspective that challenges a prior frame of reference: learners who are receiving new information are also evaluating their frame of reference [6]. This paper explores the transformative potential of summer bridge programs to inform the consideration of the Mezirow theory as a framework to assess the programs. The research question is as follows: **To what extent are summer bridge programs transformative?**

Literature Review

Summer bridge programs are viewed as significant promoters of student retention and persistence. Tinto described the structure of a college as "bipolar", since it is composed of "distinct academic and social components" [7, p. 105]. Consequently, they considered a student's degree in academic, social, and cultural integration in college as the most important predictor of retention. Considering Tinto's model as a framework to evaluate bridge programs, Quiroz and Garza found that the structure of a successful summer bridge program focuses on four key areas including student's academic preparedness, their emotional quotient, their campus and faculty interaction, and fostering their leadership skills [8]. Conley [9] discussed similar enablers of efficient bridge programs describing a structure that increases the college readiness of students by focusing on essential cognitive strategies, content knowledge, appropriate academic behaviors, college knowledge, and college awareness.

Most of the studies in the literature determine the effectiveness of summer bridge programs by examining first-year college academic outcomes such as retention, performance, and GPA [4] [7] [8] [9]. However, this type of evaluation can only inform practice for future cohorts, but it becomes too late for the ongoing cohort. Additionally, the practice overshadows other key components of summer bridge programs, such as those addressing college knowledge and other noncognitive skills [8] [9]. Moreover, it is not possible to isolate the effect of bridge performance on student GPA and retention without systematically controlling for student motivation, self-efficacy, interest in science, or other variables that might influence performance. Thus, examining the effectiveness of bridge programs solely based on student's academic success, persistence or retention could be insufficient [9]. There exists a need to examine a broader array of student outcomes.

Instead of focusing only on academic outcomes to evaluate the effectiveness of summer bridge programs, we propose to consider an examination based on the transformative nature of the programs in order to provide a holistic view of the effectiveness of the programs. Indeed, the transformative learning theory posits that thought-provoking experiential activities or scenarios (also referred to as "disorienting dilemmas") that challenges students' "meaning perspectives" and "assumptions" lead to the development of new frames of reference through a transformation

of perspectives [6]. Studies have found that these experiential components aid in challenging students' ethnocentric beliefs, habits of mind, and predetermined frames of reference [10] [11].

Mezirow's transformative learning theory offers a framework that enables us to detect the nature and extent of transformative learning that occurs in a summer bridge program. According to the theory, students who are transformed by a learning experience have learned to "negotiate and act on their frame of reference, rather than on those they have uncritically assimilated over the course of years" leading to positive academic outcomes [12]. Conversely, for students who are not transformed, the learning experience barely alters the margins of their frame of reference, leading to transient changes, if it affected them at all [13]. Therefore, the measurement of change in perspectives on account of experiencing transformative learning during bridge programs would help in answering our research question.

Transformative learning is achieved through a ten-stage process that defines the characteristics of transformative learning. The ten-stage process forms the pillars of the Learning Activities Survey developed by King (2006) to assess students' transformative experiences. These ten stages help in understanding the learners' journey of transformation. Table 1 lists the ten stages and the corresponding steps in the Journey of Transformation.

TABLE 1
MEZIROW'S STAGES OF TRANSFORMATION & KING'S JOURNEY OF TRANSFORMATION

Stage	Mezirow's Transformative Learning	Corresponding Steps of the Journey of Transformation
1	A disorienting dilemma	Discontent, i.e., the realization that one's meaning structures are being challenged in a new context
2	Self-examination	
3	A critical assessment of epistemic, sociocultural, or psychic assumptions	Testing & Exploring, i.e., reassessment of values and self-reflection
4	Recognition that one's discontent and the process of transformation are shared and that others have negotiated a similar change	
5	Exploration of options for new roles, relationships, and actions	
6	Planning of a course of action	Affirming & Connecting, i.e., shifted perspective that allows one to cope with those situations more easily in the future
7	Acquisition of knowledge and skills for implementing one's plan	
8	Provisional trying new roles	
9	Building competence and self-confidence in new roles and relationships	
10	A reintegration into one's life on the basis of conditions dictated by one's new perspective	New Perspectives, a shifted perspective that allows one to cope with those situations more easily in the future

Method

The study employed a mixed-method approach to answer the research question. We used concurrent design [14] where the qualitative and quantitative data were collected at the same time through an online survey. The quantitative data are analyzed using a correlation research design. The qualitative data obtained from the open-ended questions were analyzed through content analysis.

Participants and Settings
The data collection for this study took place in 2022 at a Midwestern research R1 institution. A cohort of 30 incoming first-year engineering students participated in a 2022 Summer Bridge Program. It was a seven-week residential program that aims to enhance students' academic preparedness and college integration. Students participate in a series of activities and programs to develop their critical thinking skills and identify their strengths and needed areas of improvement as related to their academic and professional development. The participants were invited via email to complete an online Qualtrics survey at the end of the program. Of the 30 students enrolled, 29 students completed the survey.

Instrument and Open-Ended Questions
The online survey included the Learning Activities Survey (LAS) developed and validated by King [5]. The LAS used in this paper has two sections. The first part of the LAS of quantitative data through 11 Likert-style items (1 = Strongly Disagree to 6 = Strongly Agree) was designed to assess whether students experienced the stages of Mezirow's transformative learning theory and their transformative journey through the learning experience. The items corresponding to each stage of Mezirow's transformative learning are given in Table 2, along with the corresponding step on the journey of transformation.

TABLE 2
ITEMS OF THE STAGES OF MEZIROW'S TRANSFORMATIVE LEARNING

Stage	#	Items of the Stages of Mezirow's Transformative Learning	Corresponding Steps of the Journey of Transformation (JOT)
1	1	During the bridge program, I had an experience that caused me to question the way I normally act.	JOT1: Discontent
	3	During the bridge program, I had an experience that caused me to question my ideas about social roles.	
2	4	As I questioned my ideas through the bridge program, I realized I no longer agreed with my previous beliefs or role expectations.	
3	5	During the bridge program, I realized that other people also questioned their beliefs.	JOT2: Testing & Exploring
4	6	During the bridge program, I thought about acting in a different way from my usual beliefs and roles.	
5	7	During the bridge program, I felt uncomfortable with traditional societal expectations.	
6	8	During the bridge program, I tried out new roles so that I would become more comfortable or confident in them.	JOT3: Affirming & Connecting

7	2	During the bridge program, I tried to figure out a way to adopt these new ways of acting.	
8	9	During the bridge program, I gathered the information I needed to adopt these new ways of acting.	
9	10	During the bridge program, I began to think about the reaction and feedback from my new behavior.	
10	11	Through my bridge program I took action and adopted these new ways of acting.	JOT4: New Perspectives

The second part of the LAS is made of 6 open-ended questions corresponding to the nature of transformative learning experience, and the learning components that contributed to it: (i) *During the bridge program, did you experience a situation that changed your beliefs or values? (ii) Do you think that your bridge program changed your expectations in life?(iii) What was the most important thing you learned about the world during this bridge program?(iv) What have you learned about yourself during the bridge program? (v) In what ways do you think that your bridge program impacted your life?(vi) Do you think that your bridge program by its structure and content was adequate to meet your goals?*

The online survey also included two scales. The Transformative Learning readiness (TLR) scale consists of 15 Likert-style items (1 = Strongly Disagree to 6 to Strongly Agree) aimed at evaluating the transformational nature of a learning experience students have been exposed to [15]. The TLR uses items response on a 6 points-Likert scale to rank learning experience in three categories: Transformative, Somewhat Transformative; and Traditional. The Transformative Outcomes and Processes Scale (TROPOS) consists of 30 items on a 6-point Likert scale (1 = Strongly Disagree to 6 to Strongly Agree) and is aimed at assessing the overall transformative learning of the students. The TROPOS consists of four constructs - social support, attitude towards uncertainty, criticality, and outcomes; it has a reliability coefficient of Cronbach's α = .884 [16]. The last part of the survey consists of demographic data: sex, gender, race, and ethnicity, and included the international status of the participants, their routes to college, and whether they are first-generation students.

Results

Participants
The demographic data collected is collated and presented in Table 3. As can be seen from the table, there were 7 female participants, 20 male participants, and 2 LGBTQ participants. Most of the students participating in the survey were from under-represented minority groups since the summer bridge programs target these students' participation. With most students of non-Hispanic origin, there were 15 black or African American students, 6 multiracial, 1 Asian, and 5 white students. There were only 4 international student participants, and most of them were domestic students. Only two students had a different route to college. The rest of the 27 students were planning to join college without any delay after completing high school. The sample also included 6 first-generation students, meaning that none of their parents ever enrolled in post-secondary education, such as two-year or four-year.

Table 3
Demographic Characteristics of the 2022 Summer Bridge Program

Demographics	Choices	n
Gender	Females	7
	Males	20
	Transgender	1
	Gender Non-Conforming	1
Hispanic	Hispanic	5
	Non-Hispanic	24
Ethnicity	Asian	1
	Black or African American	15
	White	5
	Multiracial	6
	Other	2
International Status	International Students	4
	Domestic Students	25
Route to College	Direct from high school without any delay	27
	Working for a year or more before college	1
	Other	1
First Generation Student	Yes	6
	No	23
Total		29

Quantitative Data

Out of the 11 items of the Learning Activities Survey, item 2 (During the bridge program, I tried to figure out a way to adopt these new ways of acting) for Stage 7 received the most positive responses with respondents recording "agree". The most negative responses were recorded for item 4 (As I questioned my ideas through the bridge program, I realized I no longer agreed with my previous beliefs or role expectations). Item 2 corresponds to stage 7 of Mezirow's transformative learning theory associated with the third step of the Journey of Transformation referred as "Affirming & Connecting", whereas item 4 corresponds to stage 2, associated with the first step of the Journey of Transformation referred to as "Discontent". Students mostly recorded "slightly agree" on the rest of the items, corresponding to the other seven stages of Mezirow's transformative learning such as "critical assessment", "exploring new actions and plans", "integration of new perspectives", etc.

TABLE 4
SUMMARY STATISTICS OF LEARNING ACTIVITIES INSTRUMENT

	Mezirow's Stages of Transformative Learning							Journey of Transformation		
	Total		Male		Female			Total	Male	Female
Stage	($n = 27$)		($n = 20$)		($n = 7$)		Step	($n = 27$)	($n = 20$)	($n = 7$)
	M	SD	M	SD	M	SD		M	M	M
1	3.21	1.04	3.31	1.08	2.94	0.97	JOT 1	2.80	2.93	2.46
2	2.44	1.32	2.59	1.33	2.06	1.25				
3	3.32	1.15	3.28	1.10	3.46	1.38	JOT2	2.89	2.86	2.97
4	2.66	1.45	2.68	1.43	2.60	1.63				
5	2.74	1.37	2.67	1.41	2.92	1.34				
6	3.82	1.00	3.65	1.04	4.36	0.79	JOT3	4.01	4.01	4.03
7	4.30	0.93	3.99	1.09	3.95	1.21				
8	3.92	1.07	4.42	0.82	3.70	1.07				
9	4.03	1.04	4.00	1.04	4.11	1.11				
10	3.96	0.92	3.95	0.89	3.99	1.07	JOT4	3.96	3.95	3.99

The percentile distribution of transformative learning readiness (TLR) scores of students ($n = 29$) is presented below in Table 5. The mean of the scores for all the 29 students was found to be 60.62 with a standard deviation of 6.43. Gender wise mean TLR scores are also shown in Table 5.

TABLE 5
TRANSFORMATIVE LEARNING READINESS (TLR)

| Frequency | | | Descriptive Statistics | | | | | |
| | | | Total ($n = 29$) | | Male ($n = 20$) | | Female ($n=7$) | |
Percentile	TLR Score	Frequency ($n = 29$)	M	SD	M	SD	M	SD
0-25	47-56	7						
26-74	59-61	10	60.62	6.43	60.68	5.83	59.55	9.14
75-100	62-76	12						

Analysis of the TROPOS scores indicated that most students responded positively with respect to all four constructs of the TROPOS scale. However, the social support construct gathered the most positive responses, as shown in Table 6.

TABLE 6
SUMMARY STATISTICS OF TROPOS INSTRUMENT

TROPOS Constructs	Total (n = 27)		Male (n = 20)		Female (n = 7)	
	M	SD	M	SD	M	SD
Social Support	4.57	0.71	4.65	0.63	4.35	0.95
Attitude Toward Uncertainty	3.92	0.36	3.95	0.40	3.83	0.20
Criticality	3.76	0.73	3.69	0.76	3.96	0.64
Transformative Outcomes	3.49	0.75	3.52	0.82	3.39	0.53

The spearman correlation between the TLR scores with the TROPOS scores is shown in Table 7. It is inferred from the analysis that students' TLR scores are positively moderately correlated with their total TROPOS scores, $r(29) = 0.376$, $p = 0.045$. The TLR scores were only highly positively correlated with the social support construct of the TROPOS scale, $r(29) = 0.481$, $p = 0.008$.

TABLE 7
CORRELATION BETWEEN TRANSFORMATIVE LEARNING READINESS AND
TRANSFORMATIVE OUTCOMES

	Total TROPOS	TROPOS Social Support	TROPOS Attitude toward Uncertainty	TROPOS Criticality	TROPOS Transformative Outcomes
Total TLR	0.376[*]	0.481[**]	0.0286	0.138	0.138

Note. $^{**}p < 0.01$; $^{*}p < 0.05$

Qualitative Phase
During the bridge program, did you experience a situation that changed your beliefs or values?
Among the 29 participants, 8 students confirmed that they have experienced changes in their values and belief systems because of the summer bridge program. Students majorly characterized such situations as arising out of academic construct, where they felt discomfort due to encountering difficulties in dealing with the college curriculum. A common theme emerged comprising of a specific disorienting dilemma, which was the "realization of academic unpreparedness".

Do you think that your bridge program changed your expectations in life?
Among all the 29 students participating in the summer bridge, 19 students agreed to changes in their expectations of life because of the summer bridge program. Most students discussed their changes in expectations from college life regarding its challenges and opportunities. Some students also noted their changes in expectations from future job roles.

What was the most important thing you learned about the world during this bridge program?
While answering about what was the most important thing they learned about the world, students majorly presented an optimistic and enthusiastic worldview and commented on the significance of inculcating qualities such as perseverance, self-dependence, motivation, and cooperation. Two students pointed out their realization regarding the significance of having a positive attitude

toward uncertain and ambiguous situations. However, a few students provided critical worldviews too describing their world as being "unfair" and "difficult".

What have you learned about yourself during the bridge program?
While answering about what the students learned about themselves during summer bridge, two major themes that emerged were learning about their personal behaviors and awareness about their learning habits. They talked about the inadequacy of their current study habits and their need to explore more efficient learning strategies. Most of the students talked about discovering what type of learners they are, and what kinds of metacognitive approaches they have. Other students took this as an opportunity to reflect on their personal and interpersonal qualities and shortcomings.

In what ways do you think that your bridge program impacted your life?
While answering about what the impact of the summer bridge program was on the student's life, the majority of the students admitted that the program helped them in their transition from high school to college and increased their college preparedness. Many students regarded summer bridge as a crucial opportunity to "make lifelong friends", develop important life skills such as "networking", and increase their sense of "inclusivity and acceptance" towards others. Also, few students perceived that attending the summer bridge program gave them a competitive advantage in terms of employment opportunities.

Do you think that your bridge program by its structure and content was adequate to meet your goals?
Fifteen students agreed that the content and structure of the summer bridge program were adequate to meet their goals. 51% of respondents were satisfied with the program structure and 49% were unsatisfied with the overall quality of the program.

The open-ended data analysis provided evidence corresponding to all ten stages of Mezirow's Transformation, as presented in Table 8.

TABLE 8
MAJOR INSTANCES OF EACH MEZIROW'S STAGE IN THE JOURNAL OF TRANSFORMATION

Stage	Action	Major Instance
Discontent	Disorienting Dilemma	*Something I could do without studying in high school I couldn't do here and that forced me to figure out how to get it done.*
	Self- Examination	*...it made me realize that I am not that smart and that I have to better myself.*
Testing & Exploring	Critical Assessment of Assumptions	*I originally thought college would be easier but now I realize it is going to be a challenge.*
	Recognition that others shared a similar transformation	*Everyone coming into stem was one of the smarter kids in their schools. You just start from scratch when you get here and any preconceived notions are null and void.*

	Exploration of new actions and roles	*I did not do too well in my physics class, And I found out I need to study way more.,*
Affirming & Connecting	Development of an action plan	*...To get and learn the material I had to manage my time extremely well.,.*
	Acquisition of skills and knowledge for implementing the action plan	*...am starting to develop good habits that will benefit me in school and in life. And also, networking., ...I gained skills and habits essential for college I didn't previously have.*
	Implementing the plan	*I study better with mnemonic devices and practice problems as opposed to anything else*
	Development of self-confidence and competence in new roles	*I'm more confident in my work*
New Perspectives	Reintegration into life based on new perspectives	*I will not know how this has impacted my life till probably a year after*

Discussion

From the analysis of the student responses, it is evident that some students underwent transformational learning during the summer bridge program. Most students talked about their initial assumptions regarding college life and their realization of their own academic and social unpreparedness. They critically reflected on their perspectives about themselves and others. In this process, they became more aware of themselves and accepting and inclusive of others. Even though most of them considered the overall experience difficult and challenging, especially academically, it is interesting to note that most of them recorded optimistic and enthusiastic statements about their college and career journey.

Apart from open-ended questions, the learning activity survey also comprised mostly positively inclined responses. This proves that students encountered enough transformative learning experiences during the program. However, the study did not collect information explicitly on the type of learning activities and degree of experiential components presented in the methods of instruction that the bridge program used. Studies have found that these experiential components aid in challenging students' ethnocentric beliefs, habits of mind, and predetermined frames of reference [10] [11]. This could have helped in understanding the dissatisfaction of the students regarding the content and structure of the program. Furthermore, since the sample size was small, the generalization of obtained result is another major limitation.

The positive correlation between transformative learning readiness and transformative learning outcomes suggests that students with high transformative readiness might be (a) more successful in their social integration, (b) more confident in stepping out of their comfort zones, (c) fosters higher critical thinking skills, and (d) be a more open-minded and inclusive person. As such, transformative learning readiness could be considered an important student characteristic to consider while determining the effectiveness of a summer bridge program, thus, improving the retention of first-year students.

Conclusion

Summer Bridge Programs participants are recruited from a diverse range of prior experiences, familial and cultural values, as well as unique career and educational aspirations and motivations. By acknowledging and incorporating these varied backgrounds, the transformative learning framework accounted for the distinct experiences of these participants. Given the limitation of the current practices and ex post facto assessment methods, transformative learning could be a viable alternative to design and assess Summer Bridge Programs.

Transformative learning outcomes have a great long-term impact on learners. Using transformative learning outcomes as an indicator of the effectiveness of summer bridge programs can aid in integrating both the academic and the social components of a summer bridge program's structure, necessary for achieving a successful college transition and long-term student retention. Indeed, as stated by Mezirow, a transformative summer bridge program would break from emphasizing the completion of tasks (informative learning) in lieu of reflective dialogue (transformative learning). Such dialogue triggers critical discourse, giving new insight into intrinsic understanding by revising students' frames of reference [12].

Acknowledgments

References

[1] V. Tinto, " Taking Retention Seriously: Rethinking the First Year of College," NACADA Journal, vol. 19, no. 2, pp. 5-9, 1999.

[2] National Center for Education Statistics, "Undergraduation graduation rates," U.S. Department of Education, 2022. [Online]. Available: https://nces.ed.gov/fastfacts/display.asp?id=40. [Accessed February 2023].

[3] "Education Advisory Board," 2016.

[4] B. Grace-Odeleye and J. Santiago, "A review of some diverse models of summer bridge programs for first-generation and at-risk college students," Administrative Issues Journal: Connecting Education, Practice, and Research, vol. 9, no. 1, pp. 35-57, 2019.

[5] K. P. King, The handbook of the evolving research of transformative learning: Based on the Learning Activities Survey, IAP, 2009.

[6] J. Mezirow, "A transformation theory of adult learning," in Adult Education Research Annual Conference Proceedings., 1993.

[7] A. Gonzalez Quiroz and N. R. Garza, "Focus on student success: Components for effective summer bridge programs," Journal of Hispanic Higher Education 17.2, vol. 17, no. 2, pp. 101-111, 2018.

[8] J. R. Sablan, " The challenge of summer bridge programs," American Behavioral Scientist 58.8 , pp. 1035-1050, 2014.

[9] B. C. Bradford, M. E. Beier and F. L. Oswald, "A meta-analysis of university STEM summer bridge program effectiveness," CBE—Life Sciences Education, vol. 20, no. 2, pp. 1-14, 2021.

[10] H. L. Bell, H. J. Gibson, M. A. Tarrant, L. G. P. III and L. Stoner, "Transformational learning through study abroad: US students' reflections on learning about sustainability in the South Pacific," Leisure Studies 35.4, vol. 35, no. 4, pp. 389-405, 2016.

[11] T. M. Chiang and J. F. Yao, "Transformative Learning Experiences through Short-term Study Abroad programs," Journal of Transformative Learning, vol. 7, no. 1, p. 3, 2020.

[12] J. Mezirow, Learning as Transformation: Critical Perspectives on a Theory in Progress, 350 Sansome Way, San Francisco, CA 94104: . The Jossey-Bass Higher and Adult Education Series. Jossey-Bass Publishers, 2000.

[13] D. T. K. Tien, S. N. Namasivayam and L. S. Ponniah, "A review of transformative learning theory with regards to its potential application in engineering education," in AIP Conference Proceedings, Selangor Darul Ehsan, Malaysia, 2019.

[14] J. W. Creswell and V. L. P. Clark, Designing and Conducting Mixed Methods Research, Thousand Oaks, CA: SAGE Publications, Inc, 2017.

[15] C. Halupa, "Are students and faculty ready for transformative learning," Learning, design, and technology: An international compendium of theory, research, practice and policy, 2017.

[16] R. C. Cox, " Grounding Transformative Learning Through Assessment: TROPOS (TRansformative Outcomes and PrOcesses S cale)," Journal of Transformative Education, vol. 19, no. 4, pp. 383-399, 2021.

[17] S. Andrew and E. J. Halcomb, Mixed Methods Research for Nursing and the Health Sciences, Germany: Wiley, 2009.

[18] T. E. Gutierrez, "The value of pre-freshmen support systems: The impact of a summer bridge program at UNM.," 2007.

[19] V. Tinto, "Leaving college: Rethinking the causes and cures of student attrition," University of Chicago press, p. 105, 2012.

[20] D. T. Conley, "Rethinking college readiness," New directions for higher education, pp. 3-13, 2008.