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Learning Styles and Student Engagement: Towards a Personalized Instruction Program

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Abstract: This study evaluated the relationship between learning styles and student engagement among undergraduate students at a university in Tianjin, in order to provide improvement plans. The researchers used modified or adjusted questionnaires on learning styles and student engagement. The first questionnaire used the Learning Style Scale. It is based on the experiential theory and learning model established by Kolb in 1984. Fusion, divergence, assimilation, and adaptive learning styles are all used as useful self-assessment tools, with the advantage that they can be completed in just 30-45 minutes. The second adjusted questionnaire is the Student Participation and Satisfaction Questionnaire (SESQ). Due to the recognition of the concept of student participation by many experts, some of them have developed a survey questionnaire to address this issue. In this study, only factors indicating student participation index, namely emotions, cognition, and behavior, were considered. The participants in this study are undergraduate students from Tianjin University. They are randomly selected from a population, regardless of age, gender, grade, and university affiliation, and come from engineering, business, humanities, law, and medicine. The proposed personalized teaching plan aims to address the different learning styles and participation levels of student groups. Based on these findings, the researchers concluded that when considering factors such as gender, grade, and university relationships, this study found no significant differences in students' self-evaluation of learning styles. However, significant differences have emerged in the context of different styles. Among the three areas of participation, cognitive participation is the most prominent among students, followed by behavioral participation. There is a moderate and statistically significant correlation between the learning styles (convergence, divergence, assimilation, and adaptation) of student respondents and their levels of cognitive, emotional, and behavioral participation. This means that students' learning styles may be influenced to some extent by their level of participation. Based on the conclusions drawn from this study and recommendations made

Keywords: Leaning Styles; Student Engagement; Personalized Instruction.

1. Introduction

Numerous studies contend that in addition to the course structure, the students' learning styles and their level of engagement also play a big role in how successful and efficient their professional abilities are. Learning styles affect how well we learn under certain conditions. Students have different learning styles. They preferentially focus on different types of information, tend to operate on perceived information in different ways, and achieve understanding at different rates. The learning styles model developed by David Kolb, who initially presented his theory in 1984, is one of many concepts that have evolved to explain how students prefer to learn best. The level of a student's direct involvement in a learning experience is referred to as engagement. It is a multidimensional entity made up of a number of separate yet closely linked task or domain engagement components. Throughout the educational pursuits of students, many have had a teacher from whom it was difficult to learn. It may have been trouble understanding an educational subject that did not particularly correspond with a student's personality, or it may have been a learning style issue. (Hammond, 2020). The mistaken assumption that every student in a particular class is performing at the same level cognitively, affectively and behaviorally, and that they all require the same things has been the foundation of the "one-size-fits-all" approach of traditional teaching. As a consequence, a lot of students are disengaged, dissatisfied, or unable to access the lesson. Everybody learns best in their own unique way. There's a good chance that each student in every class prefers a different learning style, which might make it challenging for many teachers to be the most effective ones, who can actually keep their students' engaged. Based on the researcher's observations, it is time to take the necessary steps to make sure that educational institutions can reach all students, regardless of where they are or where they wish to go. Teachers should be aware that not all students learn in the exact same way, which is why they should consider creating personalized instructional strategies.

2. Literature Review and Conceptual Framework

2.1. Learning Styles Theory

In 1984, David Kolb's experiential learning cycle theory led to the development of his learning styles model. These theories mostly concern one's own internal cognitive processes. According to Kolb's four-stage experiential learning cycle hypothesis, successful learning happens through a cycle of experiencing, reflecting, thinking, and acting. In his Learning Styles theory, Kolb identifies four different learning styles. Based on their inner cognitive makeup, social influences, and educational history, people tend to favor pa reticular learning style.

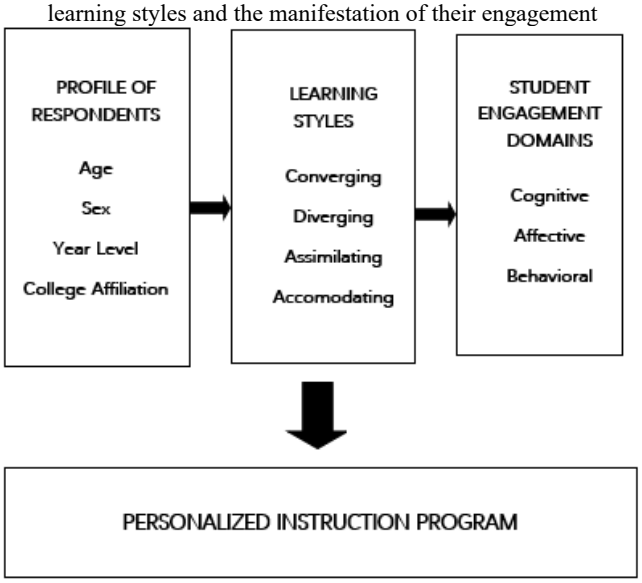
2.2. Theory of Constructivism

The significance of student engagement is also in line with learning theory, practice, and especially as they promote the advantages of actively using the resources provided for learning. Learning actively interacting with the content has its roots in Constructivism. One of the main theories of learning is constructivism deriving from psychology that tries to way

individuals discover. The theory's etymology is its central tenet, that learning occurs through building understanding and meaning from their encounters with the world.

Constructivism is largely connected with Dewey, Piaget, and Vygotsky. Dewey, for instance, discussed an "active learner" who makes sense of the environment via sensory stimuli. The learner is not a passive agent; rather, learning occurs when the learner actively interacts with the outside world. Students may learn from straight lectures, which is significant. There is a time and place for these, so they don't need to be fully removed. After all, pupils can deliberately try to create learning while taking in a lecture. Another learning theory that emphasizes the value of student engagement is Kolb's concept of experiential learning. According to experiential learning theory, experiences are what motivate learning. A person's thoughts and understanding of the world around them are formed and reformed by the experiences they have in it.

Table 1. The evaluations of the respondents regarding their learning styles and the manifestation of their engagement



2.3. Personalized Instruction Program

As depicted in the figure above, the evaluations of the student respondents regarding their learning styles and the manifestation of their engagement were examined.

The student respondents assessed their learning styles using the variables of converging, diverging, assimilating, and accommodating. Meanwhile, the evaluation of their engagement manifestation was substantiated across cognitive, affective, and behavioral domains.

Furthermore, a comparison was made between the learning styles and engagement manifestation of the student respondents and their profiles to detect any noteworthy distinctions. Ultimately, the researcher determined whether a meaningful correlation existed between the students' learning styles and their engagement. Consequently, this study proposed the implementation of a personalized instructional program.

2.4. Learning Style

A student's method of learning is referred to as their learning style. A person's preferred method of information intake, processing, comprehension, and retention is referred to as their learning style. The learning styles of David Kolb are the main topic of this paper. The four distinct learning styles identified by Kolb's learning theory are converging, diverging, assimilating, and accommodating.

2.4.1. Converging

This learning style emphasizes problem solving as a method of instruction. Those with this preferred learning method are capable of making choices and applying their ideas to novel situations. Convergers like a few different teaching methods, including as computer-based projects, interactive exercises, and workbooks or worksheets with problem sets.

2.4.2. Diverging

This method of learning employs a unique and imaginative strategy. People frequently evaluate concrete events from different angles rather than analyzing them in light of the activities made. They care about other people and cherish feelings. Those who favor this learning method frequently take pleasure in activities like idea-generating and teamwork. Divergers favor a few different teaching methods, such as practical exercises, the chance to investigate, and the traditional teacher-class lecture that emphasizes both the advantages and disadvantages of a system.

2.4.3. Assimilating

Reasoning is emphasized in this learning technique. Those that exhibit this learning style can review the information and evaluate the event as a whole. They frequently take pleasure in planning experiments and completing undertakings from beginning to end. Assimilators favor a few different teaching methods, such as independent, prepared exercises that the student can complete without the teacher present, the traditional teacher-class lecture supported by an audio or video presentation, and private exploration or demonstration that comes after a tutorial with provided answers.

2.4.4. Accommodating

This learning style is adaptable and intuitive. These individuals use trial and error to guide their experiences, preferring to discover the answers for themselves. They are able to alter their path based on the circumstance and generally have good people skills. There are a few instructional techniques that Accommodators prefer: Activities that allow them to be actively engaged, Exploration and instructor support for deeper questioning, such as "what if?" or "why not?" and Tasks that promote independent discovery

2.5. Student Engagement

Student engagement in this study relates to how attentive, curious, interested, upbeat, and passionate students are when learning or being taught, as well as how motivated they are to study and advance in their education. The idea of "student engagement" is generally based on the idea that learning is generally better when students are inquisitive, enthusiastic, or motivated, and that learning generally diminishes when students are uninterested, disinterested, disillusioned, or otherwise "disengaged."

2.5.1. Cognitive Engagement

The term "cognitive engagement" refers to "mental effort and thinking tactics," which can include using learning techniques and overcoming obstacles. While shallow cognitive engagement involves more rote memory and other techniques that engage the new material in more superficial ways, deep cognitive engagement involves elaboration processes

2.5.2. Affective Engagement

The aspect of learner engagement that deals with people's emotional reactions to learning is frequently referred to as "emotional engagement." The value that peoples attribute to finishing a task is another factor that affective involvement is related to. A task may have intrinsic value if it is fun to perform, valuable in the long run, or crucial (attainment value).

2.5.3. Behavioral Engagement

The acts and conduct people engage in while learning—behaviors that may aid or obstruct learning—is known as behavioral engagement. While several academics have identified various behaviors as indicators of engagement, this one appears particularly pertinent for workplace elearning.

3. Methodology

The design of this study is primarily correlational, comparative, and descriptive. A correlational study looks for connections between variables and forecasts the future using the information gathered. The Learning Style Inventory will be used to assess the learning styles of the student respondents using a random sampling technique. On the other side, a test based on the Student Engagement Theory will be used to analyze their engagement manifestations. The researcher will look at the crucial link between learning styles and student engagement. In order to ensure that the study will examine the relationship between the research factors, quantitative survey methodologies will be applied when evaluation the data collected from the questionnaires.

The research subjects are students from a university in Tianjin and will be randomly selected as the research subjects. 149 participants will be selected from 15000 students with a confidence level of 95% and an error margin of 8%, determined by the Qualtrics calculator. Many resources claim that at a 95% confidence level, the allowable error margin is usually between 4% and 8%. Although obtaining a small margin of error is crucial, obtaining a sample that absolutely represents the 149 target respondents is the researchers' guarantee.

They will be randomly selected from the population, regardless of age, gender, grade, and university affiliation, from engineering, business, humanities, law, and medicine.

In addition, convenient sampling will also be used. This non probabilistic sampling method selects sample units based on how easily researchers can reach them. The researcher graduated from Tianjin University. Given that students have access to school administrators, they are currently the most likely to participate in research.

In order to evaluate learning style and student engagement, the questionnaire on learning style and participation will be modified or adjusted. The learning style checklist serves as the basis for the first part of the questionnaire (LSI). Fusion, divergence, assimilation, and adaptation of learning styles are all useful self-assessment tools that can be completed in just 30-45 minutes. It will reveal to us the learning methods we enjoy in daily life. The researchers modified five (5) questions from each dimension.

The next adjusted questionnaire is the Student Participation and Satisfaction Questionnaire (SESQ). Experts from approximately 19 different countries collaborated to create SESQ. SESQ is a 109 item, self-

The Likert format report questionnaire can be completed using paper and pencil, aiming to provide a detailed evaluation of the structure of student participation.

Due to the recognition of the concept of student engagement by many experts, some of them subsequently developed a questionnaire to address this issue. For the purpose of this study, only factors that indicate student engagement indicators, namely emotions, cognition, and behavior, will be considered.

The following statistical analyses will be applied to the data to be collected in the study using the Statistical Package for Social Sciences (SPSS) software at the 0.05 level of significance:

1.Frequency Count and Percentage. This dataset will be used in the researcher's analyses of the student respondents' age, sex, age, year level and college affiliation.

2.Weighted Mean, The researcher will first utilize this to examine how the student respondents characterized their learning styles as converging, diverging, assimilating, and accommodating. Second, the researcher will utilize this to assess the engagement of the student respondents in terms of cognitive, affective, and behavioral aspects.

3.T-test / ANOVA. To determine if there are any significant differences between the learning styles and student engagement as assessed by student respondents when their profiles are taken into consideration, the researcher will use the T-test and/or Analysis of Variance or F-test.

4.Pearson’s r Correlation Analysis. The researcher will use Pearson’s r correlation analysis to determine the significant relationship between the student respondents’ learning styles and student engagement.

The 0.05 standard of significance will be used for the analysis of the hypotheses. If the computed significant level is higher than the threshold value of 0.05, the null hypotheses will be confirmed. Results otherwise will be rejected.

4. Result

Table 2. Frequency Distribution of the Respondents’ Profile

Profile	Frequency	Percentage
Age		
18-20 years old	127	67.6%
21-23 years old	58	30.9%
24 years old & above	3	1.6%
Total	188	100%
Sex		
Male	102	54.3%
Female	86	45.7%
Total	188	100%
Year Level		
Freshmen	45	23.9%
Sophomore	82	43.6%
Junior	29	15.4%
Senior	32	17.0%
Total	188	100%
College Affiliation		
School of Engineering	58	30.9%
School of Business	31	16.5%
School of Humanities	53	28.2%
School of Law	18	9.6%
School of Medicine	28	14.9%
Total	**188**	**100%**

Table 3. Student Respondents' Assessment on their Learning in Terms of Converging

Converging I learn most by	Mean	SD	Qualitative Description	Interpretation	Ranking
discovering, testing, and trying new things.	3.20	0.71	Agree	Highly Manifested	2
quick decision making.	2.93	0.84	Agree	Highly Manifested	5
searching for one correct answer.	3.25	0.71	Agree	Highly Manifested	1
independent work.	3.14	0.81	Agree	Highly Manifested	3
reflecting on my own.	3.09	0.43	Agree	Highly Manifested	4
Composite Mean	3.12	0.74	Agree	Highly Manifested	

Table 4. Student Respondents' Assessment on their Learning in Terms of Diverging

Diverging I learn most by. . . .	Mean	SD	Qualitative Description	Interpretation	Ranking
looking into the big picture.	3.11	0.74	Agree	Highly Manifested	1
relying on feelings.	2.77	0.94	Agree	Highly Manifested	5
preferring personal interaction.	2.87	0.80	Agree	Highly Manifested	4
group discussion.	2.88	0.90	Agree	Highly Manifested	3
peer reviews.	3.02	0.73	Agree	Highly Manifested	2
Composite Mean	2.93	0.49	Agree	Highly Manifested	

Table 5. Student Respondents' Assessment on their Learning in Terms of Assimilating

Assimilating I learn most by.	Mean	SD	Qualitative Description	Interpretation	Ranking
using critical thinking.	3.08	0.76	Agree	Highly Manifested	2
analyzing, organizing and sorting.	3.05	0.71	Agree	Highly Manifested	3.5
evaluating pros and cons.	3.10	0.75	Agree	Highly Manifested	1
listening to lectures.	2.81	0.90	Agree	Highly Manifested	5
using logical and detailed thinking.	3.05	0.78	Agree	Highly Manifested	3.5
Composite Mean	3.02	0.47	Agree	Highly Manifested	

Table 6. Student Respondents' Assessment on their Learning in Terms of Accommodating

Accommodating I learn most by.	Mean	SD	Qualitative Description	Interpretation	Ranking
problem solving.	3.03	0.72	Agree	Highly Manifested	3
taking risks.	3.09	0.78	Agree	Highly Manifested	2
exploring.	3.12	0.78	Agree	Highly Manifested	1
synthesing information.	3.01	0.73	Agree	Highly Manifested	4
communicating concept to others.	2.91	0.77	Agree	Highly Manifested	5
Composite Mean	3.03	0.46	Agree	Highly Manifested	

Table 7. Summary of the Student Respondents' Assessment on their Learning

Learning Style	Mean	SD	Qualitative Description	Interpretation	Ranking
1.Converging	3.12	0.43	Agree	Highly Manifested	1
2.Diverging	2.93	0.49	Agree	Highly Manifested	4
3.Assimilating	3.02	0.47	Agree	Highly Manifested	3
4.Accommodating	3.03	0.46	Agree	Highly Manifested	2
Over-all Mean	3.02	0.35	Agree	Highly Manifested	

Table 8. Differences in the Assessment of Student Respondents on their Learning Styles when their Age is Taken as Test Factor

Learning Styles	Age	Mean	SD	Computed F-value	Sig	Decision on Ho	Interpretation
Converging	18-20 y/o	3.11	0.42	1.46	0.24	Accepted	Not Significant
	21-23 y/o	3.13	0.47				
	24 y/o & above	3.53	0.12				
Diverging	18-20 y/o	2.94	0.49	3.35	0.04	Rejected	Significant
	21-23 y/o	2.87	0.46				
	24 y/o & above	3.60	0.40				
Assimilating	18-20 y/o	3.02	0.45	0.42	0.66	Accepted	Not Significant
	21-23 y/o	3.01	0.54				
	24 y/o & above	3.27	0.42				
Accommodating	18-20 y/o	3.01	0.45	1.16	0.32	Accepted	Not Significant
	21-23 y/o	3.06	0.48				
	24 y/o & above	3.40	0.20				
Over-all	18-20 y/o	3.02	0.35	2.31	0.10	Accepted	Not Significant
	21-23 y/o	3.02	0.34				
	24 y/o & above	3.45	0.18				

Table 9. Differences in the Assessment of Student Respondents on their Learning Styles when their Sex is Taken as Test Factor

Learning Styles	Sex	Mean	SD	Computed t-value	Sig	Decision on Ho	Interpretation
Converging	Male	3.10	0.44	-0.56	0.58	Accepted	Not Significant
	Female	3.14	0.43				
Diverging	Male	2.89	0.47	-1.06	0.29	Accepted	Not Significant
	Female	2.97	0.50				
Assimilating	Male	3.04	0.46	0.63	0.53	Accepted	Not Significant
	Female	3.00	0.49				
Accommodating	Male	3.08	0.41	1.68	0.09	Accepted	Not Significant
	Female	2.97	0.51				
Over-all	Male	3.03	0.34	0.22	0.82	Accepted	Not Significant

Table 10. Differences in the Assessment of Student Respondents on their Learning Styles when their Year Level is Taken as Test Factor

Learning Styles	Year Level	Mean	SD	Computed F-value	Sig	Decision on Ho	Interpretation
Converging	Freshmen	3.02	0.42	1.83	0.14	Accepted	Not Significant
	Sophomore	3.15	0.41				
	Junior	3.24	0.32				
	Senior	3.07	0.56				
Diverging	Freshmen	2.86	0.48	0.97	0.41	Accepted	Not Significant
	Sophomore	2.98	0.49				
	Junior	2.98	0.40				
	Senior	2.84	0.54				
Assimilating	Freshmen	2.96	0.40	2.78	0.06	Accepted	Not Significant
	Sophomore	3.05	0.47				
	Junior	3.19	0.39				
	Senior	2.87	0.60				
Accommodating	Freshmen	2.89	0.49	2.46	0.06	Accepted	Not Significant
	Sophomore	3.08	0.43				
	Junior	3.16	0.41				
	Senior	2.99	0.52				
Over-all	Freshmen	2.93	0.33	3.13	0.08	Accepted	Not Significant
	Sophomore	3.06	0.36				
	Junior	3.14	0.26				
	Senior	2.94	0.38				

Table 11. Differences in the Assessment of Student Respondents on their Learning Styles when their College Affiliation is Taken as Test Factor

Learning Styles	College Affiliation	Mean	SD	Computed F-value	Sig	Decision on Ho	Interpretation
Converging	Engineering	3.12	0.50	1.24	0.30	Accepted	Not Significant
	Business	3.25	0.37				
	Humanities	3.10	0.43				
	Law	2.97	0.41				
	Medicine	3.11	0.36				
Diverging	Engineering	2.91	0.50	1.22	0.30	Accepted	Not Significant
	Business	3.08	0.42				
	Humanities	2.85	0.45				
	Law	2.94	0.55				
	Medicine	2.94	0.54				
Assimilating	Engineering	3.02	0.51	0.38	0.83	Accepted	Not Significant
	Business	3.11	0.47				
	Humanities	2.99	0.49				
	Law	2.98	0.45				
	Medicine	3.00	0.41				
Accommodating	Engineering	3.00	0.50	0.58	0.68	Accepted	Not Significant
	Business	3.14	0.42				
	Humanities	3.03	0.44				
	Law	3.00	0.56				
	Medicine	3.00	0.41				
Over-all	Engineering	3.01	0.38	1.19	0.32	Accepted	Not Significant
	Business	3.15	0.33				
	Humanities	2.99	0.31				
	Law	2.97	0.43				
	Medicine	3.01	0.31				

Table 12. Student Respondents' Assessment on their Engagement in Terms of Cognitive

Cognitive Engagement	Mean	SD	Qualitative Description	Interpretation	Ranking
I try to see the similarities and differences between things I am learning for school and things I know already.	3.10	0.69	Agree	Highly Manifested	2.5
I try to understand how the things I learn in school fit together with each other.	3.10	0.64	Agree	Highly Manifested	2.5
I try to match what I already know with things I am trying to learn for school.	3.11	0.71	Agree	Highly Manifested	1
I try to think through topics and decide what I'm supposed to learn from them, rather than studying topics by just reading them over.	3.05	0.71	Agree	Highly Manifested	4
When studying, I try to combine different pieces of information from course material in new ways.	2.99	0.69	Agree	Highly Manifested	5
Composite Mean	3.07	0.43	Agree	Highly Manifested	

Table 13. Student Respondents' Assessment on their Engagement in Terms of Affective

Affective Engagement	Mean	SD	Qualitative Description	Interpretation	Ranking
Most mornings, I look forward to going to school.	2.62	0.87	Agree	Highly Manifested	5
I think what we are learning in school is interesting.	2.93	0.77	Agree	Highly Manifested	4
I enjoy learning new things in class.	3.12	0.71	Agree	Highly Manifested	1
I am happy to be at this school.	3.02	0.80	Agree	Highly Manifested	2
I am proud to be at this school.	2.99	0.76	Agree	Highly Manifested	3
Composite Mean	2.94	0.51	Agree	Highly Manifested	

Table 14. Student Respondents' Assessment on their Engagement in Terms of Behavioral

Behavioral Engagement	Mean	SD	Qualitative Description	Interpretation	Ranking
I try hard to do well in school.	3.15	0.73	Agree	Highly Manifested	2
When I'm in class, I participate in class activities.	2.89	0.80	Agree	Highly Manifested	3
I am an active participant of school activities such as sport day and other school events.	2.73	0.84	Agree	Highly Manifested	5
I take an active role in extracurricular activities in my school.	2.81	0.86	Agree	Highly Manifested	4
When I run into a difficult homework problem, I keep working at it until I think I've solved it.	3.17	0.77	Agree	Highly Manifested	1
Composite Mean	2.95	0.55	Agree	Highly Manifested	

Table 15. Summary of the Student Respondents' Assessment on their Engagement

Domains of Engagement	Mean	SD	Qualitative Description	Interpretation	Ranking
Cognitive Engagement	3.07	0.43	Agree	Highly Manifested	1
Affective Engagement	2.94	0.51	Agree	Highly Manifested	3
Behavioral Engagement	2.95	0.55	Agree	Highly Manifested	2
Over-all Mean	2.98	0.41	Agree	Highly Manifested	

Table 16. Differences in the Assessment of Student Respondents on their Engagement when their Age is Taken as Test Factor

Domains of Engagement	Age	Mean	SD	Computed F-value	Sig	Decision on Ho	Interpretation
Cognitive	18-20 y/o	3.09	0.39	1.70	0.19	Accepted	Not Significant
	21-23 y/o	3.00	0.51				
	24 y/o & above	3.40	0.20				
Affective	18-20 y/o	3.02	0.46	5.07	0.17	Accepted	Not Significant
	21-23 y/o	2.77	0.57				
	24 y/o & above	2.87	0.81				
Behavioral	18-20 y/o	3.01	0.52	2.22	0.11	Accepted	Not Significant
	21-23 y/o	2.82	0.61				
	24 y/o & above	3.00	0.40				
Over-all	18-20 y/o	3.04	0.37	3.83	0.12	Accepted	Not Significant
	21-23 y/o	2.86	0.46				
	24 y/o & above	3.09	0.33				

Table 17. Differences in the Assessment of Student Respondents on their Engagement when their Sex is Taken as Test Factor

Domains of Engagement	Sex	Mean	SD	Computed t-value	Sig	Decision on Ho	Interpretation
Cognitive	Male	3.08	0.42	0.56	0.58	Accepted	Not Significant
	Female	3.05	0.45				
Affective	Male	2.95	0.51	0.23	0.82	Accepted	Not Significant
	Female	2.93	0.51				
Behavioral	Male	2.94	0.54	-0.24	0.81	Accepted	Not Significant
	Female	2.96	0.56				
Over-all	Male	2.99	0.40	0.18	0.86	Accepted	Not Significant
	Female	2.98	0.41				

Table 18. Differences in the Assessment of Student Respondents on their Engagement when their Year Level is Taken as Test Factor

Domains of Engagement	Year Level	Mean	SD	Computed F-value	Sig	Decision on Ho	Interpretation
Cognitive	Freshmen	3.05	0.36	0.76	0.52	Accepted	Not Significant
	Sophomore	3.11	0.41				
	Junior	3.09	0.27				
	Senior	3.18	0.34				
Affective	Freshmen	2.89	0.51	2.49	0.06	Accepted	Not Significant
	Sophomore	3.09	0.41				
	Junior	2.99	0.50				
	Senior	3.10	0.24				
Behavioral	Freshmen	2.88	0.53	2.79	0.07	Accepted	Not Significant
	Sophomore	3.07	0.50				
	Junior	3.07	0.36				
	Senior	3.17	0.23				
Over-all	Freshmen	2.94	0.37	2.97	0.13	Accepted	Not Significant
	Sophomore	3.09	0.36				
	Junior	3.05	0.31				
	Senior	3.15	0.17				

Table 19. Differences in the Assessment of Student Respondents on their Engagement when their College Affiliation is Taken as Test Factor

Domains of Engagement	College Affiliation	Mean	SD	Computed F-value	Sig	Decision on Ho	Interpretation
Cognitive	Engineering	3.14	0.37	0.93	0.45	Accepted	Not Significant
	Business	3.15	0.42				
	Humanities	3.06	0.32				
	Law	3.16	0.36				
	Medicine	3.02	0.39				
Affective	Engineering	2.99	0.50	0.69	0.60	Accepted	Not Significant
	Business	3.13	0.33				
	Humanities	3.00	0.42				
	Law	3.09	0.45				
	Medicine	3.00	0.41				
Behavioral	Engineering	3.05	0.54	1.07	0.37	Accepted	Not Significant
	Business	2.17	0.38				
	Humanities	3.04	0.44				
	Law	2.99	0.37				
	Medicine	2.94	0.44				
Over-all	Engineering	3.06	0.37	1.03	0.40	Accepted	Not Significant
	Business	3.15	0.31				
	Humanities	3.03	0.32				
	Law	3.08	0.31				
	Medicine	2.99	0.33				

Table 20. Relationship Between the Students' Learning Style and their Engagement

Learning Styles	Domains of Engagement	Computed r	Sig	Decision on Ho	Interpretation
Converging	Cognitive	0.33	0.00	Rejected	Significant
	Affective	0.34	0.00	Rejected	Significant
	Behavioral	0.32	0.00	Rejected	Significant
	Average	0.41	0.00	Rejected	Significant
Diverging	Cognitive	0.36	0.00	Rejected	Significant
	Affective	0.33	0.00	Rejected	Significant
	Behavioral	0.39	0.00	Rejected	Significant
	Average	0.43	0.00	Rejected	Significant
Assimilating	Cognitive	0.45	0.00	Rejected	Significant
	Affective	0.39	0.00	Rejected	Significant
	Behavioral	0.34	0.00	Rejected	Significant
	Average	0.49	0.00	Rejected	Significant
Accommodating	Cognitive	0.48	0.00	Rejected	Significant
	Affective	0.43	0.00	Rejected	Significant
	Behavioral	0.40	0.00	Rejected	Significant
	Average	0.44	0.00	Rejected	Significant
Over-all Learning Style	Over-all Engagement	0.46	0.00	Rejected	Significant

5. Summary of Findings

5.1. Profiles of the Respondents

The study revealed that majority of the student respondents are male, within the age group of 18-20 years old, mostly are sophomore from the school of Engineering. The study's conclusions might have greater relevance for students who share characteristics resembling those of the respondents, such as youth, male gender, and sophomore status in an engineering program. Researchers should evaluate whether these findings can be extended to a wider population or if they are specific to this particular group.

5.2. The Student Respondents' Assessment as Regards Their Learning Style

5.2.1. Converging

The result indicates that students' learning style, particularly in terms of converging style, is highly manifested among the student respondents. The students agree that they learn by searching for one correct answer, working independently, reflecting on their own, discovering, testing and trying new things and by quick decision making.

5.2.2. Diverging

The result indicates that students' learning in terms of diverging style is highly manifested based on their own assessment. They agree that they learn by looking into the big picture, having peer reviews, group discussion, preferring personal interaction, and relying on feelings.

5.2.3. Assimilating

Students perceived their learning style in terms of assimilating to be of high extent. They agree that learn by evaluating the pros and cons, using logical, detailed and critical thinking, analyzing, organizing, sorting and listening to lectures. The fact that these preferences are highly manifested suggests that the students strongly believe in the effectiveness of these methods for their learning.

5.2.4. Accommodating

The student respondents strongly agree that they learn best when they explore and synthesize information. As well as, learning by taking risks, problem solving and communicating the concept to others. This means that that the students' strong agreement with both exploration and communicating concepts to others indicates an accommodating learning style.

5.3. The Student Respondents' Assessment as Regards Their Engagement

5.3.1. Cognitive

Students assessed their cognitive engagement to be of high extent. Student respondents agree that they try to match what they already know with things they are trying to learn for school which was given the highest assessment. Likewise, they also agree that when studying they try to combine different pieces of information from course material in new ways. The overall result shows that cognitive engagement is highly manifested among the student respondents based on their own assessment.

5.3.2. Affective

Students assessed their affective engagement to be of high extent. They agree that they enjoy learning new things in class, they are happy and proud to be in their school, they think that what they learn is interesting and they also agree that most mornings, they look forward to going to school. This goes to show that affective engagement is highly manifested among the student respondents based on their own assessment.

5.3.3. Behavioral

Students assessed their behavioral engagement to be of high extent. They agree that that when they run into a difficult homework problem, they keep working at it until they think they've solved it, they try hard to do well in school, participate in class activities, and they take an active role in extracurricular activities such as sports day and other school events. Generally, it is revealed that behavioral engagement is highly manifested among the student respondents based on

their own assessment.

5.3.4. Age

There is no significant difference in the assessment of the respondents when their age is taken as a test factor. This means that student respondents have relatively the same assessment on their student engagement in terms of cognitive, affective and behavioral regardless of their age.

5.3.5. Sex

There is no significant difference in the assessment of the respondents when their sex is taken as a test factor. This means that both male and female student respondents have relatively the same assessment on their student engagement in terms of cognitive, affective and behavioral regardless of their sex.

5.3.6. Year Level

There is no significant difference in the assessment of the respondents when their year level is taken as a test factor. This means student respondents have relatively the same assessment on their student engagement in terms of cognitive, affective and behavioral regardless of their year level.

5.3.7. College Affiliation

There is no significant difference in the assessment of the respondents when their school is taken as a test factor. student respondents have relatively the same assessment on the personality traits of their PE teachers in terms of conscientiousness, agreeableness, neuroticism, openness to experience, and extraversion regardless of their school.

5.3.8. School Affiliation

There is no significant difference in the assessment of the respondents when their school affiliation is taken as a test factor. This means student respondents have relatively the same assessment on their student engagement in terms of cognitive, affective and behavioral engagement regardless of their school affiliation.

Based on the findings, it was observed that the learning styles of the student respondents, categorized into converging, diverging, assimilating, and accommodating styles, demonstrated a moderate and statistically significant correlation with their levels of cognitive, affective, and behavioral engagement. This suggests that the students' learning styles may be influenced to some extent by their levels of engagement.

The phrase implies that a student's degree of participation in their academic pursuits may be influenced by their preferred learning style. In other words, a student's innate tendencies to approach learning and problem-solving might affect how mentally, emotionally, and physically invested they are in their studies.

For instance, a student might be more interested and perform better academically if their learning preferences and the course's instructional strategies and resources are a good fit. In contrast, students may find it difficult to engage with the information if their learning style and the instructional strategy are not compatible.

The consequences of this study for teachers and curriculum developers are significant. It implies that adjusting instruction and materials to accommodate different learning preferences in students'

6. Conclusion

Based on the findings, the following conclusions were arrived at by the researcher:

1. This study conducted a survey involving predominantly male student respondents, typically aged between 18 and 20 years old, with a majority of them being sophomores enrolled in the School of Engineering. The findings of the study may be more applicable to students who have traits similar to those of the respondents, like young adults, male orientation, and sophomore standing in an engineering program;

2. As reported by the student participants, the most commonly identified learning style was the converging style, receiving the highest rating. Following closely, the accommodating style ranked second, while the assimilating style secured the third position. The diverging style was indicated as the least preferred learning style based on the assessments provided by the students. The nature of the courses within the school of Engineering and the teaching methods employed by instructors may be better suited to certain learning styles. If courses emphasize hands-on activities, experimentation, or problem-solving, students with converging and accommodating styles may find these approaches more engaging;

3. This study found no significant difference in students' self-assessment of their learning styles when considering factors such as sex, year level, and college affiliation. However, a notable difference emerged in the context of the diverging style. It was observed that student respondents aged 24 years and above exhibited a higher manifestation of the diverging style compared to those in the age groups of 18-20 years and 21-23 years. This suggests that students' learning styles, particularly in terms of the diverging style, may vary depending on their age;

4. The research findings indicate that among the three domains of engagement, cognitive engagement was highly manifested by the student respondents, followed by behavioral engagement in second place. The fact that cognitive engagement was highly manifested by the student respondents suggests that they are actively involved in the mental aspects of their learning. Engineering students are likely focused on understanding and processing information, which can be a positive sign for their academic success. However, it's important for educators to ensure that this cognitive engagement is channeled effectively toward achieving learning objectives. In contrast, affective engagement was rated the lowest among the three domains based on the students' self-assessment;

5. This study showed no significant difference in the student's assessment of their engagement when their sex, age, year level, and college affiliation were taken as test factors. The lack of significant differences in student engagement based on demographic factors suggests a positive and inclusive educational environment. it's essential for institutions to continuously monitor and assess student engagement over time. Demographic patterns can change, and educational environments can evolve, so ongoing research can help institutions adapt their approaches as needed;

6. In conclusion, the research findings suggest that there is a moderate and statistically significant correlation between the learning styles of the student respondents (converging, diverging, assimilating, and accommodating) and their levels of cognitive, affective, and behavioral engagement. This implies that the student's learning styles may be influenced to some extent by their engagement levels.

7. Recommendations

Based on the conclusions derived from this study, the following are the recommendations:

1) It is recommended that educators should consider the diversity of learning styles among students. While converging and accommodating styles are prevalent, instructors should be flexible in their teaching methods to accommodate students who prefer assimilating or diverging styles. This could involve a mix of hands-on activities, interactive discussions, and independent exploration in the classroom;

2) Understanding that older students tend to exhibit a higher manifestation of the diverging style, educational institutions may explore ways to tailor teaching methods or support for different age groups. This could involve offering more experiential or reflective learning opportunities for older students;

3) Recognizing that cognitive engagement is highly manifested, educators can build upon this strength by designing courses that encourage critical thinking, problem-solving, and deep understanding. Additionally, efforts can be made to enhance affective engagement, which was rated lower. Creating a positive and emotionally engaging learning environment may help boost students' enthusiasm for learning;

4) The finding that no significant differences were observed in students' self-assessment of engagement based on demographic factors like sex, age, year level, or college affiliation suggests that engagement is a universal concern and should be addressed equally for all students. Institutions can prioritize equity in engagement strategies and support services;

5) It is recommended that schools and educators should continually assess and adapt their teaching methods and support services based on students' learning styles and engagement levels. This may involve regular surveys or assessments to gauge student preferences and satisfaction with teaching methods;

6) It is recommended to promote self–awareness in schools. Encouraging students to self-assess their learning styles and engagement levels can be beneficial. This self-awareness can empower students to seek out learning environments and strategies that align with their preferences and strengths;

7) The study's conclusion about the correlation between learning styles and engagement levels suggests the need for further research in this area. Future studies can explore in-depth the specific factors and strategies that influence how learning styles and engagement are related.

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