

Undergraduate Students' Conceptualizations of and Approaches to Learning: Natural, Computational, Health, and Medicine students of Arba Minch University in focus

Tesfaye Habtemariam¹, Abate Demissie¹, Getu Lemma²

¹Arba Minch University, Department of English Language and Literature

²Arba Minch University, Department of Geography and Environmental Studies

Email: tesfaye.habtemariam@amu.edu.et

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Abstract

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Even if the knowledge of students' conceptualizations of and approaches to learning significantly affects tertiary education teachers' choice of teaching methods, there is not much data on these. Hence, this study envisioned studying students' learning approaches and conceptualizations and the relationship between the two in seventeen different undergraduate programs at the College of Natural and Computational Sciences and the College of Health and Medical Sciences of Arba Minch University, Ethiopia. A descriptive quantitative survey design involving N=323 students was employed. The data were collected using the Approaches and Study Skills Inventory for Students (ASSIST). Students' conceptualizations of learning were compared using an independent sample t-test. Similarly, one-way ANOVA and post hoc were used to see differences in the three types of learning approaches. To decide if there is a difference in learning conceptualizations and learning approaches between the health sciences and natural sciences groups, an independent sample t-test was used along with Cohn's d. It was discovered that the students had transforming and reproducing learning conceptualizations. Moreover, the students reported adopting the deep and strategic approaches, equally. It was also found that the correlation between the aggregate conceptualizations and learning approaches was positive and significant. Therefore, teachers should help students develop more of a transformative conception of learning. They may also need to support students in adopting an approach that enhances their deep learning.

Keywords: Learning conceptualizations; learning approaches; health sciences; natural science; deep learning

1. INTRODUCTION

1.1. Learning Conceptualizations of Health and Natural Sciences

Learners' current and lifelong learning is determined by how they conceptualize learning during their university education. The students' learning conception is the lens through which students view how learning happens which in turn determines their choice of strategies for learning (Gezahegn & Shewangezaw, 2022). In line with this, studies confirmed that students with the lower-order conception of mastering view learning as a passive endeavor while those with a higher-order concept notice it as an active process (Duff & McKinstry, 2006; Biggs 2003). Learning approaches on the other hand are how individuals perceive and process information (Biggs, 2003). Accordingly, students who adopt a surface approach focus on facts and emphasize rote learning and memorization techniques (Biggs, 2003) to avoid failure. Conversely, students who adopt a deep approach center on meanings and understanding (Biggs, 2003), can organize ideas and be able to recall and apply easily the ideas or knowledge they have acquired into practice (Entwistle et al., 2000). On the other hand, students who adopt a strategic approach to learning apply a deep or surface approach to maximize their grades and excel in others through the appropriate use of study skills and cue-seeking behavior (Entwistle et al., 2000; Entwistle & Peterson, 2004). Hence, the tertiary education teachers do not get data-driven knowledge of their students' conceptualization of learning; they may not properly guide their students' learning.

Säljö (1979) has discovered five categories of conceptualizing learning. These include learning as an increase in knowledge, memorizing, acquisition of facts and procedures, abstraction of meaning, and interpretative process (Säljö's 1979). Gedamu et al. (2020) argue that the "quantitative" and the "qualitative" views of learning could generally represent most people's learning conceptualizations. In learning health and related sciences, the learning process becomes more desirable than the content to be learned (McLean, 2001). Hence, transformative (qualitative) learning conceptualizations seem to be especially more important than a reproductive (quantitative) conception in such a context. However, the argument of a desirable learning conception for science can be misleading because the learning conceptualizations seem to depend on the context of learning (Biggs et al., 2001). Lin & Tsai (2008) and Virtanen & Lindblom-Ylänne (2010) found that students in different educational contexts expressed quite different learning conceptualizations. Extending the issues of cross-cultural differences in

learning patterns, Marambe et al. (2012) found big differences in student learning patterns between students from Asian countries and European countries. Nevertheless, no significant differences were observed in the students' learning conceptualizations and approaches among students at the College of Social and Behavioral Sciences on the one hand and at the College of Business and Economics of Arba Minch University, Ethiopia on the other (Gedamu et al., 2020 & 2022). An extensive discussion of related empirical studies is made below to extend this discussion.

Purdie & Hattie (2002) in their study on learning conceptualizations in groups of students from Australia, Malaysia, and America found that the students had six learning conceptualizations, categorized into two qualitatively different conceptualizations; surface and deep. Virtanen & Lindblom-Ylänne (2010) conducting a study on Public University students' and teachers' conceptualizations of teaching and learning in the biosciences at the University of Helsinki, discovered that teachers and students differ in their conception with students tending to focus on quantitative conception. In connection to this, Sadlo and Richardson (2003) found that students who worked on problem-based curricula were more likely to adopt an orientation to the meaning of their course materials (i.e., a deep conception) than were students who studied on subject-based curricula.

These studies indicated that other factors can affect learning conceptualizations in addition to the cultural contexts (these are, the curricula and the teachers). However, the study done by Purdie & Hattie (2002) showed that there was little support for the existence of the two qualitatively different conceptualizations that are commonly identified as surface conception and deep conception. In the same way, other than the six conception indicators revealed by previous studies (Eklund-Myrskog, 1998; Marshall et al., 1999; Marton et al., 1993). Tsai (2004) found two new categories, 'testing' and 'calculating' in the domain of science. Yet, studies generally claim that learning conceptualizations are context-dependent (Biggs, 2003, Tsai, 2004, Wong et al., 2021).

Despite the inconclusive results elsewhere, little is known about how students of health and natural sciences conceptualize learning in Ethiopia. Hence, medicine, natural sciences, and other

health students may conceptualize learning differently because of the peculiarities of the fields. Yet, they may also converge in their conceptualizations as all their fields fall under the umbrella of natural sciences as opposed to social sciences. Thus, the current comparative and aggregation study seems important.

Yet, studying the students' learning conceptualizations alone can be misleading as the approach to learning is equally important. According to Dart et al. (2000) and Duff et al. (2002), the students' learning approaches are powerful in shaping the quality of their learning. There are three well-known approaches namely surface, strategic, and deep approaches (Biggs, 1987; Entwistle & McCune, 2004; Entwistle & Ramsden, 1983; Prosser & Trigwell, 1999; Ramsden 2003). Entwistle et al., (2001) and Prosser & Trigwell (1999) state that, the student intends to look for meanings and the big picture in the deep approach. Conversely, adopters of the surface approach to learning tend to apply strategies such as rote memorizing and reproducing (Entwistle & McCune, 2004; Prosser & Trigwell, 1999). Entwistle & McCune (2004) mention another approach to learning named the strategic approach which refers to the ability to manage time and effort.

There are some empirical studies on learning approaches as well. Cebeci, et al. (2013) in their study of learning approaches employed by law and medical students found that both medical and law students preferred strategic and deep approaches to surface approaches. Equally, Shaaria et al. (2012) investigated the learning approach among 354 postgraduate students in Malaysia. The result showed that the students applied the deep approach dominantly. Likewise, Senemglu (2011) found that American and Turkish students liked deep and strategic approaches. Similarly, Zakaria et al. (2018) studying medical undergraduates' approach to learning found that most students preferred the deep approach and the strategic approach. Recently, Piumatti et al. (2021) rather studied trajectories of learning approaches of medical students and discovered two longitudinal trajectories that are surface-oriented with higher and increasing levels of surface approach and lower and decreasing levels of deep approach. Alkhateeb and Milhem (2020) studied students' learning conceptualizations and approaches at a university in Jordan and found that the quantitative concepts were dominating among students but the qualitative concepts of learning were low.

In a context similar to this study, Gedamu et al. (2020 & 2022) came up with two different findings with the differences in the group they studied. Hence, we observe that learning conceptualizations and approaches have been the focus of many studies in several disciplines but with inconclusive findings. This might be because of the differences in the disciplines covered. Hence, the health and natural sciences students may show differences in their learning conceptualizations and approaches to learning. Therefore, assessing these in different fields of study and contexts seems vital.

Regarding the relationship between learning conceptualizations and approaches, several studies showed that deep conceptualizations are related to deep approaches (Dart, et al., 2000; Edmunds & Richardson, 2009; Ferla, et al., 2008; Umapathy, et al., 2019). Yet, our knowledge of the relationships between students' learning conceptualizations and approaches in the natural and health sciences of the Ethiopian higher education context is limited.

In summary, some of the studies reviewed above are made in differing contexts and fields of study to the current study. Some of the others studied either learning conception or approach separately while others concentrated on one or two fields. Moreover, none of the studies compared learning conceptualizations and approaches in several fields of the health and natural sciences at a time. Hence, this study aimed to fill these research gaps.

Hence, this study attempted to answer:

- What is the students' conception of learning health and natural sciences in an Ethiopian Public university context?
- Which learning approach is dominantly used by undergraduate students of an Ethiopian Public University?
- Do the health and natural sciences students differ in their conception and approach to learning in an Ethiopian Public University context?
- Is there a relationship between learning conceptualizations and approaches of the Ethiopian Public University health and natural sciences students?

2. MATERIALS AND METHODS

2.1.The Design and the Approaches to the Study

This study explored the students' learning conceptualizations and approaches in the different disciplines of natural and health sciences. Hence, a cross-sectional descriptive survey was used for the purpose. This is an extension of a study made one year earlier by the authors.

2.2.Participants of the Study

The undergraduate second-year students at different colleges of Arba Minch University were the population of the study. Second-year undergraduate students in the College of Natural and Computational Sciences and the College of Health and Medical Sciences in the 2021/2022 academic year were the target group. We targeted these groups because of their relative similarity of being natural science students. These groups come from ethnically diverse and spatially dispersed parts of Ethiopia. The groups were also similar because they were enrolled for four years of undergraduate programs except for the Medicine groups who studied for six years. The population of the study was 1064 (673 of Natural and Computational Sciences and 391 of Medicine and Health Sciences) students. Every 3rd of 1064 was selected to get a sample of 323 students. The health group included students from the departments of Medicine, Nursing, Medical Laboratory, Health officers, Midwifery, Medical Radiology, Anesthesia, Pharmacy, Environmental Health, and Health Informatics while the students from the natural sciences included students from departments such as Mathematics, General Chemistry, Industrial Chemistry, Forensic Chemistry, Chemical Laboratory Technology, Biology, Biotechnology, Biological Laboratory Technology, Statistics, Geology, Sport Science and Physics.

2.3.Data Collection Instrument

The ASSIST developed by Entwistle (2000) was used to comprehend the second-year students' learning conceptualizations and approaches. The items of learning conceptualizations constitute items relating to reproducing and transformative learning conceptualizations. Three of the items (items a, c, and d) are used for exploring the reproducing conception of learning while the remaining three (b, e, and f) are used for understanding the transforming conception of learning. The ASSIST comprises 52 additional items of learning approaches that include 20 items of deep, 16 items of strategic, and 16 items of surface approaches. The items consisted of Likert scales

that include 5 = agree, 4 = agree somewhat, 3 = unsure, 2 = disagree somewhat and 1 = disagree. This was earlier translated into the Amharic language by Gedamu et al. (2020).

2.4.Validity and Reliability of the Questionnaire

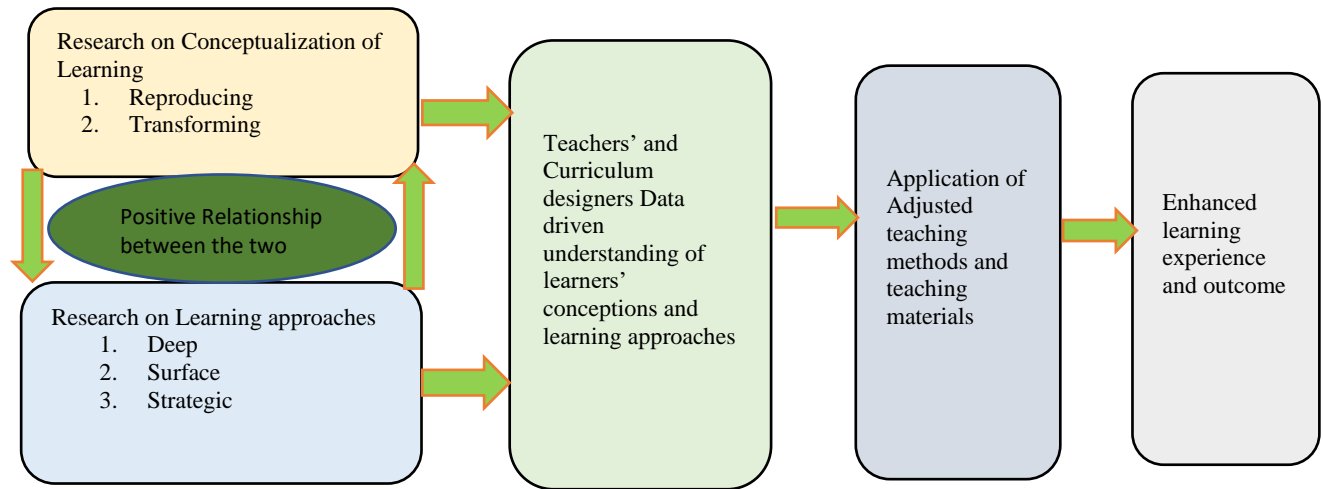
The reliability of the English and translated version of the questionnaire (ASSIST) was checked by a study by Gedamu et al. (2020). They found the two versions strongly correlated ($r=0.84$, $p < .01$). The internal consistency of the Amharic ASSIST was also checked and the values of the items for the deep approach, surface approach, strategic approach, reproducing conception and transforming conception were 0.83, 0.86, 0.84, 0.85 and 0.86, respectively (Gedamu et al., 2020, p.32).

2.5.Methods of Data Analysis

The differences between the reproducing and transformative learning conceptualizations of the students, and their learning conceptualizations and learning approaches were checked using independent sample t-tests. The dominant learning approach among the three approaches was also tested using one-way ANOVA. Similarly, the correlation between students' learning conceptualizations and learning approaches was analyzed using a Pearson-product-moment correlation. The assumptions of all these parametric statistical tools were checked before using them. In addition, a five percent ($\alpha = 0.05$) value was used to determine the existence of significant differences.

2.6.Significance and Conceptual Framework of the Study

The need to understand health and natural sciences students' learning conception and learning approaches is rooted in the ultimate goal of improving health and natural sciences students' quality of learning experience and learning outcomes. Hence, the significance of this study lies in providing teachers and curriculum designers with evidence of the health and natural sciences students' learning conception and approaches. This can help to use the evidence to adjust the methods of teaching and the course materials to enable students to develop a transformative conception and deep approach to learning health and natural sciences. On the other hand, the study may help other researchers in the field to see results from an Ethiopian Public University context.



1.2. Figure 3: Conceptual Framework of the Study

Generally, the study was guided by the following diagrammatically expressed conceptual

2.7.Ethical Clearance

We have secured ethical clearance from Arba Minch University Research Ethics Board to conduct the study with reference number AMU REB 2001/2021.

3. RESULTS

3.1.Learning Conceptualizations

The first research question intended to understand health and natural sciences students' learning conceptualizations in the two conception categories namely reproducing and transforming in aggregate. Table 1 presents this.

Table 1: Students' learning conceptualizations compared

Scale	N	Mean	SD	t	df	P
Reproducing conception	323	4.34	0.59	-0.26	644	0.79
Transforming conception	323	4.35	0.66			

An independent sample t-test (Table1) result exhibited no significant mean difference in scores for reproducing (M=4.34, SD=.59) and transforming learning (M=4.35, SD= .66); $t(323) = -$

0.26, $p=.79$. This indicates that the students of the Natural and Health Sciences programs at Arba Minch University have similar conceptualizations of reproducing and transforming learning.

3.2.Learning Approaches

The exploration of students of the Natural and Health Sciences preference of the three learning approaches was the other purpose of this study. One-way ANOVA test statistics were used for the purpose.

Table 2: One-way ANOVA Test Statistics

	Sum of Squares	df	Mean Square	F	P
Between Groups	6.326	2	3.163	11.237	.000
Within Groups	271.914	966	0.281		
Total	278.240	968			
N=323 $\eta^2= 0.023$					

The between-groups analysis of variance (ANOVA) of the three learning approaches showed that the scores differed significantly [$F(2, 966) = 11.237, p=.000$]. However, the effect size was found to be medium ($\eta^2=0.023$). The post hoc comparisons of the approaches that contributed the most to the differences were made using the Tukey HSD test. It was indicated that the surface ($M= 3.81, SD = 0.565$) was significantly different from the deep learning approach ($M = 4.00, SD = 0.49$). The strategic approach ($M=3.95, SD=0.527$) was also significantly different from the surface approach. Hence, the students dominantly utilized the deep and strategic learning approaches.

3.3. Differences between Students' Learning Approaches and Conceptualizations

The third question is intended to answer if there are differences in the approaches and conceptualizations that students prefer. Since the sample size of the Natural Science ($N=213$) is greater than the Health Sciences ($N=110$), a random selection of 110 cases of the Natural Science groups ($N=213$) was made in the SPSS and unselected cases were deleted to make the two sample sizes equal.

Regarding the differences in the two categories namely reproducing and transforming conceptualizations, the T-test was used. This result is presented as follows.

Table 3: The groups' conception of learning compared

<i>Groups</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>P</i>
Natural Sciences	110	4.30	0.60	-1.69	218	0.92
Health Sciences	110	4.42	0.41			

There was no statistical difference in the scores of the two groups' learning conceptualizations where the Natural Sciences mean was (N=110, M=4.30, SD=.60) and Health Sciences (N=110, M=4.42, SD= 0.41); $t(220) = -1.69$, $p=0.92$). Since p is > 0.05 the students of the Natural and Health Sciences programs did not differ in their learning conceptualizations. Hence, differences in the programs students attend did not make a difference in their learning conceptualizations. However, this may not be true for distinctly different programs such as social sciences and natural sciences. As a result, researchers may need to compare more programs to generalize.

Table 4: The groups' learning approaches compared

<i>Groups</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>P</i>
Natural Sciences	110	4.03	0.53	3.88	218	0.00
Health Sciences	110	3.80	0.28			

The groups' approaches were compared using an independent samples t-test. The result (Table 4) showed a statistically significant mean difference in the two groups where the Natural Sciences mean was (N=110, M=4.03, SD=.53) and Health Sciences (N=110, M=3.80, SD= 0.28); $t(220) = 3.88$, $p=0.00$). As p is < 0.05 the students of the two programs have significantly differed in their learning approaches. However, how significant this difference should be known to determine the magnitude of the difference. Hence, Glass's delta was calculated for effect size as the standard deviation differed. The output was Glass's delta = 0.43 which shows the effect size is medium (Cohen, 1988).

3.4.The Relationships between Learning Approaches and Conceptualizations

The relationship between learning conceptualizations and approaches was compared using Pearson Moment Correlation as indicated here.

Table 5: Associations between learning approaches and conceptualizations

	1	2	3	4	5
Surface approach	--				
Deep approach	.633**	---			
Strategic approach	.606**	.828**	--		
Reproducing conception	.208**	.401**	.411**	--	
Transforming conception	.163**	.336**	.333**	.536**	--

** Correlation is significant at the 0.01 level (2-tailed) N=323

Table 5 showed a significant positive correlation between the approaches and the learning conceptualizations. Specifically, a significant positive correlation was observed between reproducing conception and the surface ($r=0.208$, $p < .05$), deep ($r= .401$, $p < .05$) and strategic ($r=0.411$, $p < .05$) learning approaches. Similarly, transforming conception and surface approach ($r=0.163$, $p < .05$), deep approach ($r= .336$, $p < .05$) and strategic approach ($r=0.333$, $p < .05$) to learning are positive and significantly correlated.

In addition, the learning approaches were also correlated among themselves. A strong and positive correlation was observed between strategic and deep approaches ($r=.633$, $p < .05$) and between strategic and surface approaches ($r= .606$, $p < .05$).

4. DISCUSSION

The Natural and Health Sciences students were observed to have both reproducing and transforming learning conceptualizations. This seems to agree with a study by Alkhateeb and Milhem (2020) and Gedamu et al. (2022). According to Richardson (2011), this may help them use a range of approaches. However, the current study's finding is dissimilar to several studies. Virtanen & Lindblom-Ylänne's (2010) in their study of the students' learning conceptualizations of biosciences found that the students preferred transforming conception only. Sadi and Çevik (2016) also found that students preferred higher-level to lower-level conceptualizations in learning biology.

This difference can be due to the differences in the participants of the studies. The current study involved students from a range of departments (seventeen departments) in the health and natural

sciences. Biggs et al. (2001) assert that learning conceptualizations could be influenced by the experiences of learning different subjects. Hence, in this study, further analysis was made to examine if the students of the two programs differed in their conceptualizations. It was found that the students of the Natural and Health Sciences programs did not differ in their learning conceptualizations. However, this does not agree with the finding by Campos et al. (2018) who found out that learning conceptualizations differed between the health and non-health sciences students. The reasons for the differences in the findings can be due to the divergence in the fields and levels of study. In other words, it is unrealistic to expect differences in conceptualizations among second-year students of the natural and health sciences as the groups marginally differ in their fields of study and the second year may be too early to show divergence in the learning conceptualizations.

The students were also found to dominantly use deep and strategic learning approaches. This agrees with a study by Zakaria, et al. (2018) where the undergraduates of the faculty of Medicine and Health Sciences preferred the deep approach to learning, followed by the strategic approach. Similarly, this agrees with a study by Emilia et al. (2012) where they found that more undergraduates in their clinical phase used the deep than the surface approach. Samarakoon, et al (2013) in their study of mixed groups of medical undergraduates and postgraduates found that postgraduates had deep and strategic approaches. Chonkar, Ha et al. (2018) in their study of the predominant learning approaches of medical students discovered that they adopted the deep and strategic approach. Hence, the current study seems to be consistent with many other studies. Nevertheless, in further analysis of the current study, the students of the Natural and Health Sciences programs have significantly differed in their learning approaches. Adding more to the novelty of this study, the findings converge with the claims that learning approaches may not be similar at all places and institutions (Biggs, 2003; Biggs et al., 2001; Duff, 2002).

Concerning the relationships between the health and natural sciences students' learning conceptualizations and approaches, it was discovered that there was a positive and significant correlation although the strengths of the correlation are ranging from weak to moderate. This disagrees with several studies as reproducing or lower-level conceptualizations tended to correlate with the surface approach only (Alkhateeb & Milhem, 2020; Chiou et al., 2012; Chiou

et al., 2013; Zheng et al.,2017) while the transformative conceptualizations correlate with the deep approach (Dart, et al., 2000; Edmunds & Richardson, 2009; Ferla et al., 2008, Umapathy et al., 2019). The reasons for the differences between the current study and the studies reviewed can be context related. Moreover, the current study depended on aggregate results of different fields of study while the studies reviewed focused on specific fields such as biology, computer science, medicine and physics. On the other hand, the reproduction view may correlate to strategic and surface approaches in combination while the transformative learning view relates to the strategic and deep approaches (Dart et al., 2000; Edmunds & Richardson, 2009; Ferla et al., 2008; Watkins & Akande, 1992).

5. CONCLUSIONS

This study revealed that the health and natural sciences second-year students equally possessed both reproductive and transforming learning conceptualizations. It can, then, be concluded that the natural and health sciences second-year students have an assistive conception of learning that supports the implementation of deep learning. Furthermore, it was found that the students of the natural and health sciences programs did not differ in their learning conceptualizations. Unlike most other studies, it is possible to imply that learning programs may not necessarily bring differences in learning conceptualizations. The findings also implied that the health and natural sciences second-year students had the approach expected of tertiary-level learners.

Yet, the students of the two programs have significantly differed in their learning approaches. This gives an interesting insight that even if students may not differ in their conception of learning, they may in fact differ in their learning approach. The correlation between the students' learning approaches and conceptualizations is significant and positive. Health and natural sciences teachers should, then, help their students better develop a transformative learning conception. Besides, health and natural sciences syllabus designers should include tasks that encourage a transformative conception and a deep approach. As this study was conducted on the aggregate conceptualizations and approaches of second-year students in the fields of natural and health sciences at Arba Minch University, future studies should explore if this can be observed among specific disciplines. Moreover, other studies may need to prove or disprove if students can significantly differ in their approach to learning while they remain

similar in their conception of learning. Furthermore, other studies may need to compare more divergent disciplines than the ones in this study.

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REFERENCES

- Alkhateeb, M. A. and Milhem, O. A. Q. B. (2020). Student's concepts of and learning approaches and the relationships between them. *Cakrawala Pendidikan*, 39(3). <http://dx.doi.org/10.21831/cp.v39i3.33277>.
- Baeten, M., Kyndt, E., Struyven, K., & Dochy, F. (2010). Using student-centered learning environments to stimulate deep learning approaches: Factors encouraging or discouraging their effectiveness. *Educational Research Review*, 5,243–260.
- Biggs, J. (1994). 'Student Learning Research and Theory: Where Do We Currently Stand?', in Gibbs, G. (ed.) *Improving Student Learning: Using Research to Improve Student Learning*, pp. 1–19. Oxford: Oxford Centre for Staff Development.
- Biggs, J., Kember, D.& Leung, Y. P. (2001). The revised two-factor study process questionnaire: R- SPO-2F. *British Journal of Educational Psychology*, 71,133-149.
- Biggs, J. B. (2003). *Teaching for Quality Learning at University*. Buckingham: The Society for Research into Higher Education & Open University Press.
- Campos, F., Sola, M., Santisteban-Espejo, A., Ruyffelaer, A., Campos-Sánchez, A., Garzón, I., Carriel, V., Luna-Del-Castillo, J. D., Martin-Piedra, M. Á. & Alaminos, M. (2018). Learning concepts factors in postgraduate health sciences master students: a comparative study with non-health science students and between genders. *BMC Medical Education*, 18(128).<https://doi.org/10.1186/s12909-018-1227-x>
- Chiou, Guo-Li, Liang, Jyh-Chong & Tsai, Chin-Chung. (2012) Undergraduate students' concepts of and learning approaches in biology: A study of their structural models and gender differences, *International Journal of Science Education*, 34(2), 167-195, DOI:10.1080/09500693.2011.558131.

- Chiou, Guo-Li, Lee, Min-Hsien & Tsai, Chin-Chung (2013). High school students' approaches to learning physics with relationship to epistemic views on physics and conceptions of learning physics. *Research in Science & Technological Education*, 31(1), 1-15.
<http://dx.doi.org/10.1080/02635143.2013.794134>.
- Chonkar, S. P., Ha, T. C., Chu, S. S. H. 2, Ng, A. X., Lim, M. L. S., Ee, T. X., Ng, M. J. and Tan, K. H. (2018). The predominant learning approaches of medical students. *BMC Medical Education*, 18 (17). DOI 10.1186/s12909-018-1122-5.
- Cohen, J. (1988). Statistical Power Analysis for the Behavioral Sciences. New York, NY: Routledge Academic.
- Dart, B., Pillay, H. & Burnett, P.C. (2000). 'Australian and Filipino students' approaches to learning, conceptions of learning, and learner self-concepts: A cross-cultural comparison'. *Educational Research Journal*, 15:143–66.
- Duarte, M. A. (2007). Conceptions of learning and approaches to learning in Portuguese students. *High Educ*, 54:781–794. DOI 10.1007/s10734-006-9023-7.
- Duff, A., & McKinstry, S. (2006). Students' approaches to learning. *Issues in Accounting Education*, 22(2), 183–214
- Duff, A., Boyle, E. & Dunleavy, K. (2002). The relationship between personality, approach to learning, emotional intelligence, work attitude, and academic performance. In W. C. Smith (Ed.), *The 7th Annual ELSIN Conference* (pp. 141-151).
- Duff, A. (2002). Approaches to learning: Factor invariance across gender. *Personality and individual differences*, 33(6), 997-1010.
- Eklund-Myrskog, G. (1998). Students' conceptions of learning in different educational contexts. *Higher Education*, 35(3), 299–316.
- Emilia, O., Bloomfield, L. & Rotem, A. (2012). Measuring students' approaches to learning in different clinical rotations. *BMC Medical Education*, 12(114).
- Entwistle, N. (1997). Reconstituting approaches to learning: A response to Webb. *Higher Education*, 33(2), 213–218.
- Entwistle, N., Tait, H. & McCune, V. (2000). Patterns of response to an approach to studying inventory across contrasting groups and contexts. *European Journal of Psychology of Education*, 15, 33-48.

- Entwistle, N. (2000). *Approaches and study skills inventory for students (ASSIST)*.
<http://www.tla.ed.ac.uk/etl/questionnaires/ASSIST.pdf>.
- Entwistle, N.J., Mc Cune, V., & Walker, P. (2000). Conceptions, styles, and approaches within higher education: Analytic abstractions and everyday experience. In R.J. Sternberg, & L.F. Zhang (Eds.), *Perspectives on cognitive, learning, and thinking styles*. New Jersey: Lawrence Erlbaum.
- Entwistle, N. J. (2001). Learning styles and cognitive processes in constructing understanding at the university. In J. M. Collis & S. Messick (eds.) *Intelligence and personality* (pp. 217-232). Mahwah, N.J.: Lawrence Erlbaum.
- Entwistle, N. & Peterson, E. (2004). Learning conceptions and knowledge in higher education: Relationships with study behavior and influences of learning environments. *International Journal of Educational Research*, 41,407–428.
- Entwistle, N. (2009). *Teaching for understanding at university: Deep approaches and distinctive ways of thinking*. Basingstoke: Palgrave Macmillan.
- Edmunds, R. & Richardson, T. (2009). Learning conceptions, approaches to studying and personal development in UK higher education. *British Journal of Educational Psychology*, 79, 295–309.
- Ferla, J., Valcke, M.& Schuyten, G. (2008). Relationships between student cognitions and their effects on study strategies. *Learning and Individual Difference*, 18(2),271–278.
- Gedamu, A.D., Shewangizaw, G. L. & Gezahegn, T. H. (2020). Sophomore students' conceptions of and approaches to learning with reference to college of social and behavioral sciences at Arba Minch University. *Research on Humanities and Social Sciences*, 10(7).
- Gedamu, A.D., Shewangizaw, G. L. & Gezahegn, T. H. (2022). Business and economics students' conceptions of and approaches to learning. *Inter change*.
<https://doi.org/10.1007/s10780-022-09472-6>.
- Gijbels, D., Watering, G. V. D., Dochy, F., & Bossche, P. V. D. (2005). The relationship between students' approaches to learning and the assessment of learning outcomes. *European Journal of Psychology of Education*, XX (4),327-341.

- Marambe, K. N., Vermunt, J.D. & Boshuizen, H. P. A. (2012). A cross-cultural comparison of student learning patterns in higher education. *High Educ.* 64:299–316.
- Marton, F., Dall’Alba, G. & Beaty, E. (1993) ‘Learning conceptions.’ *International Journal of Educational Research*, 19, 277–300.
- McLean, M. (2001). Can we relate learning conceptions to student academic achievement? *Teaching in Higher Education*, 6, pp.399-413. <http://dx.doi.org/10.1080/13562510120061241>.
- Piumatti, G., Guttormsen, S., Zurbuchen, B., Abbiati, M., Gerbase, M. W. & Baroffio, A. (2021). Trajectories of learning approaches during a full medical curriculum: impact on clinical learning outcomes. *BMC Medical Education*, 21(370). <https://doi.org/10.1186/s12909-021-02809-2>.
- Pritchard, A. (2009). *Learning theories and learning styles in the classroom*. Second edition. Routledge: London.
- Prosser, M. & Trigwell, K. (1999). *Understanding learning and teaching. The experience in higher education*. Buckingham: The society for research into higher education.
- Purdie, N. & Hattie, J. (2002). Assessing students’ learning conceptions. *Australian Journal of Educational & Developmental Psychology*, 2, 17-32.
- Ramsden, P. (2003). *Learning to teach in higher education* (2nd ed). London, UK: Rutledge.
- Sadi, O. and Çevik, M. (2016). Investigating of conceptions of learning biology with respect to gender, grade level and school type. *SHS Web of Conferences*, 26, DOI: 10.1051/shsconf/20162601025.
- Sadlo, G., & Richardson, J. T. E. (2003). Approaches to studying and perceptions of the academic environment in students following problem-based and subject-based curricula. *Higher Education Research and Development*, 22, 253–274. doi:10.1080/758482623.
- Säljö, R. (1979). *Learning from the learner’s Perspective: Some common-sense conceptions*. Goteborg, Sweden: University of Goteborg, Institute of Education.
- Samarakoon. L., Fernando, T., Rodrigo, C. & Rajapakse, S. (2013). Learning styles and approaches to learning among medical undergraduates and postgraduates. *BMC Medical Education*, 13(42).
- Tsai, C. (2004). Learning conceptions science among high school students in Taiwan: A

- phenomenographic analysis. *International Journal of Science Education*, 26, pp.1733-1750.<http://dx.doi.org/10.1080/0950069042000230776>.
- Virtanen, V.& Lindblom-Ylänne, S. (2010). University students' and teachers' conceptions of teaching and learning in the biosciences. *Instructional Science*, 38 (4) , pp. 355-37.
- Wong, S. Y., Liang, J. & Tsai, C. (2021). Uncovering Malaysian secondary school students' academic hardiness in science, conceptions of learning science, and science learning self-efficacy: a Structural equation modelling analysis. *Research in Science Education*, 51, 537–564. <https://doi.org/10.1007/s11165-019-09908-7>
- Zakaria, N. M., Farok, N. A. J., Adam, S. K. & Nordin, S. A. (2018). Approaches of learning among medical undergraduates of faculty of medicine and health sciences, University Putra Malaysia in 2016. *Mal J Med Health Sci*, 14(1), pp.1-6.
- Zheng, L., Dong, Y., Huang, R., Chang, Chun-Yen & Bhagat, K. K. (2017): Investigating the interrelationships among conceptions of, approaches to, and self-efficacy in learning science, *International Journal of Science Education*, DOI: 10.1080/09500693.2017.1402142.