

The Analysis of the Grade 10 Students' Retention Level of Basic Biology Concepts and Terminologies in Relation to their Learning Styles

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ABSTRACT: Science subjects, or specifically biology, contain many concepts and terminologies that require extensive effort in memorizing. As a result, students are employing their own learning styles to learn things in the best possible way. Thus, this study aimed to investigate the possible relationship between the students' retention level in biology and learning styles in the course. A descriptive-correlational research design was utilized to determine the relationship between the retention level and learning styles of Grade 10 students in biology. A retention test was conducted that seeks to evaluate the retention level of the respondents in their biology subjects. Respondents were asked to select the best way on how they are learning biology effectively, as part of the retention test. Each of the ways indicated corresponds to a specific learning style category following the Visual, Auditory, Read, and Kinesthetic (VARK) Learning styles Model. Findings revealed that the majority of the respondents were Visual Learners comprised of 51.61% of the population and a portion of 38.71% of the respondents have an Outstanding Level of Retention in basic biology concepts and terminologies. In addition, the overall retention level category of the population is with Satisfactory Level of Retention, which was based on their mean percentage score. Furthermore, it has been proven that there is none to very weak relationship between the retention level and learning styles of the respondents where it gained a correlation level of 0.151, on which correlation is significant at 0.01 level, which strength of the linear relationship is categorized under none to the extremely weak relationship. It has been concluded that many factors, aside from learning styles, may affect the students' retention of learning biology.

Keywords: retention level, learning styles, biology education, terminologies, remembering

INTRODUCTION

Biology, as an academic discipline, is filled with numerous terminologies and concepts. As such, some high school students tend to dislike biology of subjects because of its comprehensive terminologies and concepts and a number of other related factors. These terminologies are essential to unlock difficulties without which, students cannot understand and comprehend the concurrent and succeeding topics related to it. It is also the nature of the discipline to require memorization of terms and concepts, thus the difficulty of reviewing and mastering these terms is encountered by many students studying biology. In Bloom's Taxonomy of learning objectives, remembering is the fundamental step toward reaching higher levels of cognitive thinking. Declarative knowledge is a prerequisite for procedural knowledge. As such, without mastery of key terminologies and concepts in a learning discipline, a further and higher form of learning cannot occur. Retention of learned knowledge is described as having the information stored in long-term memory in a way that allows it to be retrieved quickly, such as in response to standard prompts. Retention is having the knowledge stored in long-term memory in such a way that it may be retrieved quickly, such as in response to regular prompts [1]. The process by which knowledge gained in one context is utilized to solve a problem or make sense of a situation in another is known as a transfer. Learning retention is the capacity to retain additional knowledge in long-term memory and remember it later. When undergoing

a course, this is vital [2]. Retention level is important to measure because it is the sole purpose of the academe, to produce lifelong learners.

Memorization is the foundational level of knowledge that is needed to be taught correctly and mastered by the students before they can be taught higher-order thinking skills in using the same concept or discipline [3]. Learning at the higher level of taxonomies is dependent on how lower levels of prerequisite knowledge and skills are attained. Furthermore, recent studies show and argue that understanding and memorization are necessary for learning concepts in biology [4]. In connection to this, a set clear for choosing content, teaching, and determining students' progress are all involved in mastery learning [5]. The effectiveness of students' span of retention of information is based on the instruction used to teach a specific subject if it caters to their learning needs and styles of learning a subject. It is a fact that learners have their own learning styles, methods, and techniques to retain information better and longer.

There are four major types of learners, according to the VARK model: visual, auditory, reading/writing, and kinesthetic [6]. Students learn best, which includes retaining information when they use their individual learning methods or styles. Learning preferences refer to a learner's preference for particular educational modalities over others, such as online video versus in-person instruction. They differ from learning styles in that they do not rely on a learner's ability to learn best when all teaching is presented through one sense—visual, aural, or kinesthetic. Written and spoken explanations provide more value to verbal learners. When knowledge is given both visually and vocally, everyone learns more. Learning style is an individual's inclination or predisposition to receive and process information in a certain way or combination of ways. Learning style is a complicated manner in which, and situations under which, learners most efficiently and effectively perceive, process, store, and recall what they are attempting to learn, James and Gardner, write in their definition of learning style [7]. Most learning style assessments ask people to evaluate what type of information presentation they prefer (e.g., words versus pictures versus speech), although assessment instruments are extremely diverse, and/or what type of mental activity they find most engaging or congenial (e.g., analysis versus listening) [8]. Naturally, the best educational approach will vary from person to person in various ways. Differences in educational backgrounds, in particular, can be a crucial factor in optimizing instruction. For example, because new learning builds on previous learning, an individual student's prior knowledge is bound to affect the degree and type of instructional activities that are most appropriate for that student.

The Philippines scored the lowest in science and mathematics among 58 nations in the most current worldwide evaluation by The Trends in International Mathematics and Science Study. The Trends in International Mathematics and Science Study (TIMSS) defined four international benchmarks along a scale to measure students' competency in science and mathematics such as the Advanced International Benchmark (625), High International Benchmark (550), Intermediate International Benchmark (475) and Low International Benchmark (400). The Philippines' science marks of 297 and 249 are "substantially lower" than those of any other participating nations. Even though students in Grades 4 and 8 take the TIMSS exam, the Philippines has only administered the Grade 4 exam for this cycle. The low math criteria, which indicates that learners possess "some basic mathematical knowledge," was only satisfied by 19% of Filipino students, and 81% of them did not even come remotely close. However, the science standard found that just 13% of Filipino students achieved the low criterion, indicating that they displayed "limited knowledge of scientific ideas and inadequate mastery of key science facts," while 87% of students did not even reach this level. This is a warning sign that the educational system in our nation is suffering, particularly in the subjects of science and mathematics. The results of this assessment generally reveal that "retention" of science and mathematics among Filipino students is not effectively retained and restored.

Therefore, this study aimed to analyze the correlation between the Grade 10 students' retention level in basic biology concepts and terminologies and their learning styles as a baseline study and diagnostic to ponder what may significantly affect the retention of concepts and terminologies of students in science, specifically in biology.

The study aimed to analyze the relationship between Grade 10 students' retention level of basic biology concepts and terminologies and their learning styles. Specifically, it aimed to investigate the following problems:

1. What are the learning styles and retention levels of the respondents in the context of learning biology?
2. What is the overall retention level of the class in basic biology concepts and terminologies?
3. What is the relationship or correlation between the students' retention level of Biology concepts and terminology to their Learning styles?

METHOD

Research Design

This research activity employed a descriptive-correlational research design whereby it aims to describe the retention level of basic biology concepts and terminologies among Grade 10 students using their raw scores in the retention test. The retention test questionnaire was used to gather and examine the retention level of Grade 10 students in terms of basic biology concepts and terminologies. The construction of the test was based on the Department of Education's Curriculum Guide in Science and was crafted through Table of Specifications (TOS), thus, the constructed retention test covers the biology subjects that the respondents have learned from Grade 7 until their current Grade level. A frequency count of the learning styles of the respondents was made and the raw scores of the respondents were obtained. Through the data gathered from the respondents using the teacher-made retention test questionnaire, the retention level and its relationship to the respondents' learning styles were attested using the Spearman rho correlation test.

Research Environment

The study was conducted virtually at La Salette of Quezon located at Barangay Samonte, Quezon, Isabela, Philippines. The said school is a Private Catholic institution comprised of approximately 300 students currently enrolled for the school year 2021-2022. Due to the pandemic, the school has opted to adopt Online Distance Learning as their mode of instruction. The school is also adhering to the Most Essential Learning Competencies (MELCs) provided by the Department of Education, as their basis of instruction.

Respondents of the Study

The whole population of Grade 10 students in the school was chosen to be the respondents of this study. The respondents were selected from the students belonging to the class Grade 10 level of La Salette of Quezon who are currently enrolled for the School Year 2021-2022.

The Grade 10 level of the school consisted only of one section with a total population of 36 students. In addition, the homogeneity of students from the Grade 10 class is not pertinent to the study since it will deal with the retention level of students from the same Grade level. Considering the present health crisis we are experiencing, the number of respondents is indeed limited to what is available as such; this study opted to make use of convenient sampling as the technique in choosing the respondents. The respondents were requested to complete a retention test comprised of 50-item questions, in relation to biology, using Google Forms.

Research Instrument

Curriculum Guide. The curriculum guide outlines the K-12 program goals as well as grade-level and course goals that discourse the key cognitive, psychomotor, and affective anticipation of the content for the program. In this study, the constructed retention test was tailored from the learning competencies in the K-12 curriculum, specifically Grade 7 to Grade 10 biology quarters.

Retention Test. The retention test aims to measure how much a learner can remember and retain information. The prepared and constructed retention test undertook pilot testing in the Grade 12 level of the same institution since there is only one section for all Grade levels. The fallouts of the pilot testing underwent an inter-item reliability test through which Cronbach's alpha selected out the items with negative reliability. All the items constructed were proven and tested to be reliable after pilot testing with an overall reliability of 93.3% which is categorized as an "excellent" level of reliability.

Data Gathering Procedure

The researcher seeks for the permission of the School Principal of La Salette of Quezon, Inc. Quezon, Isabela to conduct the study in their institution. It has been communicated through a formal letter, which includes the study's objective, title, respondents, and everything related to the research. Thereafter, the researcher conducted a pilot testing of the questionnaire to a separate group of respondents, based on the agreed schedule.

After collecting the responses from the respondents for pilot testing through Google forms, the data gathered underwent a reliability test to assure the instrument's internal consistency. Once the items from the questionnaire were statistically proven reliable, the researcher then proceed to the collection of data for the study. The respondents of the study were selected using convenience sampling since it will just rely on who is available as respondents, considering the number of the population of the chosen school.

The questionnaires were sent to the students virtually, using Google Forms. Before the questionnaire was sent to the respondents, the researcher met the respondents to duly instruct them on what and how to answer the given set of questions. The respondents were requested to complete the retention test within the set time limit of 1 hour and 30 minutes and this is to prevent the respondents to have the leisure time to research answers online. After this, the questionnaires were

collected in order to obtain the numerical data needed for statistical analysis on which the result was used as the primary indicator of the students' retention level and its relation to their learning styles.

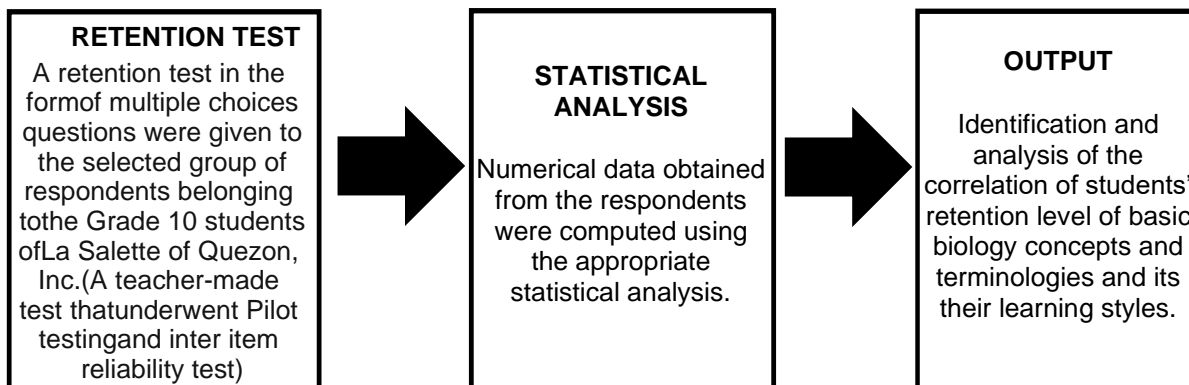


FIGURE 1. Flowchart of the Research Procedure

Treatment of Data

1. **Frequency count** was used in the first problem to determine the proportion of the learning styles and retention levels of Grade 10 students.
2. **Mean** was used to obtain the average retention level of all the students in the class. Then, a scale was used to define the retention level of the Grade 10 students of La Salette of Quezon, Inc. in basic biology concepts and terminologies. The scale was adopted from DepEd Order No. 8 s. 2015. The scores validate the retention level of students in several biology subjects.

TABLE 1. The basis for the Level of Proficiency of Student as Retention Level

Level	Raw Score	Grading Scale	Remarks
Outstanding	84.00 – 100	90 – 100	Passed
Very Satisfactory	76.00 – 83.99	85 – 89	Passed
Satisfactory	68.00 – 75.99	80 – 84	Passed
Fairly Satisfactory	60.00 – 67.99	75 – 79	Passed
Did Not Meet Expectations	0.00 – 59.99	Below 75	Failed

Source: DepEd Order No. 8 Series 2015

3. **Correlational Analysis using the Spearman rho correlation test** was used to determine the correlation of the students' retention level to that of their learning styles. If the value is positive, it indicates a direct correlation. Whereas, if the value is negative it shows an inverse correlation. Then, a scale was used to identify the strength of the linear relationship between variables.

TABLE 2. The basis for the interpretation of the strength of the linear relationship

Correlation	Strength of the Linear Relationship
1	Perfect
0.8-1.0	Very Strong
0.60-0.80	Strong
0.40-0.60	Moderate
0.20-0.40	Weak
0.00-0.20	None to extremely weak

RESULTS AND DISCUSSION

Respondents' Learning Styles and Retention Levels

Table 3 shows the Grade 10 students' Learning styles and Retention levels. In terms of the respondents' learning styles, the category with the greatest number of learners was Visual Learners with 16 responses or 51.61% of the total population. It shows that the majority of the respondents are visual learners, in terms of learning biology, where they learn best through seeing videos, pictures, or diagrams when studying. According to studies, 65 percent of the general public are visual learners, which means they need to see information to remember it. Visuals provide a dimension to communication that is missing from textual and verbal methods: speed. The brain can comprehend

images and videos 60,000 times faster than text, according to studies, making image-based communication extremely important [9].

For the respondents' retention level, basing it from their retention scores obtained from the retention test, there are 12 learners categorized with "Outstanding level of retention" comprised of 38.71% of the total respondents. In addition, since the majority of the respondents are visual learners, this may be a logical reason why there are 12 respondents of the population categorized with "Outstanding Level of Retention".

There are researchers that provided implications in their notable studies that the use of visual learning mechanisms, rather than auditory learning mechanisms, produces greater learning and memory recall [10] Thus, this indicates that utilizing visual stimuli, rather than auditory stimuli, in the classroom setting will produce better recall performance on exams and quizzes. Learners have distinct learning styles, which can have a significant impact on the learning process and, as a result, on their academic progress and outcomes. Furthermore, studies also show that learners absorb information in a variety of ways, including seeing and hearing, reflecting and acting, reasoning rationally and intuitively, memorizing, and picturing [11].

TABLE 3. Grade 10 students' Learning Styles and Retention Levels

Variables	Categories	Frequency	Percentage
Learning Styles	Visual Learners	16	51.61%
	Auditory Learners	5	16.13%
	Reading/writing Learners	9	29.03%
	Kinesthetic Learners	1	3.23%
	TOTAL	31	100%
Retention Level	Outstanding	12	38.71%
	Very Satisfactory	5	16.13%
	Satisfactory	4	12.90%
	Fairly Satisfactory	2	6.45%
	Did Not Meet Expectations	8	25.81%
	TOTAL	31	100%

Overall Retention Level of Respondents

TABLE 4 depicts the average or overall retention level of all the respondents in a class based from their obtained retention scores on the given retention test. The retention test assessed the respondents' retention of basic biology concepts and terminologies from Grade 7 to preset Grade level.

From the table above, the obtained and computed Mean Percentage Score of the respondents is 69.88. Based on the DepEd Order No. 8, s. 2015, 69.88 is transmuted to a Grading scale of 80-84 and is categorized under "Satisfactory Level of Retention" with "Passed" remarks. Generally, it is evident that the retention level of the respondents is average and satisfactory in terms of basic biology concepts and terminologies.

Learning styles refer to how people gather, sift through, assess, organize, make conclusions from, and "store" information for later use [12]. However, some studies conducted before argue that the usage of the best educational approach would vary from person to person in various ways. As such, even if students are using their learning styles, if it is not catered according to how the teacher delivered the lessons, the effectiveness of storing information will still be greatly affected [13]. This is one of the possible factors that affect the respondents' retention level categorized with "Satisfactory Level of Retention", rather than having a higher level of retention compared to what is obtained.

For instance, pictures, diagrams, flow charts, timelines, films, and demonstrations help visual learners recall what they see. Written and spoken explanations provide more value to verbal learners. When knowledge is given both visually and vocally, everyone learns more. Visual learners process information best with their eyes; auditory learners learn best with their ears; and kinesthetic/tactile learners learn best with their hands. As such, **providing multiple modalities will be most effective for learning retention** [11].

In order for learning to occur, a process of information should happen. As psychologists agreed in the Information processing Theory, there are three necessary stages involved in learning and in the memory process: *encoding, storage, and retrieval* [14]. In addition, the schema theory of Frederic Barlett (1932), as cited by Board (2013), stresses the significance of overall knowledge and concepts that help make the schemata which are the building blocks of knowledge and which show the

perception of an individual of reality based on experiences and prior knowledge. These enable an individual to remember, focus attention on cues of details and foretell future events [15].

TABLE 4. Overall Retention Level of Grade 10 – Students

Mean	Mean Percentage Score	Grading Scale	Retention Level	Remarks
34.94	69.88	80-84	Satisfactory	Passed

Correlation of Students' Retention Level to their Learning Styles

Based on Table 5 on the Correlation matrix of the students' retention level and learning styles, it gained a correlation level of 0.151, on which correlation is significant at 0.01 level, which strength of the linear relationship is categorized under none to extremely weak relationship following the Spearman rho correlation test. Thus, it can be said that there is no significant relationship between the students' retention level to their learning styles.

Even though some studies prove that learning styles affect the learners' way of organizing, processing, and storing there are other related factors that might affect the students' retention level. Studies have shown that the best conditions for education vary depending on the students' prior knowledge [12]. The best educational approach will vary from person to person in various ways. The students' retention level is also affected by the effectiveness of the instructional approach of the teacher in delivering a lesson. This may be an evident reason why there has been no significant relationship between the students' retention level and their learning styles since it should be studied considering all the factors that might affect the students' way of retaining learned information.

Furthermore, there is insufficient evidence that Learning Styles alone give a complete basis for remembering knowledge [16]. This is further affirmed by Miller (2021) whom he stated that even though the VARK learning model is well known and used even in corporate learning, there is little evidence that identifying and adapting learners' learning styles will help them grasp and retain information. However, when learners are accommodated to their preferred style, net retention and understanding increase [17].

TABLE 5. Correlation Matrix

	Learning Styles	Retention Score	Retention Level
Learning Styles	1	- 0.122	0.151
Retention Score	- 0.122	1	- 0.961
Retention Level	0.151	- 0.961	1

***.* Correlation is significant at the 0.01 level (2-tailed).

CONCLUSION

Based on the salient findings of this study, the following conclusions are derived:

1. Majority of the Grade 10 students of La Salette of Quezon, Inc. Quezon, Isabela are Visual Learners on which they learn best, in biology when they see pictures, videos, and diagrams. Moreover, most of the respondents were categorized as having an "Outstanding Level Retention" based on their scores on the retention test.
2. According to the Mean Percentage Score of the Grade 10 students of La Salette of Quezon, Inc., the said population is categorized with "Satisfactory Level of Retention" which means and indicates that the group has an average level of retention in terms of basic biology concepts and terminologies.
3. There is none to an extremely weak relationship between the Grade 10 students' retention level and their learning styles. This result indicates that these variables do not affect each other. Thus, the learning styles of the students in learning biology do not have a significant effect on their retention level and vice versa.

Implications

The study arrived at the following findings and implications:

1. Grade 10 students' Learning styles and Retention Levels in biology Based on the obtained result of the frequency count, the findings showed that the majority of the respondents are visual learners comprising 16 out of the 31 respondents or 51.61% of the population. Moreover, the majority of the group (12 out of 31 respondents or 38.71% of the population) have obtained a Grading scale of 90-100 categorized under "Outstanding Level of Retention" with passing remarks.

2. Overall Retention Level of the Respondents The mean percentage score of the respondents was obtained to generalize and categorize the retention level of the population. The result showed that the mean percentage score of the respondents is 69.88, which is categorized under “Satisfactory Level of Retention”.

3. Correlation of Students’ Retention Level to their Learning Styles Based on the results of the Spearman rho Correlation, the finding revealed that there is none to extremely weak relationship, with a 0.151 level of correlation, between the retention level of the students and their learning styles in biology.

Recommendations

From the results, the researcher recommends the following for the improvement and innovation of the study and the field where it belongs.

School Administration. The school administration should provide a simplified form of the learning modules to the students where it applies some devices or techniques like mnemonic devices that would help the students to better retain the information they are reading and to avoid overload of information and words on the part of the students.

Teachers. The teacher should venture into more ways how to improve the retention of the students with the use of some intervention in instruction. Moreover, the teachers should be mindful and must be solution-oriented to problems concerning the learning of the students. Teachers should be more sensitive and should be able to sense any difficulties that the learners are encountering with the learning materials provided to them, especially in today’s context of the educational system. Furthermore, the teachers should also be advised to provide multiple teaching methods and materials that could cater to the diversity of learners in a classroom.

Students. Since science subject, specifically biology, is filled with a lot of terminologies and concepts needed to be learned, students should also explore what ways or how they learn subjects in the best manner. Moreover, the students should also tell the teachers if ever they are encountering any difficulties in learning especially in this new era we are facing a health crisis.

Future Researchers. Future researchers may also consider evaluating other factors that may affect the retention level of the students since education is a multifaceted topic to study and explore.

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REFERENCES

1. A. G. Bennett, & N.S. Rebello, *Retention and Learning*. In: Seel N.M. (eds) *Encyclopedia of the Sciences of Learning*. Springer, Boston, MA. https://doi.org/10.1007/978-1-4419-1428-6_664. (2012).
2. A. Haqie, *What is Learning Retention?* Retrieved from: <https://www.lorman.com/blog/post/what-is-learning-retention> (2021).
3. K. Castrillon, *Inclusion strategies for secondary classrooms*. Retrieved from <http://slideplayer.com/slide/10647978/>. (2016).
4. W. Huang, & T. Nusbaum, *Biology survival guide: How to study and ace any biology course*. http://www.biologysurvival.com/pdf/TheBioGuide_Preview.pdf (2006)
5. H. C. Wilcox, S. G. Kellam, C.H. Brown, J.M. Poduska, N.S. Ialongo, W. Wang, & J.C. Anthony, The impact of two universal randomized first- and second-grade classroom interventions on young adult suicide ideation and attempts. *Drug and Alcohol Dependence*, 95(Suppl1), S60–S73. <https://doi.org/10.1016/j.drugalcdep.2008.01.005>.
6. K. Cherry, *Overview of the VARK Learning Styles*. Retrieved from: <https://www.verywellmind.com/vark-learning-styles-2795156>. (2019).
7. B. Zajacova, *Learning Styles: An Overview of Concepts and Research Tools and Introduction of Our Research Design in Physics Education Field*. WDS’13 Proceedings of Contributed Papers, Part III, 91–96 (2013).
8. H. Pashler, M. McDaniel, D. Rohrer, & R. Bjork, *Learning Styles: Concepts and Evidence*. Sage Journals Volume: 9 issue: 3, page(s): 105-119 (2009).
9. E. Spencer, *How to best with the 4 different types of learners*. *Work-Life, Atlassian*. Retrieved online from <https://www.atlassian.com/blog/teamwork/how-to-work-4-different-learning-types> (2018).

10. K. Lindner, G. Blosser, & K. Cunigan, *Visual versus auditory learning and memory recall performance on short-term versus long-term tests*. *Modern Psychological Studies*: Vol. 15 : No. 1 , Article 6 (2009).
11. M. Gokalp, *The Effect of Students' Learning Styles to Their Academic Success*. *Creative Education*. 04. 627-632. 10.4236/ce.2013.410090. (2013).
12. N. Chick, *Learning Styles*. *Vanderbilt University Center for Teaching*. Retrieved October 29, 2021 from <https://cft.vanderbilt.edu/guides-sub-pages/learning-styles-preferences/>. (2010).
13. D. S. McNamara, E. Kintsch, N. B. Songer, & W. Kintsch, *Are Good Texts Always Better? Interactions of Text Coherence, Background Knowledge, and Levels of Understanding in Learning from Text*. *Cognition and Instruction*, 14(1), 1–43. <http://www.jstor.org/stable/3233687>. (1996).
14. A. W. Melton, *Implications of short-term memory for a general theory of memory*. *Journal of verbal Learning and verbal Behavior*, 2(1), 1-21 (1963).
15. J. Board, *Learning theory-schema theory*. http://teorijjeucenja.zesoi.fer.hr/doku.php?id=learning_theories: schema_theory. (2013).
16. G. Kratzig, & K. Arbuthnott, *Perceptual Learning Style and Learning Proficiency: A Test of the Hypothesis*. *Journal of Educational Psychology*. 98. 238-246. 10.1037/0022-0663.98.1.238. (2006).
17. C. Miller, *Why Learning Preferences Are More Important Than Learning Styles*. Retrieved from <https://www.bizlibrary.com/blog/learning-methods/learning-preferences-versus-learning-styles/>. (2021).