

Activity-Based Learning and Its Effectiveness on Students' Performance in Science: Basis for an Intervention Plan

Laveña A. Amora, Erlinda A. Quirap

^alavena.amora@deped.gov.ph/caelquirap@gmail.com
Southern de Oro Philippines College, Cagayan de Oro City, Philippines

Abstract

The purpose of this study was to determine the effectiveness of activity-based learning on students' performance at Gingoog City Comprehensive National High School for the School Year 2022-2023. With Grade 10 Junior High School students (n=60), the researcher used the purposive sampling technique and a quasi-experimental research design with a pretest and posttest. A validated and reliability-tested multiple choice test questionnaire was the primary data instrument. The collected data were analyzed and interpreted using an inferential statistical method such as mean, standard deviation, p-value and T-test. The study revealed that students' performance of the experimental group who participated in activity-based learning were found to be Highly Proficient, and their mean increase was high. As a result, all students found activity-based learning to be beneficial in both the teaching and learning processes. The majority of the students in the control group, who were taught using the traditional method, performed Nearly Proficient on the posttest and got an increased Mean in the posttest. Also, both in the Control and Experimental groups, the results indicate a significant difference between the students' performance on the pretest and posttest. Finally, the findings derived an intervention on the "Activity-Based Learning Intervention Plan" utilizing activity-based learning as the core activity in the delivery of the lessons.

Keywords: Activity-Based Learning, Intervention Plan, Students' Performance

1. Introduction

The foundation of activity-based learning is the involvement of students in teamwork and group discussions. The students are expected to do a variety of task. According to Coem (2020), an important relationship between action and learning is the student's reflection on their own learning. The student is the primary emphasis of activity-based learning education, making it a student-centered approach. It encourages learners to learn independently and allows them to tailor their studies to their individual learning styles.

The DepEd Order No. 42 series of 2016 on Daily Lesson Plan Preparation for the K-12 Basic Education Curriculum is a policy directive from the Department of Education that emphasizes the implementation of a strategy or a mix of methods by teachers in the classroom. Learners need to be active in their learning and interact with others, including their teachers and peers.

In preparing for a lesson, teachers let the students engage in activity-based learning by critical thinking, discussing, investigating, and creating. As a result, students develop their skills, work through challenging topics, solve problems, make decisions, offer answers, and articulate concepts in writing and discussion in class (Theobald et al., 2020). This learning process requires timely feedback from either the teacher or fellow students. Theobald adds that education research shows that incorporating active learning strategies into different grade levels significantly enhances student learning experiences.

Further, Anwar (2019) defines Activity Based Learning as a setting in which students actively participate in the learning experience rather than sitting as passive listeners. The author underlines that active learning varies from traditional teaching approaches in two ways: (a) students take an active part in their

learning environments and (b) students collaborate with one another. Furthermore, activity-based learning was described as student-centric by Singal et al. (2018) with the intention of presenting challenging learning activities.

However, despite the activity-based learning method presented, the majority of teachers who perform the teaching process continue to employ traditional teaching approaches, which are still habits due to crowded classes, lack of time, the inadequacy of materials such as textbooks, and inadequate laboratory facilities (Celik, 2018). Unfortunately, Science and other subjects are taught through lectures, particularly at the elementary level (Bakhru & Mehta, 2020). This condition results in rote learning rather than an in-depth understanding of scientific concepts, phenomena, and theories (Zhou & Luh, 2021).

According to researchers, if teachers have limited resources, they must use the traditional lecture technique (Rajabalee et al., 2020). In addition, Jeong et al. (2019) found that traditional Science teaching methods are ineffective in instructing students, and the growing concern about the quality of Science education necessitates a change. Teachers must slowly shift to activity-based learning methods in teaching in spite of all the reasons. A good place to start is by making a small modification to the teaching style. It will be accomplished gradually through instilling activity-based learning's cognitive skills, such as pondering, debating, researching, and producing.

Thus, this research study was conducted to determine the effectiveness of activity-based learning on students' performance at Gingoog City Comprehensive National High School for the School Year 2022-2023.

Activity-Based Learning (ABL) Theory is a cognitive-learning theory that is considered a "constructivist" learning theory by George Hein. Essentially, a learner "constructs" his own microcosms of knowledge by interacting with data and drawing on prior knowledge and/or current experiences. They actively seek new information and are actively involved in the process of acquiring assimilation and application of knowledge. Instead of beginning with a classification of problem-solving methods, the facilitator engages learners in outlining real-world problems. As a result, the theory is also known as a problem-based learning theory. Thus, incorporating ABL elements is a promising way to improve students' learning experiences.

This study connects to Hein's Constructivism Theory (1991). Hein asserts that learning is an active process in which the learner makes sense of sensory data. The more conventional definition of learning holds that it entails learners interacting with the outside environment rather than simply accepting knowledge that is "out there." Additionally, the constructivist approach is a powerful teaching tool that significantly improves students' understanding of science concepts across all psychological groups (Adak 2017). It is a way that shows promise and advances education because it can help students become more creative and increases their knowledge in this regard, and is tailored to their needs (Suhendi et al., 2021). According to Albadi (2019), the constructivist philosophy that underpins activity-based learning gives this teaching method value and strengths. Agbeyenku (2017) identified the following strategies that promote activity-based learning: Cooperative learning, Inquiry method, Differentiated method, and Project method.

2. Methodology

The study's design is a Quasi-experimental research design with pretest posttest control group. In contrast to an actual experiment, the quasi-experiment defined by Farnell (2021) does not assign participants at random. Two groups were formed in this concept. The experiment group was one group, and the control group was another. While the control group did not receive any treatment, the experimental group did. In order to examine change over time, the researcher in this type gave a pretest and posttest. It analyzed two variables that are thought to be similar in order to determine whether they both reacted similarly to a particular change. This approach was used in one instance where subjects in the control group were intentionally matched by the researcher to subjects in the treatment group on characteristics that might be

associated with the outcome of interest. This matching can be done at the individual level, resulting in a one-to-one match of individuals in the two groups.

The sampling procedure used for this research is purposive sampling. It refers to a group of non-probability sampling techniques in which units are selected because they have characteristics that are needed in the sample (Nikolopoulou, 2022). Respondents were purposively chosen by the researcher since she handles the Science class subject of the respondents. Grade 10 section Cañosa was chosen for the control group and Grade 10 section Rodriguez for the experimental group because they have similar behaviors, characteristics and performance. The respondents are sixty (60) Grade 10 Junior High School students of Gingoog City Comprehensive National High. The Grade 10 section Cañosa consists of thirty (30) students (Control group) and Grade 10 section Rodriguez consists of thirty (30) students (Experimental group).

Inferential statistics such as mean score and t-test was used to evaluate and analyze the test scores of the two groups. Independent sample t-tests at a .05 level of significance were applied to both the test scores to check whether there was a really important distinction between the performance of the two groups previously and afterward the treatment. Mean, standard deviation, p-value, and T-test was calculated for the purpose of data analysis. The researcher preferred this design and statistical treatment as the best strategic approach to understand the study.

3. Results and Discussion

Problem 1. What is the level of students' performance in the control and experimental group in Activity-based learning in terms of:

- 1.1 Pretest; and
- 1.2 Posttest?

Table 1

Pretest and Posttest of Control Group

		<u>Pretest</u>		<u>Posttest</u>		Gains
		Mean	SD	Mean	SD	
Control Group		11.87	5.44	16.33	6.76	4.46
Note:	Highly Proficient 25-30 Scores Low Proficient 7-12 Scores	Proficient 19-24 Scores Not Proficient 0-6 Scores	Nearly Proficient 13-18 Scores			

Table 1 shows students' performance of Control group in pretest and posttest. It was shown that the Control group obtained a Mean of 11.87 with a standard deviation of 5.44 in the pretest and in the posttest a mean of 16.33 with a standard deviation of 6.76 was obtained. There is an increase in Mean in the posttest and the increase gains a difference of 4.46. This means that students who are taught in traditional method such as classroom discussion and lecture methods attained only nearly proficient in the level of proficiency. Students gained knowledge and competencies but not that high due to the small increase of the mean. This indicates that the traditional method can increase the students' performance but at a nearly proficient level.

The result of the study was supported by the statement of Paul (2019) that the traditional approach to teaching fails in knowledge transfer and transfer of power from the teacher (teacher-centered) to students (student-centered), and the students are unable to move the knowledge they have acquired in the school to outside the classroom. In the same study by Razia (2019) when there is no opportunity for students to participate in class discussions or give presentations, they become passive students. Students who are not good at memorizing have the highest probability of failing the subject making the students feel intellectually weak and cannot move forward to the next degree (Snowie,2018).

Table 2

Pretest and Posttest Performance of Experimental Group

		Pretest		Posttest		Gains
		Mean	SD	Mean	SD	
Experimental Group		8.71	6.05	26.23	4.80	17.52
Note:	Highly Proficient 25-30 Scores Low Proficient 7-12 Scores	Proficient 19-24 Scores Not Proficient 0-6 Scores		Nearly Proficient 13-18 Scores		

Table 2 shows the students' performance of the Experimental group in the pretest and posttest. It was revealed that the experimental group obtained a Mean of 8.71 with a standard deviation of 6.05 in the pretest and in the posttest, a Mean of 26.23 with a standard deviation of 4.80 was obtained. There is a significant increase in Mean in the posttest, and the increase gains a difference of 17.52. This means that students who are taught in an activity-based learning approach acquire a highly proficient level in the level of proficiency.

This was supported by the statement of Agbenyeku (2017) that employing an activity-based learning strategy drastically improved students' recall capacity indicators when compared to using a standard teacher-centered approach. This resulted from the fact that students who experienced activity-based learning technique had mean scores in the learning areas and understanding of Basic Science concepts that were higher. The learner components inherent in activity-based learning approaches are consequently more successful in supporting learning in Basic Science and thereby engendering the improvement of students' retention ability indices in the subject.

Moreover, the significant increase of mean in the posttest was possible due to the different teaching strategies that anchored on Activity-Based Learning. Cihad and Sari (2018) came to the conclusion that individualized instruction increased students' engagement with Science, technology, society, and the environment while also fostering their understanding of the scientific method and raising their level of science literacy. Moreover, in Divrik's (2020) research, an inquiry-based strategy promotes students' achievement, builds their scientific process abilities, fosters a favorable attitude toward Science and Technology courses, foster concept learning, and boosts academic self-efficacy. Furthermore, in terms of cooperative learning, students in secondary education who participate on a regular basis report higher levels of intrinsic motivation and recognized regulation (Fernandez-Rio et al., 2017).

Problem 2. Is there a significant difference between the students' performance in the pretest and posttest in the:

- 2.1 Control group: and
- 2.2 Experimental group?

Table 3

Test Correlation between Pretest and Posttest Performance

Group	Pretest		Posttest		t-value	p-value	Decision
	Mean	SD	Mean	SD			
Control	11.87	5.44	16.33	6.76	4.523*	0.000	Reject Ho
Experimental	8.71	6.05	26.23	4.80	18.202*	0.000	Reject Ho
Note: 0.000-0.300 No Linear Relationship (NLR)				0.301-0.500 Low Positive Relationship (LPR)			
0.501-0.700 Moderate Positive Relationship (MPR)				0.701-0.900 High Positive Relationship (HPR)			
0.901-1.000 Very High Positive Relationship (VHPR)				* = Significant when computed p-value < 0.05			

Table 3 demonstrates students' performance in the pretest and posttest. A t-value of 4.523 with a p-value of 0.000 was acquired by the Control group, while a t-value of 18.202 with a p-value of 0.000 was obtained by the Experimental group. The null hypotheses of both groups are rejected since the p-values (.000 in both groups) are less than the value (.05). It indicates that there is a significant difference in the experimental group's and the control group's performance between the pretest and posttest. This suggests that students did better on the posttest than they had on the pretest. The students knew more at the end of the lesson due to the effectiveness of both conventional approaches and activity-based learning. The study also showed that the Experimental group had improved more than the Control group in terms of mean score. The increase in the student's performance in the posttest indicates that the strategies used (activity-based learning) were better, and it improved academic achievement.

According to Anwar (2019) that in higher secondary schools, activity-based teaching improves academic achievement and increases student motivation. Teaching methods draw in students, contribute favorably to their motivation, and boost academic performance for improved learning outcomes. The same line as Albadi (2019) that the use of the activity-based learning approach has a favorable impact on a student's performance, including how feeling and motivation are involved as well as academic achievements.

Moreover, it is consistent with a similar study conducted in a different field of study. Celik (2018) find out that activity-based learning in Mathematics instruction improves students' academic success compared to traditional education. This can be due to the fact that Mathematics class activities provide pupils with the chance to work with real objects, which boosts their enthusiasm.

Problem 3. Based on the finding, what intervention plan can be formulated?

Based on the finding of the conducted study, activity-based learning improved students' performance. Thus, the researcher derived crafting an intervention plan timeline to adapt activity-based learning in the teaching-learning process. This intervention is the "Activity-Based Learning Intervention Plan."

Table 4

Activity-Based Learning Intervention Plan

Objectives	Activities/Strategies	Time Frame	Persons Involved	Budget	Success Indicator / Expected Outcome
To present the finding of the study	Presenting the finding of the conducted study and the Intervention Plan to the school head	March 2023	Researcher, School head		Approved Intervention Plan
To conduct orientation to Science teachers	Educating science teachers about activity-based learning at a LAC session	March 2023	Master teachers, teachers, School head		Conducted Orientation
To conduct workshop on daily lesson plan writing based on the activity-based learning approach	Creating a daily lesson plan using the activity-based learning approach Utilizing four DLP techniques: Cooperative learning, Differentiated Instruction, Inquiry Method, Project Method	April 2023	Master teachers, teachers, School head	4,000.00 for bond paper	completed fourth-quarter daily lesson plan
Utilizing the well crafted daily lesson plan to implement activity-based learning	Using the properly crafted daily lesson plan, deliver the fourth-quarter lesson on the activity-based learning strategy.	May 2023	Master teachers, teachers, School head, students	7,000.00 for instructional materials	Accomplishment Report
To monitor the students and the teachers during the implementation phase	Conducting of classroom observation by master teacher and school head	May to July 2023	Master teachers, teachers, School head, students		Classroom Observation Tool (COT)
To evaluate the student's performance in the fourth quarter	Conducting of summative test and Periodical exam	July 2023	Master teachers, teachers	2,000.00 for bond paper	Item Analysis Mean Percentage Score (MPS)
To conduct feedback interview or focused group discussion for the continuation and improvement of the intervention	Conducting feedback interview or focused group discussion	July 2023	Master teachers, teachers, Students	2,000 for snacks	Revised Intervention Plan

4. Conclusions and Recommendations

In the light of the above-cited findings, the following conclusions are drawn from the study:

1. Students' performance with the experimental group who were exposed to activity-based learning revealed that most were Highly Proficient, and the increase of their Mean is High. As a result, all students found activity-based learning to be beneficial in both the teaching and learning processes. The majority of the students in the Control group, who were taught using the traditional method, performed at a level of proficiency that was nearly Proficient, according to their performance. Although not for all students, the traditional method is also effective.
2. In terms of the Control and Experimental groups, there is a significant difference between the students' performance on the pretest and posttest. Both traditional method and activity-based learning were effective, and the students knew more than they did at the beginning of the lesson.
3. The finding derived an intervention, the Activity-Based Learning Intervention Plan, utilizing activity-based learning as the core activity in the delivery of the lessons.

Based on the above findings and conclusions, the following recommendations are presented:

1. The school may provide the teachers with enough instructional materials and training on activity-based learning.
2. Other tests and scales may be used in the study's implementation on a bigger sample, data may be gathered, and the impact of the activity-based learning strategy on success may be examined.
3. The use of activity-based learning may not be limited to Science but in all the learning areas to find out the relative effectiveness of the approach.

REFERENCES

- Abaidoo, Anthony (Author), 2018, Factors contributing to academic performance of students in a Junior High School, Munich, GRIN Verlag, <https://www.grin.com/document/450284>
- Adak, S. (2017). Effectiveness of constructivist approach on academic achievement in science at secondary level. *Academic Journals*, Vol. 12(22), pp. 1074-1079, 23 November, 2017 DOI:10.5897/ERR2017.3298
- Agbenyeku, Elizabeth Umoh (2017) The impact of activity-based method on the performance of Science learners from selected junior secondary schools in Nigeria, University of South Africa, Pretoria,
- Albadi, A. (2019). The Impact of Activity Based Learning on Students' Achievement. A study Among 12 Grade Science and Environment Students in a public School in Oman. *Science Arena Publications Specialty Journal of Knowledge Management*, Vol,4 (4): 44-53 <http://hdl.handle.net/10500/24959>
- Almulla, M.A. (2020). The Effectiveness of the Project-Based Learning (PBL) Approach as a Way to Engage Students in Learning. Retrieved from <https://journals.sagepub.com/doi/pdf/10.1177/2158244020938702>
- Alsalthi, Najeh & Abdelrahman, Rasha & Abdelkader, Atef & Riad, Sheikh & Habboush, Mahmoud & Alqawasmi, Abdellateef. (2021). Impact of Using the Differentiated Instruction (DI) Strategy on Student Achievement in an Intermediate Stage Science Course *International Journal of Emerging Technologies in Learning (IJET)*. 16. 25- 45. 10.3991/ijet.v16i11.22303.
- Al-Shehri, M. (2020). Effect of Differentiated Instruction on the Achievement and Development of Critical Thinking Skills among Sixth-Grade Science Students *International Journal of Learning, Teaching and Educational Research* Vol. 19, No. 10, pp. 77-99, October 2020 <https://doi.org/10.26803/ijlter.19.10.5>

- Andriyani, R. et al 2019. The effectiveness of Project-based Learning on students' science process skills: a literature review. *J. Phys.: Conf.Ser.* 1321 032121
- Anwar, F. (2019). The effect of activity-based teaching techniques on student motivation and academic achievement. *Journal of Education and Educational Development*, 6(1), 154-170
- Bakhru, S. A., & Mehta, R. P. (2020). Assignment and Project Activity based
- Brew, E.A., Nketiah, B. and Koranteng, R. (2021) A Literature Review of Academic Performance, an Insight into Factors and their Influences on Academic Outcomes of Students at Senior High Schools. *Open Access Library Journal*, 8, 1-14. doi: 10.4236/oalib.1107423.
- Caswell, C. J., & LaBrie, D. J. (2017). Inquiry-based Learning from the Learner's Point of View: A Tea
- Celik, H. (2018). The effects of activity based learning on sixth grade students' achievement and attitudes towards mathematics activities. *Eurasia Journal of Mathematics, Science and Technology Education*, vol. 14 (5), pp. 1963-1977.
- Cihad, S. & Sari, H. (2018). Investigation of the contribution of differentiated instruction into science literacy. Retrieved from <https://dialnet.unirioja.es/servlet/articulo?codigo=7593431>
- Coem, JD (2020). Activity Based Teaching-Learning: Today's Need. Retrieved from <https://www.linkedin.com/pulse/activity-based-teaching-learning-todays-need-jd-coem>
- DepEd (2016). Policy Guidelines On Daily Lesson Preparation For The K To 12 Basic Education Program Retrieved from <https://www.Deped.gov.ph/2016/06/17/do-42-s-2016-policy-guidelines-on-daily-lesson-preparation-for-the-k-to-12-basic-education-program/>
- Divrik, R. (2020). The effect of problem posing-based mathematics teaching on fourth grade students' problem solving skills and metacognitive awareness levels. *TurkishStudies-Education*, 15(3), 1729-1750. <https://dx.doi.org/10.29228/TurkishStudies.41503>
- El-sayed, R.M.N. (2020). The Effectiveness of Project-Based Learning in Developing English Oral Communication Skills of Secondary Stage Students. *Journal management sytem* DOI: 10.21608/mrk.2020.111172
- Farnell, P. (2021). Quasi-experimental Design Retrieved from <https://study.com/academy/lesson/quasi-experimental-designs-definition-characteristics-types-examples.html>
- Fernandez-Rio, J., Naira Sanz, Judith Fernandez-Cando & Luis Santos (2017). Impact of a sustained Cooperative Learning intervention on student motivation, *Physical Education and Sport Pedagogy*, 22:1, 89-105, DOI: 10.1080/17408989.2015.1123238
- Gamit, A., Antolin, J. and Gabriel, A. (2017) The Effects of Cooperative learning in Enhancing the Performance Level of Grade-10 Mathematics Students in Talavera National High School in the Philippines. *Journal of Applied Mathematics and Physics*, 5, 2386-2401. doi: 10.4236/jamp.2017.512195.
- Gholam, A. (2019). Inquiry-Based Learning: Student Teachers' Challenges and Perceptions. Retrieved from <https://files.eric.ed.gov/fulltext/EJ1241559>
- Golji, G. G. & Dangpe, A. K. D. (2016). Activity-based learning strategies (ABLS) as best practice for secondary mathematics teaching and learning. *International Advanced Journal of Teaching and Learning*, vol. 2 (9), pp. 106-116.
- Guido, M. (2017). Inquiry-Based Learning Definition, Benefits & Strategies. Retrieved October 26, 2017, from <https://www.prodigygame.com/blog/inquiry-based-learning-definition-benefits-strategies/>
- Haryono, H. E. (2020). The influence of cooperative learning model type group investigation toward results of learning science materials of students. *Jurnal Ilmiah Pendidikan Fisika*, 4(1), 1-6.
- Hein, G E, (1991) 'The significance of constructivism for museum education', in *Museums and the Needs of the People*, Jerusalem. Israel ICOM Committee
- Hew, K.F., Jia, C., Gonda, D.E. et al. (2020). Transitioning to the "new normal" of learning in unpredictable times: pedagogical practices and learning performance in fully online flipped classrooms. *Int J Educ Technol High Educ* 17, Retrieved from <https://doi.org/10.21203/rs.3.rs-41239-020-00234-x>

- Jeong, J., Gonzalez-Gomez, D., Canada, F., Pico, A. and Bravo, J., 2019). Effects of active learning methodologies on the student's emotions, self-efficacy beliefs and learning outcomes in a science distance learning course. *Journal of Technology and Science Education*, [e-journal] 9(2), pp. 217-227. doi:10.3926/jotse.530.
- Kapur, R. (2018). Factors Influencing the Student's Academic Performance in Secondary Schools in India Dr. Radhika Kapur Retrieved from <https://www.researchgate.net/profile/Radhika-Kapur-Kunga>
- Kunga, G.J. (2021). Effects Of Inquiry-Based Science Teaching Approach On Learning Outcomes Of Secondary School Physics Students In Kitui County, Kenya. Retrieved from <http://ir.mksu.ac.ke/handle/123456780/12611>
- Lewis, B. (2019). Teaching Students to Collaborate Effectively. Retrieved from <https://www.thoughtco.com/what-is-cooperative-learning-2081641>
- Masud S, Mufarrih SH, Qureshi NQ, Khan F, Khan S and Khan MN (2019). Academic Performance in Adolescent Students: The Role of Parenting Styles and Socio-Demographic Factors – A Cross Sectional Study From Peshawar, Pakistan. *Front. Psychol.* 10:2497. doi: 10.3389/fpsyg.2019.02497
- Mateen, S. (2021). Project Method: Steps, Types, Principles, Merits and Demerits. Retrieved from <https://www.studyquirk.com/project-method-stepstypesprinciples-merits-and-demerits/>
- Mautushi, Paul (2022). Why Does Academic Achievement Matter? Retrieved from <https://www.orchidsinternationalschool.com/blog/cbse-board/parenting-tips-for-academic-achievement/>
- Molla, E., Muche, M. (2018) Impact of Cooperative Learning Approaches on Students' Academic Achievement and Laboratory Proficiency in Biology Subject in Selected Rural Schools, Ethiopia. *Education Research International*, vol. 2018, Article ID 6202484, 9 pages, 2018. <https://doi.org/10.1155/2018/6202484>
- Narad, A., & Abdullah, B. (2016). Academic Performance of Senior Secondary School Students: Influence of Parental Encouragement and School Environment. *Rupkatha Journal on Interdisciplinary Studies in Humanities*, 8, 12-19. <https://doi.org/10.21659/rupkatha.v8n2.02>
- Nikolopoulou, K. (2022). What is Purposive Sampling? Retrieved from <https://www.scribbr.com/methodology/purposive-sampling/>
- Rajabalee, Y. B., Santally, M. I., & Rennie, F. (2020). Modeling Students' Performances in Activity-Based E-Learning From a Learning Analytics Perspective. *International Journal of Distance Education*, 18(4), 71–93. <https://doi.org/10.4018/IJDET.2020100105>
- Razia, N. & Rana K. (2019). Activity-Based Teaching versus Traditional Method of Teaching in Mathematics at Elementary Level Retrieved from <https://files.eric.ed.gov/fulltext/EJ1229426.pdf>
- Satyapriya, Samaresh Adak (2017). Effectiveness of constructivist approach on academic achievement in science at secondary level Roy College of Education, Kolkata, West Bengal, India.
- Senturk, C. (2018). Investigation of impacts of differentiated instruction applied in a primary school in attitudes of students towards the course. *Cypriot Journal of Educational Science*. 13(2), 487–505.
- Shanmugavelu, Ganesan, Balakrishnan Parasuraman, et al. (2020). Inquiry Method in the Teaching and Learning Process." *Shanlax International Journal of Education*, vol. 8, no. 3, 2020, pp. 6–9. DOI: <https://doi.org/10.34293/education.v8i3.2396>
- Silva, Luiz & Barbosa, Marcelo & Gomes, Rodrigo. (2018). Measuring Participation in Distance Education Online Discussion Forums Using Social Network Analysis. *Journal of the Association for Information Science and Technology*. 70. 10.1002/asi.24080.
- Singal, N., Pedder, D., Malathy, D., Shanmugam, M., Manickavasagam, S. & Govindarasan, M. (2018). Insights from within activity based learning (ABL) classrooms in Tamil Nadu, India: 59 Teachers perspectives and practices. *International Journal of Educational Development*, vol. 60, pp. 165-171.
- Singh, S. P., Malik, S. & Singh, P. (2016). Factors affecting academic performance of students. *Indian Journal of Research*, 5(4), 176-178.

- Smale-Jacobse AE, Meijer A, Helms-Lorenz M and Maulana R (2019) Differentiated Instruction in Secondary Education: A Systematic Review of Research Evidence. *Front. Psychol.* 10:2366. doi: 10.3389/fpsyg.2019.02366
- Snowie Balansag (Author), 2018, Improvement of the Teaching Style. From Traditional Teacher-Centered to Student-Centered Teaching Style, Munich, GRIN Verlag, <https://www.grin.com/document/496335>
- Suhendi, A., Purwarno, P., & Chairani, S. (2021). Constructivism-Based Teaching and Learning in Indonesian Education. *KnE Social Sciences*, 5(4), 76-89. Retrieved from <https://doi.org/10.18502/kss.v5i4.8668>
- Teed, R., Mcdaris J., Roseth C. (2017). Cooperative Learning. Retrieved from <https://serc.carleton.edu/sp/library/cooperative/index.html>
- Theobald, E. J., Hill, M. J., Tran, E., Agrawal, S., Arroyo, E. N., Behling, S., Chambwe, N., Cintr3n, D. L., Cooper, J. D., Dunster, G., Grummer, J. A., Hennessey, K., Hsiao, J., Iranon, N., Jones, L., Jordt, H., Keller, M., Lacey, M. E., Littlefield, C. E., ... Freeman, S. (2020). Active learning narrows achievement gaps for underrepresented students in undergraduate science, technology, engineering, and math. *Proceedings of the National Academy of Sciences*, 117(12), 6476–6483.
- Tisha Emerson, Jennifer Lewis, J. Todd Swarthout (2018). *Pedagogy in Action*
- Tucker, G. (2021). What is differentiated Instruction? Retrieved from <https://www.understood.org/en/articles/differentiated-instruction-what-you-need-to-know>
- Upang Septa, Putra, Muhsinatu, Siasah Masruri (2018). The Effect of Inquiry Method on Geography Learning Result. DOI: <https://doi.org/10.2991/iccie-18.2019.88>
- Utami, Budi & Probosari, Riezky & Saputro, Sulistyo & Ashadi, & Masykuri, Mohammad. (2019). Empowering critical thinking skills with problem solving in higher education. *Journal of Physics: Conference Series* 1280. 032047. 10.1088/1742-6596/1280/3/032047. Conference Series, Vol 1 No. 2, 124-130.
- Vishwaroop, A. (2022). Project Method of Teaching. Retrieved from <https://blog.teachmint.com/project-method-of-teaching/>
- Williams, Ellie (2018). Academic Performance. Retrieved from <https://work.chron.com/meaning-academic-performance-17332.html>
- Zhou, R.-L., & Luh, D.-B. (2021). Activity Design of Nature Experience Teaching (pp. 269–275). <https://doi.org/10.1007/978-3-030-80000->