



Effect of Collaborative Learning on Elementary School Students' Academic Achievement in Science

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Abstract: Science is essential for human life because it enables humans to cope with modern challenges. Effective teaching methods help students enhance their performance in science. This study aimed to examine the effect of collaborative teaching on the academic achievement of grade 8 students in science. The study was experimental with a pretest-posttest-nonequivalent control group design. Grade 8 students of a government elementary school in district Vehari participated in the study. A science achievement test developed by the school examination committee measured the students' academic achievements. There were 23 students in the control group and 20 – in the experimental group. The intervention for the experimental group was in the form of a collaborative teaching method for 12 weeks. The same pretest and post-tests were for the control and experimental groups. The results obtained from the tests were analyzed using the independent samples t-test. There was a significant difference between the mean scores of both groups. The experimental group got a higher score than the control group. We concluded that the collaborative method enhanced elementary school students' achievement in science.

Keywords: science, achievement, elementary school students.

协作学习对小学生科学学业成绩的影响

摘要：科学对人类生活至关重要，因为它使人类能够应对现代挑战。有效的教学方法有助于学生提升科学表现。本研究旨在探讨协作教学对八年级科学学生学业成绩的影响。研究采用前测后测非等效对照组设计进行实验。维哈里区一所公立小学的八年级学生参加了这项研究。学校考试委员会制定的科学成绩测验衡量学生的学业成绩。对照组有23名学生，实验组20名学生。实验组的介入采用协作教学方式，为期12周。对照组和实验组进行相同的前测和后测。使用独立样本t检验对测试获得的结果进行分析。两组的平均分之间显著差异。实

驗組的得分高於控制組。 , 協作方法提高了小學生的科學成績。

关键词：科學、成就、小學生。

1. Introduction

Collaborative learning focuses on distributing students in small groups for shared one. It helps students of heterogeneous groups with diverse learning needs [7, 12, 25, 38, 45]. Students of different social, economic, and cultural backgrounds have different learning needs. If these students have opportunities to share ideas through collaboration, learning becomes interesting [11, 13, 18, 19, 41]. Interest in learning leads to better academic achievement. In collaborative learning, students understand and share their ideas with peers. The sharing of ideas enables them to understand the academic content and achieve higher academic achievement [3, 4, 8, and 43].

Traditional teaching methods are teacher-centered, and students remain passive in these methods. The lecture method is general in science subjects. The literature reveals that the lecture method is not suitable for students' better performance [1, 6]. Students belonging to different cultural backgrounds and having diverse cultural needs cannot learn through such teaching methods. Such students require sharing ideas and active participation to learn effectively [2, 5, 17, 37]. Therefore, effective teaching methods, strategies, and approaches should be used for teaching science subjects.

Pakistan is a diverse culture country. Students belong to different cultural backgrounds. They have diverse learning needs. Therefore, effective teaching methods, strategies, and approaches should apply to Pakistani students [30, 40, 44]. Unfortunately, most Pakistani classrooms do not use effective teaching methods [16, 28]. The literature reveals that the teacher remains an authority in the classroom, and students remain passive. Students cannot freely share their ideas with their peers and teachers. Collaborative learning enables students to comprehend scientific ideas in a better way [9, 20, 24, 27, 21, 36, 35, 42]. This situation induced the researcher to conduct this study.

2. Literature Review

The education system of Pakistan originates from British India. After the 18th amendment in the constitution of Pakistan, changes took place in the education system since 2010. Traditionally, primary elementary and secondary levels exist in the school education system. Moreover, 'Kachi' and 'Pakki,' were the two stages for the students before entering primary school education [14].

According to this school education system, early childhood education has become a system part. The age

group for early childhood education is 3-5. The age group for primary education is 6-10, for middle classes 11-13, and for high classes (9-10) the age group is 14-15 [14]. The researcher selected middle-level of education and class 8 for the study. The age group of the study participants is, therefore, 11-13 years.

Middle-level education is a bridge to secondary education in Pakistan. At the secondary school level in Pakistan, knowledge of science subjects includes three main branches: Biology, Chemistry, and Physics [14]. Therefore, middle-level students should find a better way to cope with the challenges of new subjects at the secondary school level. Unfortunately, there is no recommended methodology for teaching science subjects at the school level in Pakistan.

The literature reveals that most teachers apply teaching-centered approaches and methods to deliver the content of science subjects [15]. The researcher, therefore, decided to conduct the study at the middle school level. The curriculum of middle-level education includes English, Urdu, science, mathematics, social sciences, and Islamiyat (for Muslims). Non-Muslim students study Akhlaqiat (Moral education) instead of Islamic studies. The content of the science of 8th class includes ecology, the human nervous system, variation, heredity and cell division, biotechnology, the periodic table, chemical reactions, acids, bases and salts, force and pressure, reflection and refraction of light, electricity and magnetism, technology in everyday life, and our universe [33]. The researcher taught the first four units to the students in 12 weeks. The school administration has decided to complete the book in three phases, with four units in each phase. At the end of each phase, an examination takes place across the province. Therefore, the researcher lasted the intervention for 12 weeks and taught four units.

As discussed earlier, no innovative teaching method recommended by the government exists for teaching science. The teachers at the primary and elementary schools use the textbook reading method. Lacking scientific laboratories and apparatuses, teachers do not involve their students in practical activities. Collaboration among students with their peers and teachers is almost absent. The cooperative method helps students understand scientific concepts in a better way [10, 23].

Different types of collaborative methods exist in schools in different contexts worldwide. The collaborative learning process can occur either peer to peer or within a small group. It can also occur in relatively large groups [32, 39]. A special form of

cooperative learning is reciprocal learning or reciprocal teaching. Peer learning or peer instruction involves learners working together in pairs or small groups of 3 to 4 members. The group members or peers in peer learning actively involve them in discussions to find solutions to problems. Peer learning relies on the concept that two or more brains work better than one. Learners learn from each other by clarifying misconceptions and addressing misunderstandings [22, 34, 47]. Understanding the importance of small-group collaborative learning, the researcher adopted it in this study.

3. Theoretical Framework

Social constructivism supports this study. Russian educationist Lev Vygotsky posits that the community of students is the main source of knowledge [46]. His theory of social constructivism emphasizes social interaction for developing new knowledge. According to the theory, individual development is not possible without a social context. The conversation with a more knowledgeable person develops ideas and concepts. The conversation between students with less knowledge and those with more knowledge is said to be collaborative dialog. This study was conducted in the context of social constructivism.

Several studies have been conducted worldwide to assess the effectiveness of collaborative learning for students' academic achievement and overall performance. [2] conducted a comparative study to determine the effectiveness of collaborative learning and lecture methods. He found that the students taught through the collaborative learning method got a higher score than the students taught through the lecture method. [13] found a positive significant effect of collaborative learning on students' academic achievement in science. [38] also found that collaborative learning increases students' academic achievement levels.

[4] in 2015 found a positive effect of collaborative learning on students' academic achievement in science at the elementary school level. [43] also found the collaborative learning method effective for students' academic achievement in science. [28] conducted a study to determine the effect of cooperative learning on the academic achievement of elementary school students in science. They found a positive effect of cooperative learning on students' academic achievement. [17] conducted a study to determine the effect of cooperative learning on students' academic achievement and found that cooperative learning facilitates students to enhance their academic achievement in science.

[26] conducted a study to determine the effect of collaborative learning on students' achievement. He found that collaborative learning enhanced students' academic achievement in science. The authors of [31] conducted a study to determine the effect of

cooperative learning on the academic achievement of elementary school students in science. They conducted their study in Pakistan to assess the enhancement of the academic achievement of elementary school students in science through collaborative learning. They found that collaborative learning enhanced students' academic achievement in science. [19] also conducted a study to assess the effect of cooperative learning on students' academic achievement and found that cooperative learning enhanced students' academic achievement. It can be analyzed from the above discussion that collaborative learning enhanced students' academic achievement in science.

3.1. Objective of the Study and Hypothesis

The objective of this study was to investigate the effect of collaborative learning on academic achievement.

There was no significant difference in the mean scores of the control and experimental groups.

4. Methodology

This study was experimental. A quasi- experimental design with a pretest posttest nonequivalent control group was selected. A quantitative approach was used to collect data on students' academic achievement. A research instrument developed by the school examination committee was adapted to measure students' academic achievement.

A pretest was conducted for the control and experimental groups. The nature and content of the test items were the same for both groups. After the pretest, the intervention was started for the experimental group. The experimental group received an intervention in the form of collaborative learning. The participants in the experimental group were divided into small groups. They share their ideas with their peers and teachers. The control group participants did not receive intervention in the form of collaborative learning. They were taught through the traditional lecture method. The intervention lasted for 12 weeks. After completing the intervention, a posttest was conducted for both groups. Posttest was the same for both the groups.

5. Results

Before analyzing the data, the normality and homogeneity of variance of the data were checked. The assumptions of normality and homogeneity of variance for the data of the pretest were fulfilled. A summary of the normality and homogeneity of variance of the data is in Table 1.

Table 1 The Shapiro–Wilk test of normality for the pre-test

Group	Statistic	df	P
Control	.92	23	.06
Experimental	.91	20	.07

Table 1 shows that the data of the pretest are normal

as $P > .05$. Levene's test was applied to check the equality of variances.

Table 2 Levene's test for equality of variances of the pre-test

Assumption of variance	F	P
Equal variances assumed	2.49	.12
Equal variances not assumed		

Table 2 shows that $P > .05$, therefore equality of variances has been proved. Both the assumptions of the t-test were fulfilled. Therefore, t-test was applied. The control and experimental groups were independent from each other. Therefore, an independent-samples t-test was applied for the mean score comparison. The summary is below.

Table 3 Independent-samples t-test on pre-test of the control and experimental groups

Group	N	M	S.D	Df	t	P(2-tailed)
Control	23	23.83	3.13	41	.30	.77
Experimental	20	23.47	4.51			

Table 3 illustrates that the difference in the mean cores of the control group and the experimental group is not significant as $P > .05$. Therefore, it was found that initially both the groups were at the same level.

The normality and homogeneity of variance for the post-test data were also found. It was found that the assumptions of normality and homogeneity of variance were not fulfilled. This indicated that the data were nonparametric. A summary of the normality test and homogeneity of variance has been given in the tables.

Table 4 The Shapiro–Wilk normality test for post-test

Group	Statistic	df	P
Control	.89	23	.01
Experimental	.84	20	.00

Table 4 shows a summary of the Shapiro–Wilk normality test. The results indicate that the data are not normal. It revealed that the assumptions of the t-test have not been fulfilled. Therefore, a non-parametric test is applied if the data are not normal. Independent samples–Mann–Whitney U test compared the medians of the control and experimental groups. Table 5 contains a summary of the results.

Table 5 Independent-samples Mann–Whitney U-test on post-test

	Values
Mann–Whitney	437.500
Wilcoxon W	647.500
Test statistic	437.500
Standard error	40.814
Standardized test statistic	5.084
Asymptotic significance (2-tailed)	.000

An independent-samples Mann–Whitney U test was applied to compare the medians of both the groups ($N=43$) in the pretest. The results revealed that the Mann–Hitney statistic was 437.500 and the Wilcoxon–W statistic was 647.500. The test statistic was 437.500,

and the standard error was 40.814. The standardized test statistic was 5.084, indicating a large effect size. The asymptotic significance (2-tailed) was 0.000, indicating a statistically significant difference between the two groups.

6. Discussion

The findings of this study revealed a positive effect of collaborative learning on students' academic achievement in science. The study confirms the findings of a study [28] to find the effect of cooperative learning on the academic achievement of elementary school students in science. They found a positive effect of cooperative learning on students' academic achievement. This study also confirms the findings of [28]. This study also confirms the findings of study conducted in Pakistan [31] that assessed the enhancement of the academic achievement of elementary school students in science through collaborative learning and found that collaborative learning enhanced students' academic achievement in science.

The present study also confirms the findings of some other studies conducted in Pakistan, i.e., the studies conducted by [38, 2, and 17]. This study also confirms the findings of studies conducted in other countries. This study confirms the findings of [4] that found a positive effect of collaborative learning on students' academic achievement in science at the elementary school level. This study also confirms the findings of [13, 43, 26, and 19].

7. Conclusion and Recommendations

The study findings indicate no significant difference between the mean score of the control and experimental groups in the pretest, meaning that initially, these groups had the same academic score. The study findings also show a significant difference between the mean scores of the control and experimental groups in the posttest, revealing that the experimental group achieved a score significantly better than the control group. Based on the study findings, the null hypothesis has been rejected. Therefore, we can conclude that collaborative learning significantly and positively affects students' academic achievement in science.

This study has proved the theory of social constructivism in the Pakistani context. This experimental study is innovative in Pakistan, as the study has a rural context. Most of the studies took place in girls' schools located in urban areas. This study has contributed new findings related to the rural context of Pakistan. Future research may take place in other rural areas of Pakistan.

This study has demonstrated the enhancement of elementary school student's academic achievement in science through collaborative learning. Different

studies worldwide reported a positive effect of collaborative learning on students' academic achievement. Therefore, it should apply in Pakistani classrooms at the elementary school level.

The curriculum developers should include the content and activities helpful for the students and recommend collaborative learning for science teachers. Teacher training institutes may involve collaborative learning in their scheme of studies to provide opportunities for prospective teachers to use it. Education authorities may train in-service science teachers to use collaborative learning in classrooms.

References

- [1] AHMAD Z., and MAHMOOD N. Effects of cooperative learning vs. traditional instruction on prospective teachers' learning experience and achievement. *Journal of Faculty of Educational Sciences*, 2010, 43(1): 151-164.
- [2] ALI H. A comparison of cooperative learning and traditional lecture methods in the project management department of a tertiary level institution in Trinidad and Tobago. *The Caribbean Teaching Scholar*, 2011, 1(1): 49-64.
- [3] ALMASRI A. The effect of group work on the students achievement. *Multi-Knowledge Electronic Comprehensive Journal for Education and Science Publications*, 2018, 8: 1-12.
- [4] ALTUN S. The effect of cooperative learning on students' achievement and views on the science and technology course. *International Electronic Journal of Elementary Education*, 2015, 7(3): 451-468.
- [5] ANWER M., TATLAH I.A., and BUTT I.H. Effect of cooperative learning on students' achievement in English tenses. *Pakistan Journal of Education*, 2018, 35(2): 37-52
- [6] ARIF M., MAHMOOD T.S., MAHMOOD A., and PARVEEN Q. Effect of cooperative learning on academic achievement of 8th grade students in the subject of social studies. *International Journal of Academic Research*, 2011, 9: 950-954.
- [7] CASEY A., and GOODYEAR V.A. Model fidelity and students' responses to an authenticated unit of cooperative learning. *Journal of Teaching in Physical Education*, 2015, 34: 642-660.
- [8] CASEY A., and FERNANDEZ-RIO J. Cooperative learning and the affective domain. *Journal of Physical Education, Recreation and Dance*, 2019, 90(3): 12-17.
- [9] CHAI K.C., TAY K.M., and LIM C.P. A new fuzzy peer assessment methodology for cooperative learning of students. *Applied Soft Computing*, 2015, 32(3): 468-480.
- [10] CHANG Y., and BRICKMAN P. When group work doesn't work: Insights from students. *CBE Life Science Education*, 2018, 17(3): 1-17.
- [11] CHENGL F., WU C., and SU P. The impact of collaborative learning and personality on satisfaction in innovative teaching context. *Frontiers in Psychology*, 2021, 12: 45-58.
- [12] CIGDEMOGLU C., KAPUSUZ K.Y., and KARA A. Heterogeneity in classes: Cooperative problem-solving activities through cooperative learning. *Croatian Journal of Education*, 2015, 16(4): 999-1029.
- [13] EBRAHIM A. The effect of cooperative learning strategies on elementary students' Science achievement and social skills in Kuwait. *International Journal of Science and Mathematics Education*, 2012, 14: 293-314.
- [14] GOVERNMENT OF PAKISTAN. *National Educational Policy*. Ministry of Education, 2017.
- [15] GOVERNMENT OF PAKISTAN. *Pakistan Economic survey, 2021-2022*. Finance Division, 2023.
- [16] HALAI N., and KHAN M.A. Developing pedagogical content knowledge of science teachers through action research: A case study from Pakistan. *Asia Pacific Forum on Science Teaching and Learning*, 2011, 12(1): 31-48.
- [17] HOSSEINI K. The effect of cooperative learning on the student's academic achievement. *European Journal of Education Studies*, 2017, 22: 319-328.
- [18] JOHNSON D.W., and JOHNSON R.T. Cooperative Learning in 21st Century. *Annals of Psychology*, 2014, 30(3): 841-851.
- [19] KAYMAK S., KASSYMBEK Z., KALAMKAS A., and SAYDENOV F. The effect of cooperative learning on students academic achievement. *Management Studies*, 2021, 9(6): 495-503.
- [20] KHAN G.N., and INAMULLAH H.M. Effect of student's team achievement division (STAD) on academic achievement of students. *Asian Social Science*, 2011, 7(12): 211-215.
- [21] KIBIRIGE I., and LEHONG M.J. The effect of cooperative learning on Grade 12 learners' performance in projectile motions, South Africa. *Eurasia Journal of Mathematics, Science and Technology Education*, 2016, 12(9): 2543-2556.
- [22] KUWABARA N. EINBINDER S.D., SUN S.D., and AZIZI R. Collaborative learning techniques, student learning outcomes, and equal workload within groups in different teaching modalities. *International Journal of Teaching and Learning in Higher Education*, 2020, 32(2): 293-304.
- [23] LAAL M., and GHODSI S.M. Benefits of collaborative learning. *Procedia – Social and Behavioral Sciences*, 2012, 31: 486-490.
- [24] LAU P., KWONG T., CHONG K., and WONG E. Developing students' teamwork skills in a cooperative learning project. *International Journal for Lesson and Learning Studies*, 2014, 3(1): 80-99.
- [25] LIU T., and LIPOWSKI M. Influence of cooperative learning intervention on the intrinsic motivation of physical education students—a meta-analysis within a limited range. *International Journal of Environment Public Health*, 2021, 18: 29-43.
- [26] MEHAR R., and SINGH N. Effect of cooperative learning strategy on achievement in science in relation to attitude towards science. *International Journal of Research and Analytical Reviews*, 2018, 5(2): 440-448.
- [27] MENDO-LAZARO S., LEON-DEL-BARCO B., POLO-DEL-RÍO M., and LOPEZ-RAMOS V.M. The impact of cooperative learning on university students' academic goals. *Frontiers in Psychology*, 2022, 12: 78-92.
- [28] NAJMONNISA, and SAAD I. The role of cooperative learning method in teaching of science subject at elementary school level: An experimental study. *Bulletin of Education and Research*, 2017, 39(2): 1-17.
- [29] NERONA G.G. Effect of collaborative learning strategies on student achievement in various engineering courses. *International Journal of Engineering Education*, 2019, 1(2): 114-121.
- [30] PARVEEN Q., and BATOOL S. Effect of cooperative

learning on achievement of students in general science at secondary level. *International Education Studies*, 2012, 5(2): 154-158.

[31] PARVEEN S., AKHTER M., and SAHAR B. Effect of collaborative learning strategies on student's science achievement at the elementary level. *Pakistan Social Sciences Review*, 2018, 3(2): 407-423.

[32] PHUA J., JIN S.V., and KIM J. Gratifications of using Facebook, Twitter, Instagram, or Snapchat to follow brands: The moderating effect of social comparison, trust, tie strength, and network homophily on brand identification, brand engagement, brand commitment, and membership intention. *Telematics and Informatics*, 2017, 34(1): 412-424.

[33] GOVERNMENT OF PUNJAB. *Punjab Curriculum and Textbook Board*. 2023. <https://pctb.punjab.gov.pk/E-Books>

[34] PUZIO K., and COLBY G.T. Cooperative learning and literacy. *Journal of Research on Educational Effectiveness*, 2013, 6(4): 339-360.

[35] RABGAY T. The effect of using cooperative learning method on tenth grade students' learning achievement and attitude towards biology. *International Journal of Instruction*, 2018, 11(2): 265-280.

[36] RAHMAN A., AHMAR A., and RUSLI R. The influence of cooperative learning models on learning outcomes based on students' learning styles. *World Transactions on Engineering and Technology Education*, 2016, 14(3): 41-58.

[37] RAJAB I., and IBRAHIM A. Effectiveness of cooperative learning in improving mathematical concepts among students with mild disabilities. *European Journal of Education Studies*, 2017, 12: 163-171.

[38] REZA K.M., ABOZAR H.R., ALI E.N., and AKBAR H. The impact of cooperative learning on students' science academic achievement and test anxiety. *Journal of Educational Innovations*, 2013, 11(44): 83-98.

[39] ROSELLI N.D. Collaborative Learning: A model of strategies to apply in university teaching. *Journal of Education and Social Policy*, 2017, 4(2): 113-120.

[40] SAEEDULLAH, and AKBAR R.A. Effect of metacognition on mathematical reasoning among secondary school students. *Elementary Education Online*, 2020, 19(3): 3321-3325.

[41] SCHWIEGER F., GROS E., and BARBERAN L. Lessons from the culturally diverse classroom: Intellectual challenges and opportunities of teaching in the American university. *College Teaching*, 2010, 58(4): 148-155.

[42] SHAH A.S. Effect of cooperative learning on university research scholars: achievements in learning statistical software. *Research Journal of PNQAHE*, 2021, 2(1): 1-17.

[43] SLAVIN R.E. Cooperative learning in elementary schools. *International Journal of Primary, Elementary and Early Years Education*, 2015, 43(1): 5-14.

[44] SULTANA M., and ZAKI S. Proposing project based learning as an alternative to traditional ELT pedagogy at public colleges in Pakistan. *International Journal for Lesson and Learning Studies*, 2015, 4(2): 155-173.

[45] TRAN V.D. Does cooperative learning increase students' motivation in learning? *International Journal of Higher Education*, 2019, 8(5): 12-20.

[46] VYGOTSKY L.S. *Mind in Society: The Development*

of Higher Psychological Processes. Harvard University Press, 1978.

[47] WECKER C., and FISCHER F. Where is the evidence? A meta-analysis on the role of argumentation for the acquisition of domain-specific knowledge in computer-supported collaborative learning. *Computers and Education*, 2014, 75: 218-228.

參考文:

[1] AHMAD Z. 和 MAHMOOD N. 合作學習與傳統教學對未來教師學習經驗和成就的影響

。教育科學學院學報，2010，43(1)：151-164。

[2] ALI H. 特立尼達和多巴哥某高等教育機構計畫管理部門合作學習與傳統講座方法的比較。加勒比海教學學者，2011，1(1)：49-64。

[3] ALMASRI A. 教育科學出版多元知識電子綜合期刊，2018，8：1-12。

[4] ALTUN S. 合作學習對學生成績和對科技課程看法的影響。國際基礎教育電子雜誌，2015，7(3)：451-468。

[5] ANSWER M.、TATLAH I.A. 和 BUTT I.H. 合作學習對學生英語時態成績的影響。巴基斯坦教育雜誌，2018，35(2)：37-52

[6] ARIF M.、MAHMOOD T.S.、MAHMOOD A. 和 PARVEEN Q. 合作學習對社會研究學科八年級學生學業成績的影響。國際學術研究雜誌，2011，9：950-954。

[7] CASEY A. 和 GOODYEAR V.A. 模型保真度和學生對經過驗證的合作學習單元的反應。體育教學學報，2015，34：642-660。

[8] CASEY A. 和 FERNANDEZ-RIO J. 合作學習和情緒領域。體育、遊藝與舞蹈學報，2019，90(3)：12-17。

[9] CHAI K.C.，TAY K.M. 和 LIM C.P. 一種用於學生合作學習的新模糊同儕評估方法。應用軟體計算，2015，32(3)：468-480。

[10] CHANG Y. 和 BRICKMAN P. 當小組工作不起作用時：學生的見解。歐洲商業教育協會生命科學教育，2018，17(3)：1-17。

[11] CHENGL F.，WU C.，SU P. 創新教學環境中協同學習與個性對滿意度的影響。心理學前沿，2021，12：45-58。

[12] CIGDEMOGLU C.、KAPUSUZ K.Y. 和 KARA A. 班級異質性：透過合作學習合作解決問題的活動。克羅

- 埃西亞教育雜誌，2015，16(4)：999-1029。
- [13] EBRAHIM A. 合作學習策略對科威特小學生科學成績與社交技能的影響。國際科學與數學教育雜誌，2012，14：293-314。
- [14] 巴基斯坦政府。國家教育政策。教育部，2017。
- [15] 巴基斯坦政府。巴基斯坦經濟調查，2021-2022年。財務部，2023。
- [16] HALAI N. 和 KHAN M.A. 透過行動研究發展科學教師的教學內容知識：來自巴基斯坦的案例研究。亞太科學教學論壇，2011，12(1)：31-48。
- [17] HOSSEINI K. 合作學習對學生學業成績的影響。歐洲教育研究雜誌，2017，22：319-328。
- [18] JOHNSON D.W. 和 JOHNSON R.T. 21世紀的合作學習。心理學年鑑，2014，30(3)：841-851。
- [19] KAYMAK S.、KASSYMBEK Z.、KALAMKAS A. 和 SAYDENOV F. 合作學習對學生學業成績的影響。管理研究，2021，9(6)：495-503。
- [20] KHAN G.N. 和 INAMULLAH H.M. 學生團隊成就劃對學生學業成績的影響。亞洲社會科學，2011，7(12)：211-215。
- [21] KIBIRIGE I. 和 LEHONG M.J. 合作學習對 12 年級學習者拋射運動表現的影響，南非。歐亞數學科技教育學報，2016，12(9)：2543-2556。
- [22] KUWABARA N. EINBINDER S.D.、SUN S.D. 和 AZIZI R. 協作學習技術、學生學習成果以及不同教學模式中小組內的平等工作量。國際高等教育教學雜誌，2020，32(2)：293-304。
- [23] LAAL M. 和 GHODSI S.M. 協作學習的好處。普羅奇迪亞-社會與行為科學，2012年，31：486-490。
- [24] LAU P.、KWONG T.、CHONG K. 和 WONG E. 在合作學習計畫中培養學生的團隊合作技能。國際課程與學習研究雜誌，2014，3(1)：80-99。
- [25] LIU T. 和 LIPOWSKI M. 合作學習介入對體育學生內在動機的影響 - 有限範圍內的統合分析。國際環境公共衛生雜誌，2021，18：29-43。
- [26] MEHAR R. 和 SINGH N. 合作學習策略對與科學態度有關的科學成就的影響。國際研究與分析評論雜誌，2018，5(2)：440-448。
- [27] MENDO-LAZARO S.、LEON-DEL-BARCO B.、POLO-DEL-RÍO M. 與 LOPEZ-RAMOS V.M. 合作學習對大學生學業目標的影響。心理學前沿，2022年12月：78-92。
- [28] NAJMONNISA 和 SAAD I. 合作學習方法在小學科學科目教學中的作用：一項實驗研究。教育與研究通報，2017，39(2)：1-17。
- [29] NERONA G.G. 協作學習策略對學生在各種工程課程中的成績的影響。國際工程教育雜誌，2019，1(2)：114-121。
- [30] PARVEEN Q. 和 BATOOL S. 合作學習對中學一般科學學生成績的影響。國際教育研究，2012，5(2)：154-158。
- [31] PARVEEN S.、AKHTER M. 和 SAHAR B. 協同學習策略對學生小學科學成績的影響。巴基斯坦社會科學評論，2018，3(2)：407-423。
- [32] PHUA J.、JIN S.V. 和 KIM J. 使用臉書、推特、Instagram或快照跟隨品牌：社會比較、信任、關係強度的調節作用以及品牌識別、品牌參與度、品牌承諾的網路同質性，和會員意願。遠距資訊處理與資訊學，2017，34(1)：412-424。
- [33] 旁遮普邦政府。旁遮普課程和教科書委員會。2023。<https://pctb.punjab.gov.pk/E-Books>
- [34] PUZIO K. 和 COLBY G.T. 合作學習和識字。研究雜誌教育實效，2013，6(4)：339-360。
- [35] RABGAY T. 使用合作學習方法對十年級學生學業成績和生物學態度的影響。國際教學雜誌，2018，11(2)：265-280。
- [36] RAHMAN A.、AHMAR A. 和 RUSLI R. 基於學生學習風格的合作學習模式對學習成果的影響。世界工程技術教育學報，2016，14(3)：41-58。
- [37] RAJAB I. 和 IBRAHIM A. 合作學習在改善輕度殘疾學生數學概念方面的有效性。歐洲教育研究雜誌，2017年，12：163-171。
- [38] REZA K.M.，ABOZAR H.R.，ALI E.N. 和 AKBAR H. 合作學習對學生科學學業成績和考試焦慮的影響。教育創新雜誌，2013，11(44)：83-98。
- [39] ROSELLI N.D. 協同學習：應用於大學教學的策略模型。教育與社會政策雜誌，201

7, 4(2) : 113-120。

[40] SAEEDULLAH 和 AKBAR R.A.

後設認知對中學生數學推理的影響。初等教育在線, 2020, 19(3): 3321-3325.

[41] SCHWIEGER F., GROS E. 和 BARBERAN L.

來自文化多元化課堂的教訓：美國大學教學的智力挑戰和機會。大學教學, 2010, 58(4) : 148-155。

[42] SHAH A.S. 合作學習對大學研究學者的影響：

學習統計軟體的成果。巴基斯坦高等教育品質保證網絡研究期刊, 2021, 2(1): 1-17.

[43] SLAVIN R.E. 小學合作學習。國際初等教育雜誌,

2015, 43(1) : 5-14。

[44] SULTANA M. 和 ZAKI S.

提議以專案為基礎的學習作為巴基斯坦公立大學傳統英語教學教學法的替代方案。國際課程與學習研究雜誌, 2015, 4(2) : 155-173。

[45] TRAN V.D.

合作學習能否提升學生的學習動機？國際高等教育雜誌, 2019, 8(5) : 12-20。

[46] VYGOTSKY L.S.

社會中的心靈：高級心理過程的發展。哈佛大學出版社, 1978。

[47] WECKER C. 和 FISCHER F.

證據在哪裡？關於論證在電腦支援的協作學習中獲取特定領域知識的作用的薈萃分析。電腦與教育, 2014, 75 : 218-228。