









THE EFFECT OF PEER-ASSISTED LEARNING ON MEDICAL LABORATORY SCIENCE STUDENTS' ACHIEVEMENT

Sahar Elderdiri Gafar Osman ¹  , Egbal Ahmed Basheir Abukaraig ² , Nasr Mohamed Ahmed Elsheikh ³ , Mohammed Albagir Ali Alameen ⁴ , Ehab Mohammed Elmadenah Mohammed Ahmed ⁵ , Albara Ahmed Abdulfatah Mohammed ⁵ , Osman Mohammed Almahi ⁶ ,

¹ Department of Histopathology and Cytology, Program of Medical Laboratory Science, Alfajr College for Science and Technology, Khartoum, Sudan

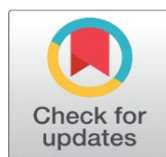
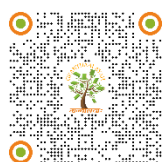
² Director of the Research and Development Centre, Alfajr College for Science and Technology, Khartoum, Sudan

³ Department of Prosthodontics, Faculty of Dentistry, The National Ribat University, Khartoum, Sudan

⁴ Dean of Alfajr College for Science and Technology Khartoum, Sudan

⁵ Department of Hematology, Program of Medical Laboratory Science, Alfajr College for Science and Technology, Khartoum, Sudan

⁶ Coordinator of Medical Laboratory Science Program, Alfajr College for Science and Technology, Khartoum, Sudan



Received 27 October 2022
Accepted 28 November 2022
Published 08 December 2022

Corresponding Author

Sahar Elderdiri Gafar Osman,
sahardirdery@yahoo.com

DOI [10.29121/granthaalayah.v10.i11.2022.4900](https://doi.org/10.29121/granthaalayah.v10.i11.2022.4900)

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Copyright: © 2022 The Author(s). This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).

With the license CC-BY, authors retain the copyright, allowing anyone to download, reuse, re-print, modify, distribute, and/or copy their contribution. The work must be properly attributed to its author.

ABSTRACT

Background: There was an urgent need for peer-assisted learning in the medical laboratory science program following examination failure in hematology, microbiology, and parasitology courses. **Aim:** The present study aimed to explore the effect of peers in supporting the low achiever medical laboratory science students at Alfajr College for Science and Technology. **Methods:** An experimental study was conducted at the medical laboratory science program. According to final exam results for the end-of-semester three all low achiever students in hematology [N=76/124 (61%)], microbiology [N=61/124 (49%)], parasitology [N=54/124 (48%)] and chemical pathology [N= 55/125 (36%)] courses assigned to peer-assisted learning groups by high achiever students (senior) under the lecturers' supervision. The results of the end-of-semester four were compared to the end-of- semester three exam results, and the differences in achievement were measured. **Results:** Students' achievements were significantly higher in the semester four final exam in parasitology, hematology, microbiology, and chemical pathology courses (P. value= <0.001 ; <0.001 , <0.001 and <0.001), respectively. No significant differences in the histopathology course (P. value= 0.511). On the other hand, the achievement of high achiever students was significantly improved in parasitology (P. value= 0.006), while in microbiology and hematology courses was not (P. value= 0.046, and <0.001) respectively. **Conclusions:** Peer-assisted learning significantly positively affects low-achiever students. However, further research into peer-assisted learning on high-achievers as supporter students' is required.

Keywords: Low Achiever Students, Peer-Assisted Learning, Sudan



1. INTRODUCTION

The origins and history of organized peer-assisted learning (PAL) are back to two British educators in the late 18th and early 19th centuries. The first was called Andrew Bell in 1789 Madras, India schools, followed by Joseph Lancaster in 1801 London, England. Then together they developed the Bell-Lancaster system that each class paired into tutors and tutees under teacher-assistant supervision in 1988 [Fuchs et al. \(1997\)](#). Then peer-assisted learning expanded into various professions and fields and takes different forms in terms of setting, structure, duration, scope, and targeted area [Tariq \(2005\)](#), [Pereira et al. \(2021\)](#). Peer-assisted learning is a sort of cooperation in teaching and learning methods. Currently, PAL is defined as the transference of knowledge and practice from one student to another, whereby peers assist each other in the educational process [Gogus \(2012\)](#), [Sari et al. \(2017\)](#).

The peers share a similar social status, experience, knowledge base, and environment and are not professional teachers who support each other to learn by teaching [Bermingham et al. \(2022\)](#), [Burgess et al. \(2020\)](#). This process is defined by different authors under different terms such as "near-peer teaching"; "peer tutoring"; and "peer support" [Burgess et al. \(2014\)](#), [Srivastava et al. \(2015\)](#), [Tai et al. \(2014\)](#). Peer-assisted learning is growingly used as a teaching and learning method in medical education worldwide. Several academic institutions implemented peer-assisted learning in the curriculum under the form of Problem Based Learning (PBL) [Bugaj et al. \(2019\)](#), [Double et al. \(2020\)](#). The basic structure of peer-assisted learning is to match a low-achiever student (student tutees) with a high-achiever student (student tutors) so that a low-achiever student may increase his academic achievement without any pressure driven by the institution [Gogus \(2012\)](#). Peer-assisted learning should consider as additional support (supplemental support) to the ongoing educational process and do not replace the educator role [Jönsson \(2018\)](#). Peer-assisted learning positively impacts students' attitudes, knowledge and learning outcomes. Moreover, peers can motivate each other and influence academic achievement [Burgess et al. \(2014\)](#), [Bursal \(2017\)](#), [Dehghani et al. \(2014\)](#), [Drysdale et al. \(2022\)](#), [Räisänen et al. \(2020\)](#). However, individual differences among students make peer-assisted learning not free from challenges. There are some barriers during peer-assisted learning, such as the student's behaviour in the classroom or the management of academic tasks. Therefore, peer-assisted learning should be structured, schemed and implemented under firm supervision and in a planned environment [Ullah et al. \(2018\)](#). The conventional method for academic treatment after examination failure includes three steps: identification of failed students at assessment; treatment period (a repeating portion of the course); and repeating the exam [Patel et al. \(2015\)](#), [Malibary et al. \(2019\)](#). The experience of failure in exams is a complex process involving the interaction between mental health, social, and academic problems [Patel et al. \(2015\)](#), [Picton et al. \(2022\)](#). In the current study, several factors probably contributed to student failure in examination in the second year: the experience online for the first time, the language barrier, and the transition from basic science in the first year to a speciality course in the second year. Following examination failure, low-achiever students need treatment with emotional, social, and academic support from the staff and peers [Abrams et al. \(2022\)](#), [Jönsson \(2018\)](#). However, low-achiever students may feel discomfort communicating with staff due to fear of course termination. Furthermore, the peers understand the learning needs of their friends better. Unfortunately, little evidence exists of peer-assisted learning available to students following examination failure, and studies of the effect of PAL on academic failure are rare. Therefore, the present study aimed to evaluate the

effect of peer- assisted learning on medical laboratory science students' achievement to support and avoid low achiever students from failing in the next exams.

2. METHODOLOGY

2.1. STUDY DESIGN

An experimental study was conducted at the medical laboratory science program/Alfajr College for Science and Technology 2021 to evaluate the effect of peer-assisted learning on Low achiever students'. Achievement is defined as a measurement of student-level knowledge or what a student has learned as a result of the education process and expressed as grades which are resulted from an assessment that involves either passing or not in a specific course exam. To clarify the terms used in this article we refer to students not receiving a passing grade in a specific course as low-achievers (grade F= less than 50), and students receiving a high grade in a specific course as high-achievers (grade A= from 80-100; and grade B+= from 75-79) [Steinmayr et al. \(2014\)](#), [Jeremy and Fisher \(2012\)](#).

2.2. PARTICIPANTS

- **Low achiever students:** The number of low achiever students (Junior) according to final exam results of semester three were: hematology [N=76/124 (61%)]; microbiology [N=61/124 (49%)]; parasitology [N=54/124 (48%)]; and chemical pathology [N= 55/125 (36%).
- **High achiever students:** The number of high achiever students (Senior) according to final exam results of semester five were [hematology (N= 11); microbiology (N= 16); parasitology (N= 8); and chemical pathology (N= (6)].

Alfajr College Research Ethical Committee reviewed and approved the study. All participants were assigned the written informed consent form. All methods were carried out following relevant guidelines and regulations.

2.3. DATA COLLECTION

The end-of-semester three and four exam results for the second academic year (2020-2021) for hematology, parasitology, microbiology, chemical pathology, and histopathology were collected for all low-achiever students. We compared the differences in achievement between semesters three and four for courses involved in PAL (hematology, parasitology, microbiology, and chemical pathology) versus courses that were not involved (histopathology) to see whether the peer-assisted learning worked or not. Also, we compared the achievement of high-achiever students between semesters five and six.

2.4. PEER-ASSISTED LEARNING SESSION

All low achiever students in hematology, microbiology, parasitology, and chemical pathology courses in the second year were assigned to groups on a voluntary basis. High-achiever students have been given a chance to volunteer; however, their achievements in final exam results for semester five should be high in the specified course. Each group contained from 7 to 10 low achiever students (tutees) and one high achiever (tutor) under academic staff supervision. High

achiever students tutored low achieving students on the lecture materials during semester four every Thursday, approximately 4 hours for one month and a half, and four tutorials were done for each course, three lectures covered in each tutorial.

2.5. DATA ANALYSIS

The data were analysed using Statistical Package for the Social Sciences 20 (SPSS Inc., Chicago). Descriptive statistics were done; the Chi-square test was used to examine the differences between categorical data. The differences in numerical data (mean scores) between the final exam result of two semesters were tested by independent and paired sample T-tests. A P. value of <0.05 was considered significant.

3. RESULTS

Of one hundred and twenty-four (124) students, there were (52%) students passed in parasitology, (38%) in hematology, (50.9%) in microbiology, and (56%) in chemical pathology in semester three as shown in [Table 1](#). There were (48.2%) of low achiever students who passed in semester four in parasitology, (54%) in hematology, (26%) in microbiology, and (67%) in chemical pathology passed, as shown in [Table 2](#). The mean scores of students were significantly higher in semester four in parasitology, hematology, microbiology, and chemical pathology courses. No significant differences in the achievement of the histopathology course as shown in [Table 3](#). The achievement of high achiever students was significantly lower in hematology and microbiology, whereas in parasitology was a significantly higher [Table 4](#).

Table 1

Table 1 The Frequency (%) of Students' Achievement in the Third and Fourth Semesters:						
Course name	Semester	Passed Students	Failed Students	Minimum	Maximum	Total
Parasitology	semester3	70 (52%)	54 (48%)	15	47	124
	semester4	84 (68%)	40 (32%)	15	74	
Hematology	semester3	48 (38%)	76 (61%)	12	47	124
	semester4	71 (58%)	53 (42%)	21	68	
Microbiology	semester3	63 (50.9%)	61 (49.1%)	15	47	124
	semester4	54 (44%)	70 (56%)	6	55	
Chemical Pathology	semester3	70 (56%)	55 (44%)	24	49	125
	semester4	92 (74%)	33 (26%)	17	74	
Histopathology	semester3	104 (85%)	18 (15%)	14	49	122
	semester4	95 (78%)	23 (22%)	23	72	

Table 2

Table 2 The Frequency (%) of Grades for Low Achiever Students in the Fourth Semester								
Courses	A	B+	B	C+	C	F	passed%	Total
Frequency (%)								
Parasitology	0 (0)	0 (0)	1 (1.8)	6 (11.1)	19 (35.1)	28 (51.8)	26 (48.2%)	54 (100)
Hematology	0 (0)	0 (0)	0 (0)	9 (12.0)	32 (42.0)	35 (46.0)	41 (54%)	76 (100)

Microbiology	0 (0)	0 (0)	0 (0)	0 (0)	16 (27.0)	45 (73.0)	16 (26%)	61 (100)
Chemical Pathology	0(0)	0(0)	4 (7.4)	11 (2.4)	18 (33.20)	22 (39)	33 (67%)	55 (100)
Histopathology	0(0)	0(0)	0(0)	1 (5%)	7 (39%)	10 (56%)	8 (44%)	18 (100)

A= (80-100); B+= (75-79); B= (70-74); C+= (60-69); C= (50-59); F= (0-49)

Table 3

Table 3 Paired Samples Statistics for Low Achiever Students						
Course name	Semester	Mean (STD)	N	95% Confidence Interval of the Difference		P. value
				Lower	Upper	
Parasitology	semester3	37.50 (7.58)	54	-13.8	-7.3	≤0.001
	semester4	48.11 (12.23)				
Hematology	semester3	33.17 (8.73)	76	-16.8	-12.14	≤0.001
	semester4	47.68 (11.42)				
Microbiology	semester3	35.83 (7.96)	61	-7.98	-3.61	≤0.001
	semester4	41.63 (9.60)				
Chemical	semester3	40.311(6.55)	55	-14.24	-7.90	≤0.001
	semester4	51.38 (12.79)				
Histopathology	semester3	43.62 (7.49)	18	-10.67	5.55	0.511
	semester4	46.18 (11.65)				

Table 4

Table 4 Paired Samples Statistics for High Achievers						
		Mean (STD)	N	95% Confidence Interval of the Difference		P. value
				Lower	Upper	
Microbiology	semester5	80.13(4.14)	16	.10546	9.64454	.046
	semester6	75.25(9.25)				
Hematology	semester 5	78.63(5.10)	11	6.57093	13.06543	.000
	semester 6	68.82(4.11)				
Parasitology	semester 5	80.49(4.75)	8	-7.25832	-1.75168	.006
	semester 6	85.00(5.87)				
Chemical pathology	semester 5	77.5 (4.96)	6	-2.590	9.257	0.205
	semester 6	75.1 (4.91)				

4. DISCUSSION

The need for peer assisted learning in the medical laboratory science program was raised from the low success percentage in the final exam for hematology, microbiology, parasitology, and chemical pathology courses in the second year/ semester three, as appears in the results [Table 1](#). Perhaps the present study is first

study done in this nature in Sudan, and we try to support low achiever students with a peer assisted learning under staff supervision. In the current study, low-achiever students' achievement was significantly improved in all courses; there were significant differences in mean scores between the third and fourth semesters. On the other hand, the achievement of low-achiever in the histopathology course was not improved, and this explained the importance of peer-assisted learning implementation after exam failure. However, high-achiever students' achievement significantly decreased in three courses. These results are comparable to [Filade et al. \(2019\)](#) who surveyed the effect of peers on academic performance. The study revealed the positive significant effect of peer support on academic performance. In contrast, this study is highly significant compared to [Sari et al. \(2017\)](#), and these differences in the significance level are probably due to the study design and setting. Moreover, [Sari et al. \(2017\)](#) found that the achievement of high achievers was affected positively. Also, our results are consistent with [Ullah et al. \(2018\)](#) who try to investigate the effect of peer tutoring on students' academic achievement in a biology course. They found that peer tutoring increased academic achievement significantly. Likewise, [Dehghani et al. \(2014\)](#) found a significant difference in students' achievement in nutrition college before and after peer-assisted learning at Shiraz University of Medical Sciences, Shiraz, Iran. The present study is comparable to [Cate et al. \(2012\)](#), who compared the achievement of students tutored by faculty and near-peer tutoring in 36 courses from 2005 to 2010. They found that the mean of 29 courses was higher but not significantly in near-peer tutoring. They concluded that peer tutoring has similar benefits as faculty tutoring. Although the role of peer-assisted learning for students is well established, the quantitative and qualitative data for the effect of peer-assisted learning on academic achievement are limited [Altermatt \(2019\)](#), [Amer et al. \(2021\)](#), [Brierley et al. \(2022\)](#), [Rashid et al. \(2011\)](#), [Tullis and Goldstone \(2020\)](#), [Yamada et al. \(2014\)](#). Furthermore, no published evidence concluded that peer-assisted learning improves the achievement of high-achiever students.

5. CONCLUSION

The main finding of the current study is that peer-assisted learning (PAL) significantly improves the achievement of low-achiever students in all courses. However, the effect of (PAL) on high achiever was controversial. Peer-assisted learning has a significant positive effect on low-achiever students.

6. LIMITATION

One of the limitations of the current study lacking a control group, and another limitation was that the study was conducted in one program, so, the findings of the present study cannot be generalized. Therefore, we recommend further longitudinal studies into peer- assisted learning conducted in all programs to determine the association between PAL and students' achievement to get a better understanding and knowledge of the PAL effect on low and high-achievers.

CONFLICT OF INTERESTS

None.

ACKNOWLEDGMENTS

All authors would like to all participants.

REFERENCES

- Abrams, M. P., Salzman, J., Espina Rey, A., and Daly, K. (2022). Impact of Providing Peer Support on Medical Students' Empathy, Self-Efficacy, and Mental Health Stigma. *International Journal of Environmental Research and Public Health*, 19(9), 1-13. <https://doi.org/10.3390/ijerph19095135>.
- Altermatt, E. R. (2019). Academic Support From Peers as a Predictor of Academic Self-Efficacy Among College Students. *Journal of College Student Retention: Research, Theory and Practice*, 21(1), 21-37. <https://doi.org/10.1177/1521025116686588>.
- Amer, M. G., Althaqafi, R. M. M., Assiri, S. A., Alsufyani, A., Alrubaei, F. S., and Mohamed, N. M. (2021). Peer-Assisted Learning Undergraduate Medical Students' Perception and Satisfaction. *Millenium*, 2(16), 11-22. <https://doi.org/10.29352/mill0216.23989>.
- Bermingham, N., Boylan, F., and Ryan, B. (2022). The 4C's of PAL-An Evidence-Based Model for Implementing Peer Assisted Learning for Mature Students. *Innovations in Education and Teaching International*, 00(00), 1-11. <https://doi.org/10.1080/14703297.2022.2050779>.
- Brierley, C., Ellis, L., and Reid, E. R. (2022). Peer-Assisted Learning in Medical Education : A Systematic Review and Meta-Analysis. *Medical Education*, 56(4), 365-373. <https://doi.org/10.1111/medu.14672>.
- Bugaj, T. J., Blohm, M., Schmid, C., Koehl, N., Huber, J., Huhn, D., Herzog, W., Krautter, M., and Nikendei, C. (2019). Peer-Assisted Learning (PAL) : Skills Lab Tutors' Experiences and Motivation. *BMC Medical Education*, 19(1), 1-14. <https://doi.org/10.1186/s12909-019-1760-2>.
- Burgess, A., Mcgregor, D., and Mellis, C. (2014). Medical Students as Peer Tutors: A Systematic Review. *BMC Medical Education*, 14(1), 1-8. <https://doi.org/10.1186/1472-6920-14-115>.
- Burgess, A., Van Diggele, C., Roberts, C., and Mellis, C. (2020). Planning Peer Assisted Learning (PAL) Activities in Clinical Schools. *BMC Medical Education*, 20(Suppl 2), 1-7. <https://doi.org/10.1186/s12909-020-02289-w>.
- Bursal, M. (2017). Academic Achievement and Perceived Peer Support Among Turkish Students: Gender and Preschool Education Impact. *International Electronic Journal of Elementary Education*, 9(3), 599-612.
- Cate, O. Ten, Vorst, I. Van De, and Broek, S. Van Den. (2012). Academic Achievement of Students Tutored by Near-Peers. *International Journal of Medical Education*, 3(2014), 6-13. <https://doi.org/10.5116/ijme.4f0c.9ed2>.
- Dehghani, M. R., Amini, M., Kojuri, J., and Nabeiei, P. (2014). Evaluation of the Efficacy of Peer-Learning Method in Nutrition Students of Shiraz University of Medical Sciences. *Journal of Advances In Medical Education and Professionalism*, 2(2), 71-76.
- Double, K. S., Mcgrane, J. A., and Hopfenbeck, T. N. (2020). The Impact of Peer Assessment on Academic Performance : A Meta-Analysis of Control Group Studies. *Educational Psychology Review*, 32(2), 481-509. <https://doi.org/10.1007/s10648-019-09510-3>.
- Drysdale, M. T. B., Mcbeath, M. L., and Callaghan, S. A. (2022). The Feasibility and Impact of Online Peer Support on the Well-Being of Higher Education Students. *Journal of Mental Health Training, Education and Practice*, 17(3), 206-217. <https://doi.org/10.1108/JMHTEP-02-2021-0012>.
- Filade, B. A., Adejoke, B. A., Christiana, O. U., Bidemi, B. A., and Nwangburuka, K. (2019). Peer Group Influence on Academic Performance of Undergraduate

- Students in Babcock University, Ogun State. *African Educational Research Journal*, 7(2), 81-87. <https://doi.org/10.30918/aerj.72.19.010>.
- Fuchs, D., Fuchs, L. S., Mathes, P. G., and Simmons, D. C. (1997). Peer-Assisted Learning Strategies: Making Classrooms More Responsive to Diversity. *American Educational Research Journal*, 34(1), 174-206. <https://doi.org/10.3102/00028312034001174>.
- Gogus, A. (2012). Encyclopedia of The Sciences of Learning. in N. M. Seel (Ed.), *Encyclopedia of The Sciences of Learning (First Edit)*. Springer US. <https://doi.org/10.1007/978-1-4419-1428-6>.
- Jeremy, T. J., and Fisher, P. A. (2012). High Achieving Students and their Experience of the Pursuit of Academic Excellence. ISEP International Symposium, Hong Kong, 475- 499.
- Jönsson, A. (2018). Meeting the Needs of Low-Achieving Students In Sweden: An Interview Study. *Frontiers in Education*, 3(August), 1-16. <https://doi.org/10.3389/feduc.2018.00063>.
- Malibary, H., Zagzoog, M. M., Banjari, M. A., Bamashmous, R. O., and Omer, A. R. (2019). Quality of Life (Qol) Among Medical Students in Saudi Arabia: A Study Using The WHOQOL-BREF Instrument. *BMC Medical Education*, 19(1), 1-6. <https://doi.org/10.1186/s12909-019-1775-8>.
- Patel, R. S., Tarrant, C., Bonas, S., and Shaw, R. L. (2015). Medical Students' Personal Experience of High-Stakes Failure : Case Studies Using Interpretative Phenomenological Analysis. *BMC Medical Education*, 15(1), 1-9. <https://doi.org/10.1186/s12909-015-0371-9>.
- Pereira, L., Radovic, T., and Haykal, K. A. (2021). Peer Support Programs in the Fields of Medicine and Nursing : A Systematic Search and Narrative Review. *Canadian Medical Education Journal*, 2(1), 16-22. <https://doi.org/10.36834/cmej.71129>.
- Picton, A., Greenfield, S., and Parry, J. (2022). Why Do Students Struggle in their First Year of Medical School? A Qualitative Study of Student Voices. *BMC Medical Education*, 22(1), 1-13. <https://doi.org/10.1186/s12909-022-03158-4>.
- Rashid, M. S., Sobowale, O., and Gore, D. (2011). A Near-Peer Teaching Program Designed, Developed and Delivered Exclusively by Recent Medical Graduates for Final Year Medical Students Sitting the Final Objective Structured Clinical Examination (OSCE). *BMC Medical Education*, 11(1). <https://doi.org/10.1186/1472-6920-11-11>.
- Räisänen, M., Postareff, L., and Lindblom-Ylänne, S. (2020). Students' Experiences of Study- Related Exhaustion, Regulation of Learning, Peer Learning and Peer Support During University Studies. *European Journal of Psychology of Education*. <https://doi.org/10.1007/s10212-020-00512-2>.
- Sari, I., Çeliköz, N., and Ünal, S. (2017). The Effect of Peer Support on University Level Students' English Language Achievements. *Journal of Education and Practice*, 8(1), 76- 81.
- Srivastava, T. K., Waghmare, L. S., Mishra, V., Rawekar, A., Quazi, N., and Jagzape, A. (2015). Peer Teaching to Foster Learning in Physiology. *Journal of Clinical and Diagnostic Research*, 9(8), 1-6. <https://doi.org/10.7860/JCDR/2015/15018.6323>.
- Steinmayr, R., Meibner, A., Weidinger, A. F., and Wirthwein, L. (2014). Academic Achievement. Exford University Press, 1-4.
- Tai, J., Haines, T. P., Canny, B. J., and Molloy, E. K. (2014). A Study of Medical Students ' Peer Learning on Clinical Placements : What They Have Taught Themselves To Do. *Journal of Peer Learning*, 7, 57-80.

- Tariq, V. N. (2005). Introduction and Evaluation of Peer-Assisted Learning in First-Year Undergraduate Bioscience. *Bioscience Education*, 6(1), 1-19. <https://doi.org/10.3108/beej.2005.06000004>.
- Tullis, J. G., and Goldstone, R. L. (2020). Why Does Peer Instruction Benefit Student Learning? *Cognitive Research: Principles and Implications*, 5(1). <https://doi.org/10.1186/s41235-020-00218-5>.
- Ullah, I., Tabassum, R., and Kaleem, M. (2018). Effects of Peer Tutoring on the Academic Achievement of Students in the Subject of Biology at Secondary Level. *Education Sciences*, 8(3), 1-11. <https://doi.org/10.3390/educsci8030112>.
- Yamada, Y., Klugar, M., Ivanova, K., and Oborna, I. (2014). Psychological Distress and Academic Self-Perception Among International Medical Students : The Role of Peer Social Support. 1- 8. <https://doi.org/10.1186/s12909-014-0256-3>.