

Research Article

Influence of teachers' self-efficacy on secondary school students' self-efficacy in biology in Ogbomoso, Nigeria

Mulka Adebisi Ahmed^{a,1,*}, Ahmed Abiodun Lawal^{a,2}, Rihanat Aduke Ahmed^{a,3}

^a Department of Science Education, University of Ilorin, P.M.B. 1515, Ilorin, Nigeria

¹ahmed.ma@unilorin.edu.ng; ²ahmed.al@unilorin.edu.ng; ³ahmed.ar@unilorin.edu.ng

* Corresponding author

ARTICLE INFO

Article history

Received: 05 July 2021

Revised: 24 March 2022

Accepted: 30 March 2022

Published: 30 March 2022

Keywords

Biology learning

Students' self-efficacy

Teacher self-efficacy

ABSTRACT

It is widely proven by several studies that efficacy is an important factor in the teaching-learning process. Therefore, the goal of this study was to examine whether teachers' self-efficacy contributes to the development of students' self-efficacy in Biology. This study was a descriptive research with survey type which used proportionate and stratified sampling techniques to select 98 secondary schools in Ogbomoso, Nigeria. Proportionate, purposive, and simple random sampling techniques were used to select 207 biology teachers and 392 SSS I and II biology students based on gender. The data collected were analysed using mean scores, chi-square, and regression analysis at 0.05 level of significance. The findings revealed that: 1) there was a positive correlation between teachers' self-efficacy and students' self-efficacy in biology; 2) the level of teachers' self-efficacy was moderately high; and 3) female students have higher self-efficacy than male students in biology. The study concluded that teachers' self-efficacy influences their students' self-efficacy. Thus, it is recommended that biology teachers should be responsible and pay more attention to the development of their students' self-efficacy irrespective of students' gender.



Copyright © 2022, Ahmed et al

This is an open access article under the [CC-BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license



How to cite: Ahmed, M. A., Lawal, A. A., & Ahmed, R. A. (2021). Influence of teachers' self-efficacy on secondary school students' self-efficacy in biology in Ogbomoso, Nigeria. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, 8(1), 58-64. <https://doi.org/10.22219/jpbi.v8i1.17231>

INTRODUCTION

Education is an essential and indispensable part of human life. It is described as the cultivation of wise, hope and respect which will be taken as belief shared in life. Education enables human in achieving high technological advancement (Oscarsson et al., 2012; Ramankulov et al., 2016). The more developed the life, the higher the necessity of education would be. Science education is included to the education part which produces scientifically-skilled (Septiani & Rustaman, 2017) and literate citizens. To be more detail, there are three major branches of pure science i.e. Biology, Chemistry, and Physics which are learnt in senior secondary school level in the Nigerian education system (Aina & Ayodele, 2018; Akintola & Ahmed, 2018). These sciences help student to prepare for pure science and pure science-based courses in their tertiary education level and even their future professions (Entrich, 2015).

As one of pure science branches, Biology has been playing a very significant role in society. It contributes immense effect in dealing with problems faced society in terms of various diseases, poor yields in agriculture, overpopulation, safety, and environmental issues (Huang, 2016). Acknowledging the wide scope of Biology, teaching is, somehow, demanding in a variety of ways which including time, effort, and commitment. Teachers,

as lifelong trainers, teach learners the skills and resources needed to attain success academically and socially. Thus, there are studies focused on comprehending the factors and process undergirding their work engagement and satisfaction (Granziera & Perera, 2019).

The feat of any teaching strategies and practices depends on teachers' self-perception, attitude, and confidence in their professional capacity to face up to the changes involved in teaching-learning process. This self-perception, called self-efficacy belief, plays a key role in the way teachers select homework and activities for students. It also determines their efforts and persistence in addressing certain challenges, as significant as affecting their emotional reaction in facing tough situations. In addition, it has been proven that person's self-efficacy is strongly related to their motivation (Ates & Saylan, 2015; Diseth, 2011). Thus, it can be said that teacher self-efficacy is the set of beliefs teachers hold regarding their abilities and competencies to teach and influence their students regardless of outside influence or obstacle.

Theoretical and empirical works have demonstrated the complex ways in which teacher self-efficacy may affect outcomes at different levels of the classroom environment. Past empirical evidence suggested that as educators have resilient sense of self-efficacy, they are more likely to successfully deal with challenging study behavior and to persist longer than teachers who lack such beliefs. Teacher's sense of self-efficacy is also an important factor in recent studies that has been revealed to influence students' behavior towards learning.

In education, students' self-efficacy is also a key contributing factor for learners' success or achievement. This because self-efficacy influences the learners' decisions make and the courses of action they pursue (Aguilera-Hermida, 2020; Ingole & Pandya, 2016). Furthermore, self-efficacy is believed to be situational rather than being viewed as a stable trait. Research showed that students' academic self-efficacy influences their academic performance. Academic achievement or performance is, in many cases, designated by test and examination scores or marks assigned by the subject teachers. It could also be said to be an expression used to represent students' scholastic standing. Academic performance or achievement is a major issue for teachers, students, parents, and guardians as well as other stakeholders in the education industry.

Self-efficacy is, eventually, considers as a cognitive paradigm which intercedes between knowledge and action. The previous research suggested that in science and other fields, greater attention should be paid to the relationship between student achievement and non-cognitive factors. Moreover, the other several studies have established self-efficacy as a predictor of academic achievement, social life (İlhan, 2014), attitude toward environment (Huang, 2016), and even health (Martos-Méndez, 2015; Sari et al., 2018). There is also research which considers academic self-efficacy as an outcome variable (Liu et al., 2012; Tonissen et al., 2014) which explores ways in which teachers contribute to the development of student self-efficacy.

Students' achievement begins from their classroom where teachers introduce, supervise, and monitor their daily activities associated with learning. However, in Nigeria, very few teachers who consider properly the way and manner they teach, handle, behave, and interact with students in classroom. In the same way, not many of teachers who considerate that their teaching ways give a significant impact on students' expectations and motivations for success in science subjects, particularly in Biology. Moreover, students' self-efficacy, expectations and motivations for academic success have been shown to directly affect their performance.

Aina and Ayodele (2018) opined that the Nigerian students' performance in the Senior School Certificate Examinations (SSCE) conducted by both West African Examinations Council (WAEC) and National Examinations Council (NECO) have remained under the average, mainly in Biology as one of the highest enrolments and the poorest results over the years. Notwithstanding those students are the main subjects who did the examination and achieved the poor scores, but, the other determining factors responsible for this low achievement must be considered.

This study, therefore, addressed the role teachers' self-efficacy towards students' self-efficacy in Biology learning. This study aimed to examine whether there is significant correlation between teachers' self-efficacy and their students' self-efficacy in biology in Ogbomoso, Oyo State, Nigeria.

METHOD

This study was a descriptive survey research which used questionnaires to obtain respondents information. The population of this study is all biology teachers and students in all senior secondary schools in Ogbomoso, Oyo State, Nigeria. The population consisted of all biology teachers and students offering Biology in SSS I and II classes in all secondary schools in the five local government areas of Ogbomoso (i.e. Ogbomoso North, Ogbomoso South, Surulere, Orire, and Ogo-Oluwa).

The study adopted proportionate and stratified sampling techniques to select 98 secondary schools across the five local government areas in Ogbomoso. The proportionate and purposive sampling techniques were further used to select 207 biology teachers. For the purpose of selecting sample of students, purposive and simple random sampling techniques were adopted to select 392 SSS I and II students based on gender.

The instruments used in this study were: (1) a researcher modified instrument entitled Teachers' Self-Efficacy Questionnaire (TSQ) and (2) Science Self-Efficacy and Motivated Learning Questionnaire (SSMLQ). The TSQ was divided into three sections and administered to teachers as respondents. The first section required teacher participants' demographic information which included the biology teachers' gender. The TSQ comprised of science teaching efficacy belief subscale. This section contained of items which measured teachers' self-efficacy in biology teaching. It comprised of 12 items of Likert scale with responses ranging from not at all, only slightly, to some extent, and to a high extent. Items in this section were adapted from Teachers' Sense of Efficacy Scale (short form) developed by [Tschannen-Moran and Hoy \(2001\)](#).

The second instrument, SSMLQ, has two parts in which each of them comprised of eight items and was administered to students as respondents. The first part was to measure students' confidence in doing tasks as well as skills to perform tasks associated with biology. Meanwhile, the second part contained items to measure students' perception about their teacher's attribute contributing to their confidence in doing tasks associated with biology. This questionnaire contained items adapted from the self-efficacy subscale of the Motivated Students' Learning Questionnaire scale developed by [Pintrich, Smith, Gracia, and Mckeachie, \(1991\)](#).

The items of the two instruments, TSQ and SSMLQ, were standardized and validated. The validation of the instruments for this study was ensured using two instruments which were subjected to face and content validation by three lecturers in the Department of Science Education, and two lecturers in the Department of Guidance and Counselling, University of Ilorin, Ilorin, Nigeria. The validators verified the items and effect appropriate corrections.

The reliability of the instrument was established with a field test that was conducted by employing 25 biology teachers and 25 SSS II students in secondary schools in Oyo state outside Ogbomoso where the study was conducted. The instruments were administered twice at an interval of two weeks using the test-retest method to determine reliability coefficient of the instruments. Pearson Product Moment Correlation was utilized to find out the correlation between respondents' opinions and responses. A calculated reliability coefficient of 0.83 for the TSQ and 0.76 for SSMLQ were obtained and considered for the study.

An Informed Consent forms detailed all the necessary information about the research and ethical issues such as voluntary participation, confidentiality, willingness to withdraw, and possible risks were made available to the biology teachers and students. The researchers revisited each of the schools the same week to retrieve the informed consent forms and ascertain the participation status of each school, biology teachers, and students. Ethical issues were properly addressed by ensuring participants on the confidentiality of the information provided. The information and data collected were used for research purpose only.

This study has its limitations as it was focused primarily on teacher-level variables as predictors of student academic self-efficacy; though, a number of other available variables were not chosen for examination, such as many of those related to student experiences outside of the classroom environment. The results of this study are hindered by the exclusion of a number of student background, student level, and parent level variables that may be additional determinants of students' academic self-efficacy. These limitations, nevertheless, this study produced a number of significant findings regarding teacher factors that contribute to the development of students' academic self-efficacy in biology.

RESULTS AND DISCUSSION

The influence of teachers' self-efficacy on students' self-efficacy in learning biology is determined by gathering the respondents' data (served in [Table 1](#)). The mean value of 2.5 was used as the benchmark. This means that the mean values greater than 2.5 indicate higher and above average level of respondents' self-efficacy belief. Contrarily, the mean values less than 2.5 indicate lower level of self-efficacy belief of respondents.

Based on the data served in [Table 1](#), it can be seen that the study results are considered as moderate to relatively high self-efficacy belief of teachers as the 12 items gained the mean values above 3.0, even though there was no mean value above or at 3.5. The highest mean value gained was 3.50 which represents teacher self-efficacy in keeping class in calm condition and avoiding noise in the class (Question 7). Contrarily, the lowest mean value obtained in Question 2 (3.30) which represent teachers' competence in motivating low-

motivated students. This study was set out to explore the ways in which teachers' self-efficacy influence the development of students' expectations for success in biology in senior secondary schools. A great deal of previous research examines self-efficacy as an antecedent to academic success.

Table 1. Mean value of Influence of teachers' self-efficacy on students' self-efficacy in biology

S/N	Item description	NT	OS	TSE	THE	MEAN	SD
1.	How much can you do to control disruptive behavior in the classroom?	2	12	88	105	3.42	0.54
2.	How much can you do to motivate students who show low interest in biology class?	9	14	89	95	3.30	0.26
3.	How much can you do to get students to believe they can do well in biology class?	8	11	87	101	3.35	0.65
4.	How much can you do to help your students' value learning?	6	9	87	105	3.40	0.44
5.	To what extent can you craft good questions for your students?	-	25	83	99	3.35	0.56
6.	How much can you do to get students to follow classroom rules?	-	21	89	97	3.36	0.47
7.	How much can you do to calm a student who is disruptive or noisy?	-	7	88	112	3.50	0.51
8.	How well can you establish a classroom management system with each group of students?	-	18	88	101	3.40	0.65
9.	How much can you use a variety of assessment strategies?	-	24	88	95	3.34	0.72
10.	To what extent can you provide an alternative explanation for example when students are confused?	-	17	85	105	3.42	0.68
11.	How much can you assist families in helping their children do well in school?	-	18	102	87	3.33	0.59
12.	How well can you implement alternative strategies in your classroom?	-	28	86	93	3.31	0.69

where: NT is not at all; OS is only slightly; TSE is to some extent; and THE is to a high extent

To go further, [Table 2](#) shows that teachers' self-efficacy was relatively high for the sub-scales with efficacy in student engagement gained the highest mean value (3.46). This finding proves that, generally, biology teachers in Nigeria have a good potential in terms of self-efficacy. Moreover, it is in line with the previous studies which reported the god secondary teachers efficacy ([Ates & Saylan, 2015](#)). In addition, it is important to be highlighted as the basic information to determine further steps to improve the other determining factors of education which are strongly correlated with self-efficacy such as teacher motivation ([Granziera & Perera, 2019](#)), learning media ([Huang, 2016](#)), instructional strategies ([Ingole & Pandya, 2016](#)), learning orientation ([Diseth, 2011](#)), and so forth.

Table 2. Mean value of teachers' sense of efficacy sub-scales

Teachers' sense of efficacy sub-scales	N	Mean
Efficacy in Student Engagement (items 2, 3, 4, 11)	828	3.46
Efficacy in Instructional Strategy (items 5, 9, 10, 12)	828	3.36
Efficacy in Classroom Management (items 1, 6, 7,8)	828	3.42

The level of students' academic self-efficacy in biology was proven by gaining the student data as presented in [Table 2](#). A benchmark of mean value of 3.0 was used to determine the level of students' self-efficacy. This means that the mean values higher than 3.0 proved that students are confident in the points addressed by the items questioned. Moreover, the mean values equal to 3.0 indicate that students are fairly confident, and the mean values less than 3 indicate that students show lower confidence in their academic self-efficacy.

Based on [Table 2](#), it can be seen that the research results depicted that the respondents were moderately confident of their academic self-efficacy in biology since the eight items asked obtained mean value above 3.0. In more detail, the highest score gained in Question 8 (3.55) which express students' belief that if they do proper endeavour, they will enact their goals. Yet, the lowest mean was gained in Question 2 (3.37) which shows students opinion about themselves in conquering the most difficult concepts in biology. Notwithstanding this lowest score was found, but the value was still above 3.0 which means that students' self-efficacy in Nigeria is still in a good level.

The findings of the study revealed that teachers' self-efficacy belief has a significant influence on students' academic self-efficacy in biology. The high-quality teachers, somehow, determine the variation of instructional strategies as well as dynamic motivation for students in the class. This, in turn, stimulates students creativity

and their self-efficacy (Liu et al., 2012). This finding is also in accordance with the findings of Tonissen et al. (2014) which reported that the students' self-efficacy is related to various tasks given.

Table 3. Mean value of Students' academic self-efficacy in biology

S/N	Items	TC	VC	FC	OLC	NAC	MEAN	S. D
1.	I believe I will receive an excellent grade in biology	116	110	90	71	15	3.66	0.87
2.	I'm confident I can understand the most difficult concepts taught in biology class	90	109	98	69	26	3.37	0.88
3.	I expect to do well in biology subject	110	109	88	45	35	3.50	0.78
4.	I'm confident I can understand the basic concepts taught in biology	102	107	97	73	13	3.54	0.78
5.	I'm confident I can do an excellent job on the assignments and tests in biology	105	102	92	74	19	3.51	0.86
6.	I know I can master the skills being taught in biology subject	102	105	94	60	31	3.42	0.73
7.	I'm confident of understanding the most complex material presented by the teacher in biology	92	99	88	83	30	3.35	0.45
8.	I can solve most problems if I put the necessary effort.	106	108	92	68	18	3.55	0.56

where: T is Totally Confident; VC is Very Confident; FC is Fair Confident, OLC is Only a Little Confident; NAC is Not at All Confident; SD is Deviation Standard

The correlation between teachers' self-efficacy and students' self-efficacy in biology was proven by performing regression test in which the results are served in Table 4 and Table 5. It shows that there was a positive and significant relationship between teachers' self-efficacy and students' self-efficacy in biology with the coefficient value was 2.041 and the significance value was 0.000. In other words, there is a significant relationship between teachers' self-efficacy and students' self-efficacy.

Table 4. Beta estimates of predictors of students' self-efficacy in biology/regression coefficient showing the predictive influence of teachers' variables on the students' self-efficacy in biology

Variables	B	Std. error	Standardize coefficients beta	t	Sig.
Teachers' self-efficacy	2.041	0.512	2.120	3.934	.000
Students' perception of teachers' attributes in fostering students' science self-efficacy	1.337	0.521	0.431	2.990	.045
Constant	3.38	1.033	2.551	6.93	.000

Table 5. Summary of regression analysis of the predictor variables on the SGB

Source	Sum of squares	df	Mean squares	F	Sig.
Regression	4663.665	5	932.733	45.362	0.000
Residuals	4153.524	202	20.562		
Total	8817.189	207			

Based on Table 5, it can be inferred that the significant regression equation was obtained [$F(5,202)=45.362$, $p<0.001$] in which the equation is $y = 3.38 + 2.041x_1 + 1.337x_2$. This means that the increase of teachers' self-efficacy along with the students' perception will elevate the students' efficacy as high as 3.38 point.

In addition to the previous findings, the level of academic self-efficacy of male and female students was also measured in this research by performing Chi-square test. The results of this test are shown in Table 6. The table depicts that there was a significant association of self-efficacy between male and female students [$X^2(4)=13.928$, $p < 0.05$]. This phenomenon may emerge as various different factors surround male and female students. The similar facts were also found by many previous studies which revealed the differences occurred among male and female students (Alon & Diprete, 2015; Dilek Eren et al., 2015; Meyers-Levy & Loken, 2015).

Table 6. Chi-square results of the difference in the level of self-efficacy of male and female students.

Gender	TC	VC	FC	OLC	NAC	Total	X^2_{cal}	X^2_{Tab}	df
Male	669	473	210	137	26	1515	13.928	9.488	4
Female	790	482	177	131	44	1624			

where: TC is Totally Confident; VC is Very Confident; FC is Fair Confident, OLC is Only a Little Confident; NAC is Not at All Confident; SD is Deviation Standard

The findings of the study also revealed that there was a significant difference in the level of self-efficacy of male and female students. The result showed that female students have higher academic self-efficacy than their male colleagues in biology. This finding is in agreement with Yaminah et al.'s (2017) study which indicated that students' gender differences affected their academic performance. Moreover, the study also elaborated those female students performing better than male students in both self-efficacy and academic achievement. This must be worth information to consider the difference learning strategies used in educating male and female students. Moreover, special policies in education may also be needed to optimize learning process among male and female students not only by considering the results of this study, but also analyzing the other study findings which strongly related to this study such as teaching ethics (Chowdhury, 2016), teacher perceptions (Chiappetta & Koballa, 2010; Kang et al., 2013), teacher assessment (Fomichova & Misonou, 2015), and so forth.

CONCLUSION

In brief, the major findings of this study are: 1) there is a positive correlation between teachers' self-efficacy and students' self-efficacy in biology. Hence, teachers' self-efficacy positively influences students' self-efficacy; 2) the level of teachers' self-efficacy was moderately high; 3) the students' academic self-efficacy was moderately high; 4) female students reportedly have higher self-efficacy than their male colleagues in biology.

Based on the findings of the study, it can be suggested that: 1) the policymakers should ensure to organize training programs and provide a conducive and supportive atmosphere for teachers' motivation so that their self-efficacy can be improved; 2) the school management should organise motivational talks and events with students, as this will go a long way to increase their self-confidence in their academic endeavor; 3) there is a need for biology teachers to create a conducive atmosphere for healthy interaction with students to reinforce students' confidence in teaching and learning of biology; 4) Biology teachers should be responsible and pay more attention to the development of all their students' self-efficacy irrespective of their gender.

REFERENCES

- Aguilera-Hermida, A. P. (2020). College students' use and acceptance of emergency online learning due to COVID-19. *International Journal of Educational Research Open*, 1(July), 100011. <https://doi.org/10.1016/j.ijedro.2020.100011>
- Aina, J. K., & Ayodele, M. O. (2018). The decline in science students' enrolment in Nigerian colleges of education: Causes and remedies. *International Journal of Education and Practice*, 6(4), 167–178. <https://doi.org/10.18488/journal.61.2018.64.167.178>
- Akintola, D. A., & Ahmed, A. M. (2018). Assessment of biological drawing among the senior secondary schools students in Nigeria. *Pakistan Journal of Society, Education and Language*, 4(2), 1–14. https://www.researchgate.net/publication/329814614_ASSESSMENT_OF_BIOLOGICAL_DRAWING_AMONG_THE_SENIOR_SECONDARY_SCHOOLS_STUDENTS_IN_NIGERIA
- Alon, S., & Diprete, T. A. (2015). Gender differences in the formation of a field of study choice set. *Sociological Science*, 2(February), 50–81. <https://doi.org/10.15195/v2.a5>
- Ates, H., & Saylan, A. (2015). Investigation of pre-service science teachers' academic self-efficacy and academic motivation toward biology. *International Journal of Higher Education*, 4(3), 90–103. <https://doi.org/10.5430/ijhe.v4n3p90>
- Chiappetta, E. L., & Koballa, T. R. (2010). Thoughts and actions of beginning science teachers. In *Science Instruction in the Middle and Secondary Schools: Developing Fundamental Knowledge and Skills* (Seventh Ed, pp. 1–13). Pearson.
- Chowdhury, M. (2016). Emphasizing morals, values, ethics, and character education in science education and science teaching. *The Malaysian Online Journal of Educational Science*, 4(2), 1–16. <https://files.eric.ed.gov/fulltext/EJ1095995.pdf>
- Dilek Eren, C., Karadeniz Bayrak, B., & Benzer, E. (2015). The examination of primary school students' attitudes toward science course and experiments in terms of some variables. *Procedia-Social and Behavioral Sciences*, 174, 1006–1014. <https://doi.org/10.1016/j.sbspro.2015.01.1245>
- Diseth, Å. (2011). Self-efficacy, goal orientations and learning strategies as mediators between preceding and subsequent academic achievement. *Learning and Individual Differences*, 21(2), 191–195. <https://doi.org/10.1016/j.lindif.2011.01.003>
- Enrich, S. R. (2015). The decision for shadow education in Japan: Students' choice or parents' pressure? *Social*

- Science Japan Journal*, 18(2), 193–216. <https://doi.org/10.1093/ssjj/jyv012>
- Fomichova, K., & Misonou, T. (2015). Teachers Assessment of Japanese Lower Secondary School Biology Education Teachers' Assessment of Biology Education in Comparison to Other Areas of Science in Lower Secondary Schools of Japan-A Case Study. *Asian Journal of Biology Education*, 8. http://www.aabe.sakura.ne.jp/Journal/Papers/Vol8/02_Fomichova.pdf
- Granziera, H., & Perera, H. N. (2019). Relations among teachers' self-efficacy beliefs, engagement, and work satisfaction: A social cognitive view. *Contemporary Educational Psychology*, 58(February), 75–84. <https://doi.org/10.1016/j.cedpsych.2019.02.003>
- Huang, H. (2016). Media use, environmental beliefs, self-efficacy, and pro-environmental behavior. *Journal of Business Research*, 69(6), 2206–2212. <https://doi.org/10.1016/j.jbusres.2015.12.031>
- Ilhan, I. (2014). A study on the efficacy of project-based learning approach on Social Studies Education: Conceptual achievement and academic motivation. *Educational Research and Reviews*, 9(15), 487–497. <https://doi.org/10.5897/err2014.1777>
- Ingole, M., & Pandya, S. (2016). Interactive effect of meta-cognitive strategies-based instruction in mathematics and self-efficacy of students on their meta- cognitive awareness. *Third Asia Pacific Conference on Advanced Research*, 341–351. Retrieved from: https://secure.hbcse.tifr.res.in/epi6/papers/Strand-2-main-talks/epi6_P-17_Meenakshi%20Ingole%20&%20Shefali%20Pandya.pdf
- Kang, E. J. S., Bianchini, J. A., & Kelly, G. J. (2013). Crossing the border from science student to science teacher: preservice teachers' views and experiences learning to teach inquiry. *Journal of Science Teacher Education*. <https://doi.org/10.1007/s10972-012-9317-9>
- Liu, E. Z. F., Lin, C. H., Jian, P. H., & Liou, P. Y. (2012). The dynamics of motivation and learning strategy in a creativity-supporting learning environment in higher education. *Turkish Online Journal of Educational Technology*, 11(1), 172–180. Retrieved from: <http://tojet.net/articles/v11i1/11116.pdf>
- Martos-Méndez, M. J. (2015). Self-efficacy and adherence to treatment: The mediating effects of social support. *Journal of Behavior, Health & Social Issues*, 7(2), 19–29. <https://doi.org/10.5460/jbhsi.v7.2.52889>
- Meyers-Levy, J., & Loken, B. (2015). Revisiting gender differences: What we know and what lies ahead. *Journal of Consumer Psychology*, 25(1), 129–149. <https://doi.org/10.1016/J.JCPS.2014.06.003>
- Oscarsson, M., Jidesjö, A., Strömdahl, H., & Karlsson, K.-G. (2012). Science in society or science in school: Swedish secondary school science teachers' beliefs about science and science lessons in comparison with what their students want to learn. *Nordic Studies in Science Education*, 5(1), 18. <https://doi.org/10.5617/nordina.280>
- Pintrich, P. R., Smith, D. A., Garcia, T., & Mckeachie, W. J. (1991). Reliability and predictive validity of the motivated strategies for learning questionnaire (MSLQ). *Educational and Psychological Measurement*, 53, 810-813. <https://doi.org/10.1177/0013164493053003024>
- Ramankulov, S., Usembaeva, I., Berdi, D., Omarov, B., Baimukhanbetov, B., & Shektibayev, N. (2016). Formation of the creativity of students in the context of the education informatization. *International Journal of Environmental & Science Education*, 11(16), 9598–9613. <http://www.ijese.net/makale/1192.html>
- Sari, C. W. M., Yamin, A., & Santoso, M. B. (2018). Community-based education program on knowledge and self-efficacy of type 2 diabetes mellitus' patients in Bandung. *Indonesian Contemporary Nursing Journal (ICON Journal)*, 2(1), 38. <https://doi.org/10.20956/icon.v2i1.3583>
- Septiani, A., & Rustaman, N. Y. (2017). Implementation of performance assessment in STEM (Science, Technology, Engineering, Mathematics) Education to detect science process skill. *Journal of Physics: Conference Series*, 812(1), 012052. <https://doi.org/10.1088/1742-6596/812/1/012052>
- Tonissen, K. F., Lee, S. E., Woods, K. J., & Osborne, S. A. (2014). Development of scientific writing skills through activities embedded into biochemistry and molecular biology laboratory courses. *International Journal of Innovation in Science and Mathematics Education*, 22(4), 1–14. <https://openjournals.library.sydney.edu.au/index.php/CAL/article/view/7564/8365>
- Tschannen-Moran, M., & Hoy, A. W. (2001). Teacher efficacy: Capturing an elusive construct. *Teaching and Teacher Education*, 17(7), 783–805. [https://doi.org/10.1016/S0742-051X\(01\)00036-1](https://doi.org/10.1016/S0742-051X(01)00036-1)
- Yamtinah, S., Masykuri, M., & Syahidul Shidiq, A. (2017). Gender differences in student's attitudes toward science: an analysis of students' science process skill testlet instrument. *AIP Conference Proceedings*, 4, 030003-1-030003–030006. <https://doi.org/10.1063/1.4995086>