



The effect of stad learning with make a match on collaboration skills and understanding of immune system concepts

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Abstract. The collaboration skills and conceptual understanding of 11th-grade students at MAN 2 Yogyakarta are still relatively low, even though these are 21st-century skills that every student should possess. This study aims to determine the effect of the Student Teams Achievement Division (STAD) cooperative learning model combined with the Make a Match method on students' collaboration skills and conceptual understanding of the human body defense system material in grade XI at MAN 2 Yogyakarta. This study used a quantitative, quasi-experimental approach with a nonequivalent control group design and was conducted during the even semester of the 2025/2026 academic year. Using purposive sampling, 70 grade XI students were selected, comprising class XI C as the experimental group and class XI E as the control group, each with 35 students. Data were collected through observation, questionnaires, and tests, then analyzed descriptively and inferentially using the Shapiro-Wilk normality test, Levene's homogeneity test, the Mann-Whitney test, and the effect size test. Results showed that the STAD model with the Make a Match method had no significant effect on students' collaboration skills (Sig. > 0.05) but had a significant effect on conceptual understanding (Sig. < 0.05), with a small effect size of 8.10%. The model is thus effective in improving conceptual understanding, though not yet effective in improving collaboration skills. This research can serve as a reference for teachers implementing innovative learning in the classroom.

Keywords: *Collaboration, Conceptual understanding, Human body defense system, Make a match, STAD*

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INTRODUCTION

Collaboration skills are important because they relate to a person's ability to work together in a team and help individuals move away from an individualistic mindset (Junita et al., 2021). However, low collaboration skills among high school students remain widespread, including in schools in the Yogyakarta area, as seen in a lack of activity, a low sense of responsibility for group tasks, and little appreciation for the role of group friends. Observations and interviews with biology teachers at MAN 2 Yogyakarta for the 2025/2026 school year show that many students still do not actively contribute to group activities. In addition to collaboration skills, understanding concepts is also important and makes it easier for students to solve learning problems.

Historical data from the Trends in International Mathematics and Science Study (TIMSS) in 2015 shows that Indonesia's science score is below the international average, and this condition has not shown significant improvement as reported by the results of the Programme for International Student Assessment (PISA) in 2022 which placed Indonesia in 65th place out of 81 countries with a science score of 383 (OECD, 2023). Observations and interviews at MAN 2 Yogyakarta also show that students' conceptual understanding remains relatively low, reflected in below-average daily assessment scores, especially in the material on the body's defense system.

The problems of biology learning at MAN 2 Yogyakarta include teacher-centered learning, which makes students less actively involved; difficulty constructing concepts from

abstract material; and passive students during learning. This condition tends to lower students' collaboration skills and conceptual understanding. One way to address this problem is to implement the right cooperative learning model, because an appropriate learning model can support the development of 21st-century skills (Puspa et al, 2023). The Student Teams Achievement Division (STAD) cooperative learning model is effective in increasing student engagement and concept understanding (Slavin, 2015), as this model encourages students to work together in groups, help each other, and be responsible for their groupmates' learning, thereby increasing learning independence (Johnson & Johnson, 2014).

The cooperative learning model includes many types, but not all are inherently effective at improving students' collaboration skills. This is because some students tend to dominate group work, leading to uneven task distribution and leaving other students without a clear role in their group (Dewi & Juwana, 2023). This study selected the STAD model because it emphasizes collaboration and uses an assessment system based on individual improvement scores and group awards. In STAD, the team's success is determined by each group member's increase in score from their respective baseline. This mechanism creates positive interdependence, in which each member must ensure that all members master the material taught. This collaborative characteristic distinguishes STAD from other cooperative models and is the main reason it was selected to improve students' collaboration skills.

The STAD model alone is not enough to overcome the weaknesses of learning abstract and complex biology material, such as the body's defense system, because it has limited variety in activities that trigger students' physical and cognitive involvement. Therefore, a supportive method in the form of Make a Match is needed; it is a cooperative learning method that emphasizes physical and cognitive activity by matching question cards with answer cards in a fun atmosphere. This is supported by research (Aisyah & Kurniawati, 2026), which shows that applying Make a Match has a positive and significant effect on students' understanding of mathematical concepts. In addition, research has shown that Make a Match also develops students' collaboration skills (Anifah & Bintaro, 2026), increasing active participation, responsibility, and cooperation in each learning cycle. Combining the STAD model with the Make a Match method is expected to strengthen student engagement, improve concept understanding, and address 21st-century learning challenges that conventional learning has not fully resolved.

This study chose the body's defense system material because it is highly conceptually complex, abstract (invisible), and requires a deep understanding of the immune system's mechanisms and disorders. Interview results with biology teachers at MAN 2 Yogyakarta show that students' mastery of this material is still lower than that of other biology materials. This is reflected in the results of daily assessments on the body's defense system material, which remain below average. In addition, research at SMAN 1 Depok Sleman shows that the percentage of students' learning completeness in the body's defense system material only reaches 60% (Husniarti, 2022). Therefore, this material is relevant to study through learning that emphasizes concept understanding and collaboration. Based on the description above, this study aims to determine the influence of the STAD cooperative learning model with the Make a Match method on students' collaboration skills and concept understanding in the body defense system material in class XI MAN 2 Yogyakarta.

METHOD

This study used a quantitative approach with a quasi-experimental type and a nonequivalent control group design. The experimental group received biology learning using the STAD model with the Make a Match method, while the control group received learning using the Direct Instruction model. Both groups were given a pre-test before treatment and a post-test after treatment to measure concept understanding, while collaboration skills were

measured through questionnaires after treatment. Table 1 presents the research design.

Table 1. Nonequivalent Control Group Design Research

Groups	Pre-test	Treatment	Post-test
Experimental groups	O1	X	O3
Control group	O2	Y	O4

Description: O1/O2 = initial ability to understand concepts; O3/O4 = final ability to collaborate and understand concepts; X = learning the STAD model using the Make a Match method; Y = learning the Direct Instruction model.

The research was carried out at MAN 2 Yogyakarta in the even semester of the 2025/2026 academic year, which is from 18 to 26 May 2026. The research population is all students in class XI (Phase F) of MAN 2 Yogyakarta for the 2025/2026 school year, totaling 105 students divided into three classes. The sample was determined using purposive sampling based on the criterion that classes study the material on the body's defense system, resulting in 70 students: class XI C as the experimental group and class XI E as the control group, 35 students each.

The independent variable was the STAD cooperative learning model with the Make a Match method, while the dependent variables were collaboration skills and students' conceptual understanding. The control variables included the teacher, learning materials, and the same allocation of learning time in both groups. Collaboration skills were measured using 5 indicators modified from [Junita et al. \(2021\)](#), [Maielfi & Wahyuni \(2020\)](#), and [Dewi et al. \(2020\)](#), namely actively contributing to group success, effective communication, carrying out tasks for which they are responsible, helping each other, and appreciating group members. Understanding of concepts is measured using seven indicators of [Anderson & Krathwohl \(2001\)](#): interpreting, giving examples, classifying, summarizing, summarizing them, comparing, and explaining.

Data collection was carried out through three techniques. First, learning implementation was observed using an observation sheet completed by one observer at each meeting to identify the teacher's activities in the experimental and control classes. Second, students completed a Likert-scale collaboration skills questionnaire to assess their own performance and that of group members. Third, a concept understanding test consisting of 20 multiple-choice questions was given as a pretest and posttest, prepared based on the Learning Outcomes of the body's defense system material.

Expert lecturers validated all research instruments before use. The feasibility test results showed that the STAD teaching module with the Make a Match method obtained a feasibility percentage of 92.5% (very feasible category), and the LKPD obtained 74% (feasible category). The validity test of the pre-test and post-test question items using Pearson Product-Moment correlation in Microsoft Excel showed that all items were valid ($r_{\text{count}} > r_{\text{table}} = 0.361$; $p < 0.05$). The reliability test using the KR-21 formula showed a pre-test reliability value of 0.773 and a post-test value of 0.673, both in the high category.

The data were analyzed descriptively to describe learning implementation, collaboration skills, and concept understanding in both groups. Inferential analysis began with a prerequisite test using the Shapiro-Wilk normality test and the Levene homogeneity test in SPSS 26. Because the data were not normally distributed or homogeneous, hypothesis testing used the non-parametric Mann-Whitney test at a significance level of 5%. Next, an effect size test was conducted to determine the magnitude of the treatment's influence on concept understanding, with interpretation categories referring to [Cohen \(1988\)](#).

RESULTS AND DISCUSSION

Results

Learning implementation was observed in two meetings using an observation sheet completed by one observer in each class. The results showed that learning implementation in

the experimental group increased from 90% in the first meeting to 100% in the second meeting. In comparison, the control group increased from 85% to 92%, so the average implementation of the two groups was 95% and 88.5%, respectively, both of which were in the very good category. In the experimental group, the entire syntax of the STAD model with the Make a Match method was well implemented, except that the evaluation and score calculation stages were less than optimal due to time constraints, so teachers did not fully follow the planned time allocation in these two stages. In the control group, the Direct Instruction learning stage was also carried out very well, except for the correction stage of evaluation answers, which was not implemented, as well as the reflection stage and drawing conclusions, which were carried out less than optimally due to similar time constraints.

The results of the collaboration skills measurement questionnaire showed that the experimental group had a consistently higher percentage than the control group on almost all indicators, as presented in Table 2.

Table 2. Descriptive Data of Collaboration Skills Variables Based on Indicators

Indicators	Group	Results	Category
Indicator 1	Experimental	94.60%	High
Indicator 1	Control	94.16%	High
Indicator 2	Experimental	93.00%	High
Indicator 2	Control	92.84%	High
Indicator 3	Experimental	93.00%	High
Indicator 3	Control	95.50%	High
Indicator 4	Experimental	94.00%	High
Indicator 4	Control	92.80%	High
Indicator 5	Experimental	97.00%	High
Indicator 5	Control	91.50%	High

Indicator description: 1) actively contribute to the success of the group; 2) effective communication; 3) carry out the tasks for which they are responsible; 4) help each other; 5) reward the group members.

Descriptive data on collaboration skills showed that the experimental group had an average score of 19 (95%) with a standard deviation of 0.870, while the control group had 18.7 (93.5%) with a standard deviation of 0.915. Both groups were in the very high category. The highest difference between the two groups was seen in the indicator of appreciation for group members, which was 97% in the experimental group compared to 91.5% in the control group. In contrast, the indicator of carrying out the tasks for which the control group was responsible was slightly superior (95.5% compared to 93%).

Table 3 presents the results of the concept comprehension test for the experimental and control classes.

Table 3. Description of Concept Comprehension Test Results of Experimental Class and Control Class

Description	Experiment Pretest	Experiment Post-test	Control Pre-test	Control Post-test
Number of respondents	30	30	30	30
Minimum score	40	55	50	60
Maximum score	100	95	100	95
Average (mean)	75	82.33	86.67	89.5
Standard deviation	21.05	12.847	13.667	7.352

In the *pre-test* stage, the experimental class obtained an average score of 75, lower than the control class's 86.67, indicating that the two groups' initial conditions were not equal. After learning, the experimental class's average post-test score increased to 82.33 (an increase of 7.33 points), while the control class increased to 89.50 (an increase of 2.83 points). The standard deviation of the experimental class also decreased from 21.050 to 12.847, or about 39%, indicating that achievement became more homogeneous after the treatment.

The Shapiro-Wilk normality test showed that all pre-test, post-test, and collaboration questionnaire data in both groups were not normally distributed ($p < 0.05$). The Levene homogeneity test showed that pre-test and post-test data on concept understanding were not homogeneous ($p < 0.05$), while collaboration skills data were homogeneous ($p = 0.781$). Because the data did not meet all prerequisites, hypothesis testing was performed using the Mann-Whitney non-parametric test, with results presented in Table 4.

Table 4. Results of the Mann-Whitney Hypothesis Test

Variables/Data	Sig. (2-tailed)	Description
Collaboration Skills	0,256	Not significant
Conceptual Understanding - Pretest	0,068	Not significant
Conceptual Understanding - Posttest	0,023	Significant

The Mann-Whitney test results for the collaboration skills questionnaire showed a significance value of 0.256 ($p > 0.05$), so H_0 was accepted, meaning there was no significant difference in collaboration skills between the experimental group and the control group. The results of the Mann-Whitney test on the pre-test data on concept understanding showed a significance value of 0.068 ($p > 0.05$), while the post-test data showed a significance value of 0.023 ($p < 0.05$), so H_0 was rejected, which means that there was a significant difference in concept understanding between the two groups after treatment. The effect size test showed a Z value of 0.284 and an influence percentage of 8.10%, which falls in the small category according to Cohen (1988). These results show that applying the STAD model with the Make a Match method influences students' understanding of concepts, even though the effect is relatively small.

Discussion

This study aims to determine the influence of the STAD cooperative learning model with the Make a Match method on students' collaboration skills and concept understanding in the body defense system material. The difference between the experimental and control groups lies in the use of the STAD cooperative structure with the Make a Match method in face-to-face sessions. The STAD model has six stages of learning, namely introduction, information, student organization, evaluation, awarding, and closing. At the same time, the Make a Match method strengthens concept understanding through fun partner-finding activities and prioritizes student interaction.

The influence of the stad model with the make a match method on collaboration skills

The experimental group's collaboration skill score was descriptively higher than that of the control group, indicating that active learning and direct learner involvement positively affected collaboration skills. This condition aligns with students' behavior during the discussion and the Make a Match game, where the principle of positive interdependence encourages each group member to take responsibility not only for themselves but also to ensure that their groupmates master the material (Ismana & Wibowo, 2025). These findings align with Setyaningsih and Sujarwo (2023), who found that applying the STAD model improves students' collaboration skills, as reflected in indicators such as joining groups, solving problems, and sharing tasks. Students who actively interact through communication and discussion in the Make a Match game also align with the findings of Tozlu et al. (2025), which show that the Make a Match technique is effective in developing students' social and communication skills and creating an interactive, collaborative learning environment.

However, the Mann-Whitney U test showed no significant difference in collaboration skills between the experimental and control groups, so the research hypothesis for this variable was rejected. This does not necessarily mean that the STAD model with the Make a Match

method does not affect collaboration skills, but several factors may have influenced the results. First, the short learning duration, which is only two meetings, limits the optimal collaborative interaction process of students, in line with [Rosnaeni's \(2021\)](#) statement that collaboration skills require repeated habituation to develop consistently. Second, both groups scored in the high range (17 to 20 out of a maximum score of 20) before treatment, so there was little room to show differences in achievement. This condition aligns with the characteristics of collaboration skills that can also be developed through group discussion activities in conventional learning ([Ulhusna et al., 2020](#)).

The influence of the STAD model with the make a match method on concept understanding

The pre-test and post-test scores of the two groups showed improvement, indicating that the learning process helped students understand the material on the body's defense system. The Mann-Whitney test results on the pre-test data showed no significant difference, meaning the two groups' initial abilities were not equal before the treatment. This inequality is thought to be due to the use of a quasi-experimental design with purposive sampling techniques that do not involve individual randomization, so the class's academic characteristics are not evenly distributed; this is one of the study's limitations.

The Mann-Whitney test results on the post-test data showed a significant difference between the experimental and control groups. However, because the two groups were not equal at the initial condition, the posttest difference could not be directly interpreted as evidence of treatment effectiveness. The effectiveness of the treatment was further supported by the data of an absolute increase in the experimental group that was much larger than that of the control group (7.33 compared to 2.83 points), as well as a decrease in standard deviation of the experimental group by 39%, which indicated that the understanding of concepts between students became more even after the treatment, in line with the cooperative learning objectives.

Group discussions in STAD allow students to explain, correct, and deepen their understanding of concepts. [Slavin \(1995\)](#) found that students understand difficult concepts more easily when they discuss them with peers within a structure of interdependent tasks, goals, and rewards. Individual assessment in STAD also ensures that each student truly understands the material, rather than relying solely on group contributions. Meanwhile, the Make a Match method requires students to actively connect concepts with their definitions or applications through card-pair searches, encouraging them to exchange ideas and clarify confusing concepts.

Social interaction in the STAD group is not only affective, but also functions as a cognitive mechanism. When students explain concepts to their peers, they also strengthen their own understanding through elaboration and reflection, in line with [Vygotsky's \(1978\)](#) theory of social constructivism, which holds that learning occurs through meaningful social interaction. The combination of STAD and Make a Match creates an environment that encourages students' involvement in cognitive, social, and emotional aspects simultaneously, so that the effectiveness of the model can be measured not only from test results but also from the dynamics of the learning process that occurs ([Melenia & Rindrayani, 2023](#)). Although the influence shown is relatively small, these findings reinforce the belief that combining the STAD model with the Make a Match method makes a significant contribution to supporting students' understanding of concepts more evenly.

The Make a Match method also gives students space to practice making decisions independently before interacting socially in the STAD group, so learning becomes an arena for metacognition and self-control development. Students familiar with the matchmaking strategy tend to be better prepared to face the challenges of classroom learning because they have built a cognitive and affective foundation independently ([Hou et al., 2022](#)). Although combining the STAD model with the Make a Match method shows effectiveness in understanding concepts,

even with a relatively small sample, adapting this model to students' diverse characteristics still needs consideration. Meanwhile, Make a Match creates positive dependency and social interaction between students through match-seeking games. This increases students' collaboration skills, as evidenced by research by Anifah & Bintaro (2026), which shows that applying Make a Match improves the collaboration skills of grade IV elementary school students, as seen in increased active participation, sense of responsibility, and cooperation in groups in each learning cycle. Students with visual, kinesthetic, and reflective learning styles respond differently to this learning model, so flexibility in material presentation and group-structure arrangements is key to ensuring all students benefit (Dinata et al., 2024).

Research limitations

This research has several limitations that future research should consider. First, the short duration of the study, namely two meetings, has not been able to fully capture the long-term impact of the application of the STAD model with the Make a Match method. Second, class selection is based on the teacher's discretion without individual randomization, which may introduce bias and unequal initial abilities between groups. Third, the diverse characteristics of students and classroom conditions during learning cannot be fully controlled. Fourth, the results of this study apply only to the material on the body defense system in class XI, so they cannot be generalized to other materials or levels.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that: (1) the STAD cooperative learning model with the Make a Match method does not have a significant influence on the collaboration skills of class XI MAN 2 Yogyakarta students on the body defense system material, which is suspected to be influenced by the limited learning time and the initial condition of the collaboration skills of the two groups which are already high; and (2) the STAD cooperative learning model with the Make a Match method has a significant influence on students' understanding of concepts, which is supported by an increase in average scores and a decrease in standard deviation by 39% in the experimental group, even though the effect size is relatively small, which is 8.10%.

The results provide empirical support for cooperative learning theory and social constructivism theory, which affirm that social interaction and group discussion can improve students' understanding of concepts. However, collaboration skills do not improve automatically by applying the cooperative model; they require special attention to duration, social skill development, and group dynamics management. Teachers are advised to apply this model by paying attention to time allocation and students' social skills development; schools are advised to provide supporting facilities for cooperative learning; and researchers are further advised to expand the sample, research duration, or variables studied.

REFERENCES

- Anderson, L. W., & Krathwohl, D. R. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. New York: Longman.
- Aisyah, N. R. N., & Kurniawati, A. (2026). The effect of the make a match model on critical thinking skills and student motivation in reproductive system material. *Jurnal Edukasi Biologi*, 12(1), 65–76. <https://doi.org/10.21831/edubio.v12i1.21822>
- Anifah, N., & Bintaro, T. Y. (2026). Peningkatan Keterampilan Kolaborasi dan Prestasi Belajar IPAS Melalui Penerapan Model Make a Match Kelas IV SD. *Jurnal PGSD*, 19(1), 33–39. <https://doi.org/10.33369/pgsd.19.1.33-39>

- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. New Jersey: Lawrence Erlbaum Associates. <https://doi.org/10.4324/9780203771587>
- Dewi, A. P., Putri, A., Anfira, D. K., & Prayitno, B. A. (2020). Profil keterampilan kolaborasi mahasiswa pada rumpun pendidikan MIPA. *Pedagogia Jurnal Ilmu Pendidikan*, 18(1), 57–72. <https://ejournal.upi.edu/index.php/pedagogia/article/view/22502>
- Dewi, P. D. K. P., & Juwana, I. D. P. (2023). Penerapan pembelajaran kooperatif tipe Teams Games Tournament pada mata pelajaran biologi kelas 11 dapat meningkatkan keterampilan kolaborasi siswa. *Emasains: Jurnal Edukasi Matematika dan Sains*, 7(2), 121–133. <https://doi.org/10.59672/emasains.v12i2.2790>
- Dinata, V. M., Wedi, A., & Fajarianto, O. (2024). Pengembangan model pembelajaran adaptif dengan implementasi learning analytics berdasarkan gaya belajar VARK. *Didaktika: Jurnal Kependidikan*, 13(4), 177–186. <https://doi.org/10.58230/27454312.1444>
- Hou, X., Nguyen, H. A., Richey, J. E., Harpstead, E., Hammer, J., & McLaren, B. M. (2022). Assessing the Effects of Open Models of Learning and Enjoyment in a Digital Learning Game. *International Journal of Artificial Intelligence in Education*, 32(1), 120–150. <https://doi.org/https://doi.org/10.1007/s40593-021-00250-6>
- Ismana, L. N., & Wibowo, Y. (2025). Comparison of the Cooperative Learning Model Type Tgt and Nht To Students' Cognitive Abilities. *Jurnal Edukasi Biologi*, 11(2), 162–171. <https://doi.org/10.21831/edubio.v11i2.21594>
- Johnson, D. W., & Johnson, R. (2014). Cooperation and the use of cooperative learning in classrooms. In D. Gillies (Ed.), *Pedagogy: Learning, teaching, and education* (pp. 57–74).
- Junita, A., Suprianto, B., & Purwianingsih, W. (2021). Profil keterampilan kolaborasi siswa pada praktikum maya sistem ekskresi. *Assimilation: Indonesian Journal of Biology Education*, 4(2), 50–57. <https://doi.org/10.17509/aijbe.v4i2.41480>
- Maielfi, D., & Wahyuni, S. (2020). Model Quantum Teaching tipe Tandur terhadap keterampilan kolaborasi mahasiswa. *JUPI (Jurnal IPA dan Pembelajaran IPA)*, 4(2), 219–230. <https://doi.org/10.24815/jupi.v4i2.18395>
- Melenia, D. R., & Rindrayani, S. R. (2023). Perbedaan Model Pembelajaran Cooperative Learning Tipe Student Team Achievement Division dan Make a Match terhadap Kreativitas Siswa SMP. *AKSIOMA: Jurnal Sains Ekonomi Dan Edukasi*, 1(1), 16–24. <https://doi.org/10.62335/36fxhg66>
- OECD. (2023). *PISA 2022 results (volume I): The state of learning and equity in education*. Paris: OECD Publishing. <https://doi.org/10.1787/53f23881-en>
- Puspa, C. I. S., Rahayu, D. N. O., & Parhan, M. (2023). Transformasi pendidikan abad ke-21 dalam merealisasikan sumber daya manusia unggul menuju Indonesia Emas 2045. *Jurnal Basicedu*, 7(5), 3309–3321. <https://doi.org/10.31004/basicedu.v7i5.5030>
- Rosnaeni, R. (2021). Karakteristik dan asesmen pembelajaran abad ke-21. *Jurnal Basicedu*, 5(5), 4341–4350. <https://doi.org/10.31004/basicedu.v5i5.1548>
- Setiyaningsih, I., & Sujarwo. (2023). The STAD Learning Model Supported by Scientific Student Worksheets on Learning Outcomes and Collaboration Skills of Elementary School Students. *International Journal of Elementary Education*, 7(1), 154–161. <https://doi.org/10.23887/ijee.v7i1.57964>
- Slavin, R. E. (1995). *Cooperative learning: Theory, research, and practice*. Boston: Allyn and Bacon.
- Slavin, R. E. (2015). *Cooperative learning: Theory, research, and practice* (11th ed.). Boston: Allyn & Bacon.
- Tozlu, B., Akgunduz, A., & Zeng, Y. (2025). Unbiased criteria identification for two-sided matching: An environment-based design approach. *Expert Systems with Applications*, 277, 127233. <https://doi.org/https://doi.org/10.1016/j.eswa.2025.127233>

- Ulhusna, M., Putri, S. D., & Zakirman, Z. (2020). Permainan ludo untuk meningkatkan keterampilan kolaborasi siswa dalam pembelajaran matematika. *International Journal of Elementary Education*, 4(2), 130. <https://doi.org/10.23887/ijee.v4i2.23050>
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.