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THE EFFECT OF LEARNING LOSS ON STUDENT'S COGNITIVE DEVELOPMENT DURING PANDEMIC OF COVID-19

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Abstract. *COVID-19* has had an impact on people's lives and a variety of activities. Public health organizations have advocated for preventative policies to limit viral spread, such as stay-at-home orders that closed businesses and schools as well as limited children's learning and regular activities. The purpose of this quantitative study is to gather information and understanding about the research topic. The aim of this study is to offer an overview of the impact of learning loss on cognitive development in Pekanbaru, Indonesia, during the COVID-19 pandemic. The sample technique for this study is simple random sampling, and the sample population for this study is 400 high school students. The data is a student's Higher Order Thinking Skills (HOTS) and GPA results during the COVID-19 (before lockdown). The impact of lock down during a pandemic forces schools to close for an extended length of time; the result of school closures is learning loss, which reduces students' cognitive and knowledge growth. Online classes are an alternate option for students to improve their academic skills. That lockdown is one of the most severe problems that the repercussions of COVID-19 have on schooling and unprivileged students may be one step behind due to learning loss.

Keywords: COVID-19, Cognitive Development, Learning Loss, Students

A. INTRODUCTION

COVID-19 has had an influence on many key items across the world, including the economy, education, health and hospitality, tourism, and human activities. The epidemic has affected people's life and altered numerous activities. Since the first reports of new corona virus in 2020, public health groups have campaigned for preventative policies to restrict viral spread, such as stay-at-home orders that shuttered businesses, day cares, schools, and playgrounds, as well as curtailed kid learning and normal activities[1]. Preventing COVID-19 causes instability, resulting in the collapse of some departments of government. Education is one of the most essential factors to consider; many schools and education departments were closed during the epidemic. Online classes, on the other hand, are said to allow students to study at a distance. People should be educated on the word "human rights," which is more likely to be "basic human necessities"[2]. The effects of a pandemic can be seen in a variety of settings, particularly in education. Learning Loss (summer learning loss, senior year, returning dropouts) is defined as any particular or general information that has an influence on academic achievement and nonacademic activities. The most prevalent causes of learning loss are lengthy gaps or discontinuities in a student's education. The problem impacts 95% of the student population.[3]. The necessity to utilize multiple tests for different age groups throughout time is one of the most difficult elements of evaluating cognitive development in early infancy[4].

Access to technology, such as electronic gadgets and an internet connection, is required for online learning. In fact that marginal area (isolated islands, villages, and marginal districts) face the issue[5]. Due to budgetary constraints, the family was unable to offer enough internet connection and gadgets for family members who were still in school[6]; Even thought, there are numerous components of cognitive growth that are connected to academic performance. Certain elements (social and economic position, student mood, motivation, peer relationships, and parental support) may have an impact on academic success. [7][8]. The lack of social connection during a pandemic has a significant influence on student academic performance. Positive peer relationships may improve academic achievement, which is influenced by cognitive development in students and is connected to GPA (Grade Point Average)[9][10]. Environmental variables are also responsible for decreasing student motivation, which is connected to student performance [11]. Similarly, certain student groups, such as special needs children (Down syndrome, autism, intellectual impairments, and handicapped individuals), may be more vulnerable to learning loss in a pandemic. [12]. Even thought, students may have low cognitive development [13]. Due to learning loss, some students living in higher-poverty households may be able to attend private courses that may influence academic performance, but the learning loss does not affect them considerably.[14];[15]. In eastern cultures, particularly Southeast Asian (most likely Indonesian), the consequences of learning loss may be caused by student activities[16]. School closures and online classes may have distinct effects on students depending on their gender. Female students are more likely than male students to be assigned domestic chores. It may have an effect on cognitive development.[17]. However, there is no gender difference between male and female students that suffer from learning loss [18]; [19]. There are considerable disparities in key abilities affecting pre-school children's school preparation, gaps that typically persist and influence children's later academic achievements, employment, and adjustment. [20];[21].Play provides a variety of developmental benefits, including physical, emotional, cognitive, and social advantages. [22].

Schooling has been identified as an important factor in determining the level of performance on cognitive tasks in cross-cultural studies, with the stage referred to as concrete because children can think logically much more successfully if they can manipulate real (concrete) materials or pictures of them[23]. Based on phenomenal during pandemic, many children and adolescent experience and suffer learning loss. It affects their achievement and performance in cognitive [24]. However, the rate of learning loss has a big effect toward cognitive development [25]. Technology, socioeconomic background, and environmental factors might all be factors (teacher-student relationship, and peer relation). It might be an alternative to decrease learning loss by moving closer to the goal of this research. The new aspect of this study is how learning loss affects pupils' academic performance during a pandemic due to school closures and lock down. The purpose of this study is to provide an overview of the influence of learning loss on cognitive development on pupils in Pekanbaru, Indonesia, during the Pandemic COVID-19. This study is quantitative, and the goal is to obtain information and comprehension about the research issue. Data will be gathered from school reports of students and HOTS results in Pekanbaru, Indonesia. The literatures utilized for this research will be gathered from journals and books of educational psychology, newspapers that include data and issues about school closures, and psychology. Relevant papers relating to the issue will be obtained from Research Gate for this study. Non-probability sampling will be used to acquire subjects. The data will be converted into a table and analyzed using SPSS to get a conclusion.

B. LITERATURE REVIEW

The purpose of this study is to evaluate the description of comparison of learning loss to cognitive function based on HOTS score. Previous studies by UNICEF shown that school cancellations during a pandemic reduce learning loss substantially strikes by teachers may result in kids obtaining experience that will help them develop cognitively. During the last outbreak in Africa from 2013 to 2014, the high impact of school closures was responsible of learning loss has high rates on kids owing to the facility that the government provides is insufficient for all of the pupils. [26][27]In five nations (Belgium, Germany, the Netherlands,

Switzerland, and the United States) reported that school closures during the epidemic impacted kids' cognitive development, resulting in learning loss. In order to press education policy in specific situations, cognitive performance is necessary. The previous research has found similar result, [28]portrays learning loss as a deadly trap that exists to reduce human resource by losing information and academic competence on academic performance that is connected to cognitive growth[29]. Cognitive development is the process through which a person perceives, thinks about, and comprehends his or her surroundings as a result of a mix of inherited and acquired factors. Cognitive development includes information processing, intelligence, reasoning, language development, and memory. (Children's health 2021Typical cognitive development is defined as expected gains in language, thinking, and understanding. The term "atypical development" refers to a delay in expected improvements. [30].

Lockdown has paralyzed education in the world, learning loss have huge impact toward family with low-income and students that lived in marginal area that is related to cognitive development(Ed 2018). Even if parents urge their children to study, the activities of an online class may be dull because students have time to quit the class (by turning off the camera) [31]. Missing school for an extended length of time will have an influence on cognitive development.COVID-19 may have an influence on them in the same way as children with summer learning loss do[6];[32]It has been reported that when schools close for an extended period of time, students' cognitive development may suffer as a result of not training their cognitive development for an extended period of time. This is why school closures may result in learning loss that is related to students' motivation and achievement[33]. Asian Development Bank [34]stated that school closures during a lockdown might deprive children of opportunity to study. It may have an impact on cognitive development, social (peer-relationship) and emotional abilities that kids may learn through face-to-face schooling.

C. METHOD

1. Literature Data

During COVID-19, the literature data will be evaluated from journals (educational psychology, press articles, school closures, and psychology) that contain information on learning loss, cognitive development, and lockdown. A key of terms will be created to help in this study, and the sources will be connected with this topic. This information will be derived from the student's GPA (before lockdown) and Higher Order Thinking Skill (HOTS).

2. Sampling

This study's sample method is simple random sampling. This study's population consists of high school students (15-18 years old). High school students, according to the authors, are appropriate for being samples due to high school students have a significant influence on learning loss, which is required for further education and a profession. The total number of high school students in Pekanbaru, Indonesia is 47.775 with 10% of the total population and 5% error, and the sample size for this study is 400 high school students.

3. Data Collection

Data will be gathered from numerous high schools in Pekanbaru that are taking part in this study. As part of an agreement contract, the authors will provide informed consent to students. The data is a student's HOTS score, and the analysis comprises the interpretation of the two scores. During the COVID-19 Pandemic, the authors will provide Higher Order Thinking Skills (HOTS) and GPA result (before lockdown).

4. Data Analysis

Data analysis is quantitative that will determine the information about how learning loss during pandemic effect on academic performance on students. The data which will be collected will be converted into table to compare with statistic tools. The variable of this research is learning loss will be viewed based on HOTS of students during lockdown. Due to lack of samples and the aim of this research, high school students only will be participated on this research. With ANOVA to get the result of HOTS score (to see the difference between HOTS score of each grade) after that, the result of HOTS will be compared to GPA (before lockdown)

5. Mind Concept

COVID-19 alters human actions and has an impact on some aspects, particularly schooling. School inactivity and the gap in face-to-face learning cause pupils to lose information and abilities that will be useful in their future careers. The authors create a notion of learning loss that affects students' cognitive growth in order to evaluate how learning loss might affect students' cognitive development.



Table1. Mind concept of learning loss toward cognitive development

D. **RESULTS**

Data were collected among 400 students in Pekanbaru, each student was asked to answer the question of HOTS. There were 20 questions which each questions had 5 points. If student get all answers correctly, student will get 100 score. 121 students are in 10 Grade, 131 students are in 11 Grade, and 148 students are in 12 grade. The lowest score is 55 and the highest score is 95. The average score that 10 grade students get is 74.55. The average score that 11 grade students get is 74.39. The average score that 12 grade students get is 75.57. The average score of 11 grades is lower than the average score of 10 grades. However, average of 12 grade students is higher than average score of 10 grades. The significant is 0.616 which is higher than 0.05 (5% significance) with the result that the hypothesis is declined. Even thought, there is no difference between 10 grades, 11 grades, and 12 grades toward learning loss which affects cognitive development (**Table 1**).

Grades	Students	Mean	Significant
10 Grade	121	74.55	
11 Grade	131	74.39	0.616
12 Grade	148	75.57	
Total	400	74.88	

Table 1. Analysis One Varian of HOTS Results

School closures make students lose their knowledge and cognitive ability. Learning loss already affects individual's cognitive development. Participants will be asked to submit the GPA before lockdown. However, 10 and 11 graders submitted the GPA result in middle school (8 grades and 9 grades). 12 graders submitted the GPA result in 10 grades. The gap showed the differences significance between 10 Grades during lockdown (74.55) and before lockdown (81.34). 11 grades GPA Result before lockdown is higher than the score during lockdowr grades have significantly lower than the score before lockdown (**Table 2**). In general, lear loss has been affected students cognitive development for almost 2 years. The online school could be an obstacle for certain students. However, there is a gap between GPA score before lockdown and during COVID-19. To avoid bias on GPA during COVID-19, the authors give a HOTS test to 400 Participants.

Grade (Before COVID-19)	GPA Score Average	HOTS Results Average	Grades (during Lockdown)
8 Grade	81.34	74.55	10 Grade
9 Grade	81.75	74.39	11 Grade
10 Grade	85.93	75.57	12 Grade

Table 2 The comparison of GPA result before school closures and HOTS results

Each school in Indonesia has their own GPA standard. The range is 66 - 75 of GPA minimum. The authors made the range of result based on the HOTS score of students. The range of score is divided into 3 categories. Low (55 -65), Average (66 – 80), and High (81 – 95). The total results of HOTS which belong to students are in Average category. Participant's GPA score before lockdown is in High category. More wise, the differences score for each grades is started from 10.00 to 13.50 (**Table 3**).

Table 3. Categorize of results

Categories	Result
Low	55 - 65
Average	66 - 80
High	81 - 95

When COVID-19 began rapidly spreading in the spring, school districts were understandably overwhelmed and unable to respond. The education ecosystem in the United States is centered on the in-class experience, from technological investments in school-level broadband internet and devices to curriculum creation and teacher training [35]. In many areas, schools also serve as a hub for services including school meals, mental-health counseling, and childcare. Many students' homes, particularly those of low-income families, lack access to the internet, gadgets, and a designated, peaceful study space. However, social influences have had an important impact in children's cognitive development. Children live with their own parents and interact with their classmates and teachers; all of these factors have a significant impact on a child's level of thinking and understanding. Children's brains grow in a sociocultural environment rather than interactions with physical objects, as Piaget proposed. As a result it is advised that psychology researchers include social and cultural settings in cognitive development investigations. Cultural skills like numbering systems and language have a significant influence on cognitive development[36].Cognitive abilities have an essential role in predicting educational and vocational success, socioeconomic attainment, health, and lifespan. Decreases in cognitive capacities are connected to deficits in everyday tasks in older individuals, although persons differ in their rates of cognitive decline throughout maturity and old life. As a result, discovering characteristics that guard against impaired late-life cognition is of considerable societal importance[37].Individuals' years of formal education completed are favorably connected to their cognitive function throughout adulthood and suggest a decreased risk of dementia later in life.

Students in grades 1–12 who are affected by the closures may expect to earn 3% less over the course of their lives[38]. The poorer long-term growth associated with such losses may result in a 1.5 percent worse GPA score for the balance of the century for nations. These economic losses will increase if schools do not reopen as soon as possible. As schools begin to re-establish their programs despite the ongoing pandemic, it is natural to place a high priority on the mechanics and logistics of safe re-opening. However, the long-term economic impacts necessitate careful consideration, as the losses already incurred necessitate more than the best of currently considered re-opening options. It is natural to place a high priority on the mechanics and logistics of safe re-opening as schools begin to re-establish their programs despite the ongoing pandemic[39].However, the long-term economic consequences must be carefully considered, as the losses already incurred necessitate more than the best of currently considered re-opening options. Studies to increase knowledge of the impact of epidemics and pandemics on children's mental health and development, such as COVID-19, can assist lead measures to minimize harm to children's growth and encourage good development[40].

School and daycare closures have a substantial negative long-term impact on the human capital and welfare of the affected children, particularly those from low-income families[41].There is also a substantial relationship between malnutrition and children's cognitive development. For example, diet in a child's early years can influence brain development at several levels. This decrease in human capital accumulation is expected to dampen nations' long-run economic prospects, particularly those with highly human capital-intensive economies, such as the United States and Europe[42]. The issue of learning loss during pandemic affects human lives that are also related to cognitive development. Learning loss impacts cognitive development of students during school closuring. It could affect student's academic and achievement performance as well. Unfortunately, marginal and disabilities students also face this problem as well. For the future research, finding another variable and phenomenon could give novelty of new research.

E. CONCLUSION

The impact of lockdown during pandemic force school to close in long period, the effect of school closures is learning loss, that decrease student's development in cognitive and knowledge. Online class is an alternative way to improve the student's academic to get skills. Unfortunately, the issues such as technology (devices and internet), marginal area, and socioeconomic are the main topic that related to learning loss that lockdown is one of most pressing problem that consequences of COVID-19 which have impact on education, unprivileged children might have one step left behind that is related to learning loss. However, education is one of main needs that children should get for their future. The online instruction could help certain student with high class family and educated parents. Many countries effort their decision to run an online class that is replaced face-to-face class, the decision address the impact of learning loss on students. The access of disadvantaged children extremely limited access to attend a distance learning platforms. Moreover, parents with low education could claim that an online class is not an official learning from school. The willingness to study and support the students on parents is low. This could relate to cognitive development on students.

REFERENCES

- [1] S. C. Deoni, J. Beauchemin, A. Volpe, V. Dâ Sa, and RESONANCE Consortium, "Impact of the COVID-19 Pandemic on Early Child Cognitive Development: Initial Findings in a Longitudinal Observational Study of Child Health.," *Dev. Cogn. Neurosci.*, pp. 1–37, 2021.
- [2] M. A. Mahammed, "Analysis of Covid-19 Lockdown Policy Impact by the Goverment of the Country on the Economic Sector and Signing of Working Relationships (LAYOFFS)," *Int. J. Law Recontruction*, vol. 4, no. 1, pp. 44–55, 2020.
- [3] P. Engzell, A. Frey, and M. D. Verhagen, "Learning loss due to school closures during the COVID-19 pandemic," *Proc. Natl. Acad. Sci. U. S. A.*, vol. 118, no. 17, 2021.
- [4] D. Neumann, E. R. Peterson, L. Underwood, S. M. B. Morton, and K. E. Waldie, "The development of cognitive functioning indices in early childhood," *Cogn. Dev.*, vol. 60, p. 6074, 2021.
- [5] S. Ranjitkar *et al.*, "Determinants of Cognitive Development in the Early Life of Children in Bhaktapur, Nepal," *Front. Psychol.*, vol. 10, no. December, pp. 1–10, 2019.
- [6] M. Kuhfeld *et al.*, "Projecting the Potential Impacts of COVID-19 School Closures on Academic Achievement. EdWorkingPaper No. 20-226," *Annenb. Inst. Sch. Reform Brown Univ.*, no. 20, 2020.
- [7] S. Masud, S. H. Mufarrih, N. Q. Qureshi, F. Khan, S. Khan, and M. N. Khan, "Academic Performance in Adolescent Students: The Role of Parenting Styles and Socio-Demographic Factors – A Cross Sectional Study From Peshawar, Pakistan," Front.

Psychol., vol. 10, no. November, pp. 1–12, 2019.

- [8] L. Simon *et al.*, "Post-Term growth and cognitive development at 5 years of age in preterm children: Evidence from a prospective population-based cohort," *PLoS One*, vol. 12, no. 3, pp. 1–2, 2017.
- [9] V. Kassarnig, E. Mones, A. Bjerre-Nielsen, P. Sapiezynski, D. D. Lassen, and S. Lehmann, "Academic performance and behavioral patterns," *EPJ Data Sci.*, vol. 7, no. 1, pp. 1–16, 2018.
- [10] P. P. and R. A. Kievit, "The Development of Academic Achievement and Cognitive Abilities: A Bidirectional Perspective," *Soc. Reaseach Child Dev.*, vol. 14, no. 1, pp. 15–20, 2020.
- [11] O. Chukwuemeka, "Environmental Influence on Academic Performance of Secondary School Students in Port Harcourt Local Government Area of Rivers State," J. Econ. Sustain. Dev., vol. 4, no. 12, pp. 34–39, 2013.
- [12] R. Bharat and R. Gopinath, "Prominence of Self-Actualization in Organization," *Int. J. Adv. Sci. Technol.*, vol. 29, no. 3, pp. 11591–11602, 2020.
- [13] A. Reuben *et al.*, "Residential neighborhood greenery and children's cognitive development," *Soc. Sci. Med.*, vol. 230, pp. 271–279, 2019.
- [14] H. H. Burgess, S., & Sievertsen, "Schools, skills, and learning: The impact of COVID-19 on education.," *Voxeu.Org.*
- [15] V. N. Locke, "Learning Loss in Reading and Math in U. S. Schools Due to the COVID-19 Pandemic," no. March, 2021.
- [16] M. Pérez-Pereira, M. P. Fernández, M. L. Gómez-Taibo, Z. Martínez-López, and C. Arce, "A follow-up study of cognitive development in low risk preterm children," *Int. J. Environ. Res. Public Health*, vol. 17, no. 7, p. 17072380, 2020.
- [17] I. Bidzan-Bluma and M. Lipowska, "Physical activity and cognitive functioning of children: A systematic review," *Int. J. Environ. Res. Public Health*, vol. 15, no. 4, p. 15040800, 2018.
- [18] H. Cooper, "Summer Learning Loss: The Problem and Some Solutions," *ERIC Dig.*, pp. 1–7, 2003.
- [19] M. Grätz and O. Lipps, "Large loss in studying time during the closure of schools in Switzerland in 2020," *Res. Soc. Stratif. Mobil.*, vol. 71, no. October 2020, pp. 0–4, 2021.
- [20] S. L. Nijhof *et al.*, "Healthy play, better coping: The importance of play for the development of children in health and disease," *Neurosci. Biobehav. Rev.*, vol. 95, pp. 421– 429, 2018.
- [21] L. E. Murray-Kolb *et al.*, "Early childhood cognitive development is affected by interactions among illness, diet, enteropathogens and the home environment: Findings from the MAL-ED birth cohort study," *BMJ Glob. Heal.*, vol. 3, no. 4, pp. 1–11, 2018.
- [22] R. C. Mishra and P. R. Dasen, "The Influence of Schooling on Cognitive Development: A Review of Research in India," *South African J. Educ.*, vol. 4, no. 3, pp. 133–137, 2004.
- [23] S. I. Yurevna, "Cognitive research in Education," in *Proceedings of International Scientific-Practical Conference on "Cognitive research in Education,"* 2021, pp. 151–153.
- [24] M. Saeed, R. N. Malik, and A. Kamal, "Fluorosis and cognitive development among children (6–14 years of age) in the endemic areas of the world: a review and critical analysis," *Environ. Sci. Pollut. Res.*, vol. 27, no. 3, pp. 2566–2579, 2020.
- [25] A. N. Davis *et al.*, "Exposure to environmental toxicants and young children's cognitive and social development," *Rev. Environ. Health*, vol. 34, no. 1, pp. 35–56, 2019.
- [26] C. A. Conto, S. Akseer, and T. Dreesen, "COVID-19: Effects of School Closures on Foundational Skills and Promising Practices for Monitoring and Mitigating Learning Loss," UNICEF - Innocenti Work. Pap., vol. WP 2020-13, no. October, pp. 1–30, 2020.
- [27] K. Zierer, "Effects of pandemic-related school closures on pupils' performance and learning in selected countries: A rapid review," *Educ. Sci.*, vol. 11, no. 6, 2021.
- [28] Y. Zhao, "Build back better: Avoid the learning loss trap," *Prospects*, no. 0123456789, 2021.
- [29] A. Nesayan, M. Amani, and R. A. Gandomani, "Research paper: Cognitive profile of children and its relationship with academic performance," *Basic Clin. Neurosci.*, vol. 10, no. 2, pp. 165–174, 2019.

- [30] N. Rao *et al.*, "Early childhood development and cognitive development in developing countries: A rigorous literature review," 2014.
- [31] N. Angrist, Bergman, C. Brewster, and M. Matsheng, "Stemming Learning Loss During the Pandemic: A Rapid Randomized Trial of a Low-Tech Intervention in Botswana," *https://ssm.com/abstract=3663098*, no. August, 2020.
- [32] M. M. Chiu, S. W. Joh, and L. Khoo, "The effects of school closure threats on student performance: Evidence from a natural experiment," *B.E. J. Econ. Anal. Policy*, vol. 16, no. 4, 2016.
- [33] T. Tikhomirova, A. Malykh, and S. Malykh, "Predicting Academic Achievement with Cognitive Abilities: Cross-Sectional Study across School Education," *Behav. Sci. (Basel).*, vol. 10, no. 10, p. 158, 2020.
- [34] ADB, "LEARNING AND EARNING LOSSES FROM COVID-19 SCHOOL CLOSURES IN DEVELOPING ASIA," *Spec. Top. Asian Dev. Outlook*, no. April, 2021.
- [35] E. Dorn, B. Hancock, J. Sarakatsannis, and E. Viruleg, "COVID-19 and learning lossdisparities grow and students need help," *Mckinsey & Company*, no. December, pp. 1–2, 2020.
- [36] Z. H. Babakr, P. Mohamedamin, and K. Kakamad, "Piaget's Cognitive Developmental Theory: Critical Review," *Educ. Q. Rev.*, vol. 2, no. 3, 2019.
- [37] M. Lövdén, L. Fratiglioni, M. M. Glymour, U. Lindenberger, and E. M. Tucker-Drob, "Education and Cognitive Functioning Across the Life Span," *Psychol. Sci. Public Interes.*, vol. 21, no. 1, pp. 6–41, 2020.
- [38] E. A. Hanushek and L. Woessmann, "The Economic Impacts of Learning Losses," 2020.
- [39] N. Dove, J. Wong, R. Gustafson, and T. Corneil, "Impact of School Closures on Learning, Child and Family Well-Being During the COVID-19 Pandemic," 2020.
- [40] L. A. de Araújo, C. F. Veloso, M. de C. Souza, J. M. C. de Azevedo, and G. Tarro, "The potential impact of the COVID-19 pandemic on child growth and development: a systematic review," *J. Pediatr. (Rio. J).*, vol. 97, no. 4, pp. 369–377, 2021.
- [41] N. Fuchs-schündeln, D. Krueger, A. Ludwig, I. P. November, N. Fuchs-schündeln, and D. Krueger, "The long-term effects of school closures," no. November, pp. 1–4, 2021.
- [42] A. Borkowski *et al.*, "COVID-19: Missing More Than a Classroom The impact of school closures on children's nutrition," 2021.