



The Use of Socioeconomic Status (SES) in PEMANTIK Instrument: How Parental Education and Occupation Explain the Relationship with Children Literacy and Numeracy Achievement?

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Abstract. Numerous research has shown the relationship between family SES with children literacy and numeracy achievement, even since the children were in preschool. However, there have been mixed results regarding this issue in Indonesia. This study aims to assess the quality of the Pengukuran Mandiri Literasi dan Numerasi (PEMANTIK) SES indicators and to examine the relationship between SES and children's literacy and numeracy achievement. This research uses data from the subject age 6 - 12 years ($n = 1,637$) in Karawang Regency. Before looking into the association between family SES with children literacy and numeracy achievement, this research will first analyze whether the data on parental education and occupation could represent the family SES. The construct analysis found that SES Indicators on PEMANTIK is a good fit. The relationship between parents' education and occupation could explain family and child's SES, and there was a positive with moderate magnitude correlation between family SES with students' literacy ($r = 0.41$) and numeracy ($r = 0.55$) achievement. Moreover, the further analysis shows that as the SES increases, the achievement also increases; leaving the low SES children with lower scores, compared with their high SES peers. Specific interventions are needed in order to alleviate this inequality issue, and particularly in assisting low SES children to learn in a more effective way which could improve their literacy and numeracy achievement.

Keywords: socioeconomic status (SES), literacy and numeracy achievement, parental education, occupation

1 Introduction

OECD (Organization for Economic Cooperation and Development) and PISA (Program for International Student Assessment) define Socioeconomic Status (SES) as a concept reflecting financial, social, cultural, and human resources that a child could afford [1]. The American Psychology Association (APA) sees SES as a position of a person or group in a socioeconomic stage, which is a combination of several social and economic aspects, such as income, education and occupation level, home location, and number of family members. These aspects then form a composite value of SES and this research, specifically, uses parental education and occupation as SES indicator. However, it first will analyze whether the education and occupation of parents could represent a child's SES, before examining the relation with literacy and numeracy achievement.

1.1 How does SES affect students' achievement?

Numerous research has shown the relation of literacy and numeracy achievement with family SES, where the lower the SES, the lower the achievement, and vice versa. In the US, it's closely related to the opportunity gap to access quality education, particularly by putting the low SES children at high risk. White research then became the first research to show this relationship [2]. His research showed that if SES is a composite of income, parents' occupation and education, and a child as a unit of analysis, then the correlation with achievement is weak ($r = 0.22$). Meanwhile, when the unit of analysis is the aggregate score of several indicators, including school, then the correlation between SES and achievement is quite strong ($r = 0.73$). However, the variety of SES definition and indicators lead to different conclusions, especially in determining the magnitude of the correlation.

The international assessment such as PISA and TIMSS also showed the achievement gap happening in many countries [3]. In OECD countries, on average, children from high SES families scored 89 points higher in reading than their low SES counterparts. The relation is stronger in mathematics, where children' SES could predict almost 14 percent of their math score. Research in Australia using PISA results in 2003 also concluded that higher SES children have a higher math score [4]. In Taiwan, parental income, specifically, affects children's achievement significantly, with higher income families having their child score better [5].

In a study using data from a survey of preschool students in the United States, disparities in children's cognitive skills, especially reading, were clearly visible at the beginning of preschool, with children from high socioeconomic groups having far better reading skills and being more ready to learn than their peers from low SES groups [6]. The lower the SES of a child's family, the lower the child's readiness to learn in preschool. Disparities that occur before starting elementary school are feared to widen and further disadvantage children from low SES families if they are not intervened early.



Fig. 1. Difference of cognitive ability of students entering preschool. Source: [6]

Similar to the results of other studies, research in Indonesia that looked at the effect of SES, especially parental education, on the mathematics achievement of high school students also showed that maternal education has a stronger influence on student achievement in school [7]. Research conducted by Inovasi untuk Anak Sekolah Indonesia (INOVASI) also showed that children who are in families with high maternal education, high household spending, and more possessions (cell phones and internet access) - as some of the factors that shape SES-, tend to have higher achievement [8]. However, interestingly, based on the results of the National Education Report in 2021, there was no difference in the achievement of children's literacy and numeracy based on SES in almost all provinces in Indonesia. Saniarto's research also showed similar results, where no correlation was found between parental education and income levels with children's learning outcomes [9], and Rahayu's research which showed that parents' SES level does not have a direct impact on children's learning outcomes [10].

Research found that children from low SES families or communities are more likely to have slower academic skill development than children from high SES families [11]. The American Psychological Association (APA) also adds that growing up in a low-SES family is associated with weak cognitive, language, memory, and social-emotional development in children, which can impact their earnings and health as adults. In addition, school systems in low-SES areas or communities are more likely to lack adequate resources, which can negatively affect student development and academic outcomes [12].

This means that in many locations, children from families with low SES are less likely to have the same learning experiences as children from higher SES families, both in school and outside of school [13]. The access to learning support, such as book ownership, and parental involvement in learning is also lacking, which then contributes to the difference in children's academic achievement [12]. Children from lower-middle-class families are also less likely to receive meaningful learning outside of school hours, compared to their higher-SES peers who generally have access to additional learning after school [14]. The inequality that occurs even before a child starts their elementary school education will affect their academic achievement, including literacy and numeracy, during their school years, affecting other aspects such as access and participation in higher education, and on the change in the child's SES when they are adults [15].

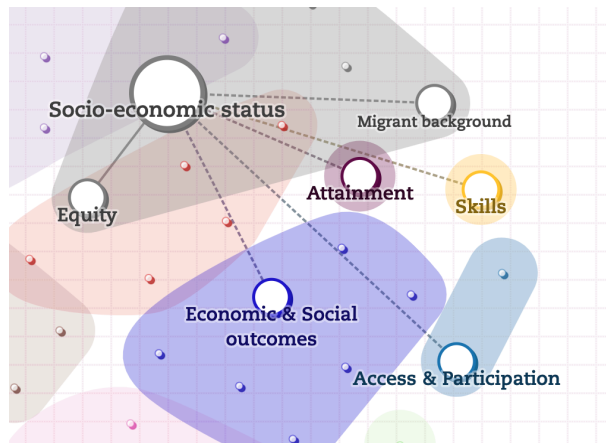


Fig. 2. Relationship of SES with other education-related factors. Source: [3]

Research on the relationship between SES and early literacy and numeracy achievement is then very important because its results can show the urgency of the need for intervention and then be used as the basis for programs to minimize learning outcome disparities since the beginning of a child's schooling [10]. Heckman found that since third grade, the achievement gap between children with different SES levels tends to be stable, meaning that interventions or learning processes at subsequent levels will have little impact in reducing or widening the existing gap before starting school [11]. This emphasizes the need for interventions to be given from the early stages of the education process, interventions that can strengthen the foundation of knowledge and basic skills mastery, especially literacy and numeracy. Certain interventions and approaches, both in school and outside of school, can be carried out with a focus on improving the literacy and numeracy achievement of children from lower-middle SES and to increase access to learning resources that can support their learning process inside and outside of school.

This study will first look at how SES can be represented by parental job and education background, specifically by using PEMANTIK as an assessment platform [16]; before examining how the relationship between children's SES and their basic literacy and numeracy achievement; whether the relationships found in many studies are also proven to exist in the process of children's learning development who are the subjects of the study.

2 Method

This study uses an exploratory descriptive study with a quantitative approach. The Confirmatory Factor Analysis aims to describe the quality of the PEMANTIK instrument to measure SES. Assessment platform PEMANTIK is a web-based platform that is specifically used as a diagnostic tool for measuring literacy and numeracy achievement level of children aged 6 - 12. The descriptive study is in line with the research objective, which is to see the functionality of the SES-related

instrument in the PEMANTIK instrument. This study also explores the relationship between SES and children's literacy and numeracy achievement.

The research sample was selected using data from a literacy and numeracy assessment, -using PEMANTIK assessment platform-, and intervention conducted by Yayasan Inspirasi in Karawang Regency, West Java. The survey technique used was a census survey, which uses all members of the population as a sample [17]. A census survey is used to provide detailed information about all or most elements in the population. The research sample for this study consisted of 1,637 elementary school students aged 6-12 years old in Karawang Regency.

PEMANTIK, a rapid survey assessment platform, was developed using simple and most used SES questions, without some comprehensive questions such as parental income or the availability of access to literacy and numeracy facilities. The PEMANTIK instrument determined SES through four main questions or information: father's education (EDUF), mother's education (EDUM), father's occupation (FJO), and mother's occupation (MJO). To prove that these four main questions can measure the SES variable, the instrument's construct measurement is carried out using factor analysis.

The following analysis is to determine the cut-off to create SES categories based on the Composite SES score in the dataset. The criteria determination uses a reference that has been established using the total score of parental education and occupation as shown in Table 1.

Table 1. SES classification

	SES Class	Total Score
I	Upper	15-16
II	Upper Middle	11-14
III	Lower Middle	6-10
IV	Lower	4-5

All data analyzes conducted in this study used the RStudio software. Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were analyzed using the 'lavaan' package [18] and data were visualized using the 'semPlot' package [19]. Afterwards, the correlation analysis was performed to identify the relationship between SES scores and children's literacy and numeracy achievement.

3 Results and Discussion

3.1 Construct Validity Result

The results of factor analysis shows that the eigenvalues of the resulting factors were 2.118, 0.868, 0.694, and 0.318. The decision that the four questions could be one factor is since the eigenvalue of the first factor is much larger than the others, or eigenvalues >1 [20].

The results of Figure 3 are the output of a measurement model using confirmatory factor analysis (CFA) with the "lavaan" package in R. The model is tested with measurement data from 4 latent variables, namely FJOB, EDUF, MJOB, and EDUM. The results show that the model is a good fit to the available data because of the high values of the comparative fit index (CFI) and Tucker-Lewis's index (TLI) (0.989 and

0.968 respectively)[21]. In addition, the RMSEA value of 0.087 indicates that the model has a good fit to the data. The results show that the four latent variables are interrelated and have significant positive relationships with loading factors > 0.3 [21], [22], [23].

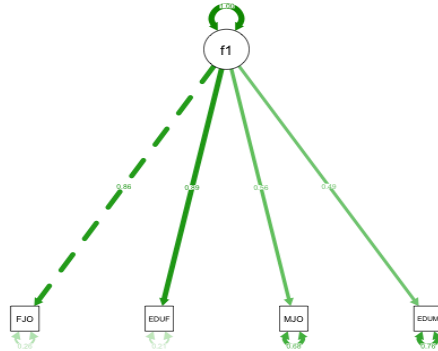


Fig. 3. CFA model for SES indicators

3.2 Correlation and Association between SES and Literacy and Numeracy Achievement

The analysis implies that there is a correlation between the SES variable and literacy achievement. The correlation coefficient between the two variables is 0.41, which indicates a moderate positive relationship. Similarly, the correlation between numeracy achievement and SES is also positive with a moderate magnitude, which is 0.55, implicating the linear relationship between the variables. Linear regression analysis also illustrates that one standard deviation increase in SES is associated with 0.24 standard deviation increase in literacy and 0.31 standard deviation for numeracy score. This concludes that as the SES increases, literacy and numeracy achievement also improve. This condition leads to consistent inequality in children's achievement due to their family SES, leaving the low SES students behind their high SES counterparts.

The positive influence between Socioeconomic Status (SES) and students' literacy and numeracy achievement is attributed to the fact that the questions used to measure SES are well-fitted as a measurement model. Specifically, they are directed as predictive variables for literacy and numeracy achievement. The differences in the predictive variable results of SES for measuring students' Literacy and Numeracy Achievement with PEMANTIK, compared to the national assessment results, are presumed to be due to variations in sample characteristics. The national assessment focuses on grades 5, 8, and 11, while PEMANTIK focuses on children aged 6-12, encompassing populations from both formal and non-formal schools, resulting in SES characteristics that tend to be diverse. In the context of prediction models, heterogeneity in predictor measurement between derivation and validation data can

result in miscalibration of predictions and reduced overall predictive accuracy [24], [25].

This result is similar with the result of other research, highlighting the crucial effects of family SES on children's achievement. While SES is not the sole factor affecting children's achievement, the effects could be lasting since children spend more time at home and at the community. As previously mentioned, children from a better off family background have more access to additional learning resources and support (parental support or surrounding), making them not rely solely on lessons from school. From a young age, they have access to activities that stimulate their cognitive skills to develop, including in early literacy and numeracy. Well educated high SES parents are more likely to read to their children, such as stories, than parents with lower levels of education and/or low SES family.

They also use their good speaking and language skills to communicate with their children [26]. In communication, these parents tend to use more complex, extensive, and varied vocabulary, which can influence and increase children's vocabulary. Research in the United States estimates that since the age of 3, children from low SES families are likely to hear less than a third of the words that children from high SES families hear [26]. As a result, when they are at school, children from families of highly educated parents have better early literacy skills, with them being able to form and use more complex sentences and have a larger vocabulary even before they start school. Further, this is relevant with other research mentioned above that the inequality of skills is developed from an early academic stage.

During school years, they also have access to high quality afterschool learning programs or even have their parents support and assistance during learning. In contrast, their low SES peers tend to have less opportunity, they most likely study only at school, and after school hours are over, they go home and study independently or simply help their parents work (e.g., farming, raising livestock, etc.). This stark difference, if not addressed, has the possibility of widening the achievement inequality between these two groups of children.

4 Conclusion and Recommendation

The results indicate that the SES instrument can be used to measure SES with four questionnaire items. These items measure parental education (both father and mother) and parental occupation (both father and mother). SES instrument four questions allows for quick data collection, making it suitable for subjects involving children.

The analysis results show that SES has a significant impact on children's literacy and numeracy achievement, and that the achievement gap increases as the SES level increases. Therefore, specific interventions or programs need to be provided, especially for children from low-SES families who have low literacy and numeracy achievement. At the school level, teachers are recommended to practice teaching at the right level, a concept of teaching that is tailored to the level of ability and needs of the child. Teachers are expected to conduct an assessment first to see how far the students have progressed, and at what stage the development needs of their literacy and numeracy knowledge and skills are. The results of this assessment are then used as a foundation for the learning process and the provision of additional support,

especially for children from low-SES families who have low literacy and numeracy achievement. However, further research is also needed to examine other determining factors of children's literacy and numeracy achievement.

In addition, providing access to meaningful learning outside of school hours can help children from low-SES families improve their literacy and numeracy skills. There is a growing body of research that shows the effectiveness of meaningful after-school learning, particularly as one approach (in addition to in-school learning) to reduce the achievement gap for children from low-income families [27], [28], [29]. This can be done and achieved through collaboration with educational advocacy communities (working specifically in literacy and numeracy), the involvement of local governments, and communities around the children's residence. However, to be an effective process, interventions involving non-school parties also need to be evidence-based, using data on the child's achievement stage and learning needs (PEMANTIK can also be used as it is a community friendly platform), as well as using interventions that have been scientifically proven to improve the child's literacy and numeracy competence.

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References

1. N. Center for Education Statistics, "Improving the Measurement of Socioeconomic Status for the National Assessment of Educational Progress: A Theoretical Foundation--Recommendations to the National Center for Education Statistics.," *National Center for Education Statistics*, Nov. 2012.
2. K. R. White, "The relation between socioeconomic status and academic achievement.," *Psychol Bull*, vol. 91, no. 3, pp. 461–481, May 1982, doi: 10.1037/0033-2909.91.3.461.
3. OECD, "PISA 2018 Results (Volume II)," Dec. 2019, doi: 10.1787/B5FD1B8F-EN.
4. A. McConney and L. B. Perry, "Socioeconomic status, self-efficacy, and mathematics achievement in Australia: a secondary analysis," *Educational Research for Policy and Practice*, vol. 9, no. 2, pp. 77–91, Jun. 2010, doi: 10.1007/s10671-010-9083-4.
5. M.-L. Fu, L. Cheng, S.-H. Tu, and W.-H. Pan, "Association between Unhealthy Eating Patterns and Unfavorable Overall School Performance in Children," *J Am Diet Assoc*, vol. 107, no. 11, pp. 1935–1943, Nov. 2007, doi: 10.1016/j.jada.2007.08.010.
6. E. García and E. Weiss, "Reducing and averting achievement gaps: Key findings from the report 'Education inequalities at the school starting gate' and comprehensive strategies to mitigate early skills gaps | Economic Policy Institute." Accessed: Jan. 14, 2024. [Online]. Available: <https://www.epi.org/publication/reducing-and-averting-achievement-gaps/#epi-toc-7>

7. K. Kusaeri, A. Aditomo, A. Ridho, and Ah. Z. Fuad, "Socioeconomic Status, Parental Involvement In Learning And Student' Mathematics Achievement In Indonesian Senior High School," *Jurnal Cakrawala Pendidikan*, vol. 37, no. 3, Oct. 2018, doi: 10.21831/cp.v38i3.21100.
8. J. Spink, D. Cloney, and A. Berry, "THE LEARNING GAP SERIES-ONE Beyond letters and numbers: the COVID-19 pandemic and foundational literacy and numeracy in Indonesia," 2022, Accessed: Jan. 14, 2024. [Online]. Available: <http://www.inovasi.or.id>
9. F. Saniarto and B. Panunggal, "POLA MAKAN, STATUS SOSIAL EKONOMI KELUARGA DAN PRESTASI BELAJAR PADA ANAK STUNTING USIA 9-12 TAHUN DI KEMIJEN SEMARANG TIMUR," *Journal of Nutrition College*, vol. 3, no. 1, pp. 163–171, Jan. 2014, doi: 10.14710/JNC.V3I1.4552.
10. J. Manajemen Fakultas Ekonomi, U. Negeri Malang Korespondensi, and P. Summersari Baru Kav, "Analisis Intensitas Pendidikan Oleh Orang Tua Dalam Kegiatan Belajar Anak, Status Sosial Ekonomi Orang Tua Terhadap Motivasi Belajar Dan Prestasi Belajar Siswa," *Jurnal Pendidikan dan Pembelajaran Universitas Negeri Malang*, vol. 18, no. 1, pp. 65–71, 2011, Accessed: Jan. 14, 2024. [Online]. Available: <https://www.neliti.com/publications/121105/>
11. P. L. Morgan, G. Farkas, M. M. Hillemeier, and S. Maczuga, "Risk Factors for Learning-Related Behavior Problems at 24 Months of Age: Population-Based Estimates," *J Abnorm Child Psychol*, vol. 37, no. 3, pp. 401–413, Apr. 2009, doi: 10.1007/s10802-008-9279-8.
12. N. L. Aikens and O. Barbarin, "Socioeconomic differences in reading trajectories: The contribution of family, neighborhood, and school contexts.," *J Educ Psychol*, vol. 100, no. 2, pp. 235–251, May 2008, doi: 10.1037/0022-0663.100.2.235.
13. A. K. Chmielewski, "The Global Increase in the Socioeconomic Achievement Gap, Online appendix The existence of a 'socioeconomic achievement gap'-a disparity in academic achievement," 1964.
14. E. Silva, "Off the Clock: What More Time Can (and Can't) Do for School Turnarounds. Education Sector Reports.," *Education Sector*, Mar. 2012.
15. E. L. Ng, R. Bull, and K. H. Khng, "Accounting for the SES-Math Achievement Gap at School Entry: Unique Mediation Paths via Executive Functioning and Behavioral Self-Regulation," *Front Educ (Lausanne)*, vol. 6, Sep. 2021, doi: 10.3389/educ.2021.703112.
16. Pusat Studi Pendidikan dan Kebijakan, "PEMANTIK: Pengukuran Mandiri Literasi dan Numeasi PSPK." Accessed: May 01, 2023. [Online]. Available: <https://pemantik.or.id/>
17. A. G. Bluman, *Elementary Statistics, a Step-by-Step Approach*, 10th ed. New York: McGraw-Hill Education, 2018.
18. Y. Rosseel, "lavaan: An Package for Structural Equation Modeling," *J Stat Softw*, vol. 48, no. 2, 2012, doi: 10.18637/jss.v048.i02.
19. S. Epskamp, "semPlot: Path Diagrams and Visual Analysis of Various SEM Packages.," Accessed: Jul. 14, 2023. [Online]. Available: <https://CRAN.R-project.org/package=semPlot>
20. H. F. Kaiser, "The Application of Electronic Computers to Factor Analysis," *Educ Psychol Meas*, vol. 20, no. 1, pp. 141–151, Apr. 1960, doi: 10.1177/001316446002000116.
21. K. Lai and S. B. Green, "The Problem with Having Two Watches: Assessment of Fit When RMSEA and CFI Disagree," *Multivariate Behav Res*, vol. 51, no. 2–3, pp. 220–239, May 2016, doi: 10.1080/00273171.2015.1134306.
22. F. Chen, P. J. Curran, K. A. Bollen, J. Kirby, and P. Paxton, "An Empirical Evaluation of the Use of Fixed Cutoff Points in RMSEA Test Statistic in Structural Equation Models," <http://dx.doi.org/10.1177/0049124108314720>, vol. 36, no. 4, pp. 462–494, May 2008, doi: 10.1177/0049124108314720.

23. L. T. Hu and P. M. Bentler, "Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives," *Struct Equ Modeling*, vol. 6, no. 1, pp. 1–55, 1999, doi: 10.1080/10705519909540118.
24. A. Olsson-Collentine, M. Bakker, and J. Wicherts, "Unreliable Heterogeneity: How Measurement Error Obscures Heterogeneity in Meta-analyses in Psychology," Jan. 2024, doi: 10.31234/OSF.IO/JNB6E.
25. K. Luijken, R. H. H. Groenwold, B. Van Calster, E. W. Steyerberg, and M. van Smeden, "Impact of predictor measurement heterogeneity across settings on the performance of prediction models: A measurement error perspective," *Stat Med*, vol. 38, no. 18, p. 3444, Aug. 2019, doi: 10.1002/SIM.8183.
26. A. J. Egalite, "How Family Background Influences Student Achievement: Can Schools Narrow the Gap?," *Education Next*, vol. 16, no. 2, pp. 70–78, 2016.
27. National Conference of State Legislatures (NCSL), "Supporting Student Success Through Afterschool Programs." Accessed: Jan. 14, 2024. [Online]. Available: <https://www.ncsl.org/education/supporting-student-success-through-afterschool-programs>
28. Alliance, "What does the research say about afterschool?," 2017.
 1. A. M. Wong, "Secrets of Successful Afterschool Programs | Harvard Graduate School of Education." Accessed: Jan. 14, 2024. [Online]. Available: <https://www.gse.harvard.edu/ideas/usable-knowledge/08/02/secrets-successful-afterschool-programs>

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