Majumdar, R. et al. (Eds.) (2025). Proceedings of the 1st International Conference on Learning Evidence and Analytics. Asia-Pacific Society for Computers in Education

Exploring K–12 Teachers' Data Literacy in Singapore: Knowledge, Self-Efficacy, and Perceived Value of Data

Ean Teng KHOR* **& Amelia CHEE**
Nanyang Technological University, Singapore
***eanteng.khor@nie.edu.sg**

Abstract: Despite the growing emphasis on data-informed teaching, there is limited understanding of how well-equipped teachers are to engage with data especially in Singapore. The study examines data literacy among K–12 teachers in Singapore, focusing on their knowledge of data concepts, self-efficacy, and perceived value of data-informed practices. Findings show teachers value and feel confident using data but demonstrate low data knowledge. Subject specialization and age were also found to be associated with significant differences in data literacy outcomes. These insights can guide more targeted professional learning to strengthen teachers' capacity for data-informed instruction.

Keywords: Data literacy, data-driven decision making, self-efficacy, perceived value of data use, K–12 teachers

1. Introduction

As data-driven decision-making becomes central to education, data literacy is increasingly recognised as a key teacher competency. It enables more responsive instruction and helps address diverse student needs (Öngören, 2021). However, despite wider access to educational data and tools, many teachers still struggle to apply data effectively (Means et al., 2010). This suggests that access alone is not enough; confidence, understanding, and perceived value also play important roles. The study examines three dimensions of teacher data literacy in Singapore: knowledge, self-efficacy, and perceived value. Findings aim to inform more targeted professional learning and policies that enhance teachers' capacity for data-informed instruction.

2. Literature Review

2.1 Data Literacy in education

Data literacy is the ability to collect, analyze, and interpret data to inform educational decisions (Mandinach & Gummer, 2016). It enhances differentiated instruction, and contributes to improved learning outcomes (Lee et al., 2024). Despite growing access to data and tools, many educators struggle to use data effectively (Means et al., 2010). Frameworks such as Data Literacy for Teachers (DLFT) address this by outlining key competencies in interpretation, application, and ethical data use (Mandinach & Gummer, 2016). In Singapore, efforts such as the EdTech Masterplan 2030 and Professional Learning Communities promote data-informed practices (Lee et al., 2013). However, local research on teachers' data literacy remains limited.

2.2 Factors Influencing Teachers' Data Literacy

Self-efficacy is a key factor in teachers' engagement with data. Educators with higher self-efficacy are more confident in identifying student needs, applying interventions, and evaluating

instructional strategies (Alaqeel, 2024). Defined as belief in one's capabilities to achieve desired outcomes (Bandura, 1997), it helps teachers persist through interpretive challenges when using data. Lastly, demographic factors such as gender, role, and experience also influence data use (Sattayaraksa et al., 2023). However, little is known about how these factors affect K–12 teachers in Singapore.

2.3 Challenges and Barriers to Effective Data Use in Teaching

Teachers face challenges when applying data such as locating, interpreting, constructing assessments, and connecting data to instructional decisions (Means et al., 2010; Van den Bosch et al., 2017). These can lead to data anxiety, especially when navigating unfamiliar systems (Lee et al., 2024). Such barriers highlight the need for sustained support and context-specific strategies to build teachers' capacity for effective data use.

3. Research Methods

3.1 Participants and Study Design

Data were collected from 126 K–12 teachers in Singapore. After removing ineligible and duplicate entries, 121 valid responses remained. The sample comprised 44 males and 77 females with varied teaching backgrounds. Participants had 0–40 years of experience and were aged 21 to over 60, enabling exploration across career stages. This quantitative cross-sectional study examined teachers' self-efficacy (SE), perceived value of data use (PVDU), and data literacy knowledge (DK). Data was collected through adapted versions of the 3D-MEA (Dunn et al., 2013) and TDUS (Wayman et al., 2016), chosen for their strong psychometric properties, along with a knowledge assessment. Descriptive and inferential analyses were used to identify patterns across demographic groups, aiming to provide a baseline understanding of teachers' data literacy competencies and beliefs.

3.2 Measures

Participants completed a combined survey using 5-point Likert items from the 3D-MEA and TDUS that measure SE and PVDU respectively. The adapted SE and PVDU subscales both showed strong reliability ($\alpha = 0.91$ *and* 0.92, *respectively*). DK was assessed using 13 multiple-choice and 5 open-ended items developed by the research team, drawing from the DLFT framework (Mandinach & Gummer, 2016) and the Data Literacy Questionnaire for Educators (Donate-Beby et al., 2024). Items were designed to cover key domains such as data interpretation, display analysis, and instructional application. The rubric for open-ended responses was formed and refined through team discussion. Final responses were double coded by two independent raters, with high inter-rater reliability (*ICC = 0.957)* supporting consistency.

4. Results and Discussion

Teachers reported moderately high self-efficacy ($M = 45.25$, $SD = 5.61$) and strong perceived value of data use ($M = 61.69$, $SD = 7.26$), but lower data knowledge scores ($M = 12.20$, $SD = 6.55$), indicating a gap between confidence and competence. ANOVA showed no significant differences in SE or PVDU by demographic factors ($p > .05$), though DK differed by subject ($p = .006$) and region ($p = .005$), with small subgroup sizes limiting interpretation. SE and PVDU were strongly correlated ($\rho = .653$, $p < .001$), while DK was not. Generalized Linear Models identified subject and age as significant predictors of SE and PVDU, with higher scores among STEM teachers and those over 50. Younger Art teachers scored lowest. DK showed a significant subject-by-age interaction, with younger Art teachers performing worse than peers in STEM, Language, and Humanities. Gender effects were marginal ($p = .054$). Interaction patterns suggest that beliefs about data use may vary across intersecting factors. These

results suggest that while teachers value and feel confident in using data, many lack data knowledge.

5. Conclusion

This study provides insights into K–12 teachers' data literacy in Singapore, revealing strong self-efficacy and positive beliefs about data use, but gaps in foundational knowledge. These findings suggest that confidence alone does not ensure effective data application. To bridge this gap, professional learning should go beyond tools used to build analytical skills such as interpretation, source evaluation, and data-based decision-making. Training should build on teachers' self-efficacy and positive beliefs by aligning content with their subject, experience, and knowledge levels. Future qualitative research could explore how demographic factors shape teachers' beliefs and practices to inform more targeted, sustainable initiatives.

Acknowledgements

This study was funded by Singapore Ministry of Education (MOE) under the Education Research Funding Programme (OER 19/22 KET) and administered by National Institute of Education (NIE), Nanyang Technological University, Singapore. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Singapore MOE and NIE NTU, Singapore.

References

Alaqeel, A. S. (2024). Examining self-efficacy and anxiety in data-driven decision-making practices among learning disabilities teachers in Saudi Arabia: A mixed-methods study. *Cogent Education, 11*(1), 2434775. https://doi.org/10.1080/2331186x.2024.2434775

Bandura, A. (1997) Self-efficacy: The exercise of control. W.H. Freeman and Company, New York.

Donate-Beby, B., García-Peñalvo, F. J., & Amo-Filva, D. (2024, June). Data Literacy Questionnaire for Educators. In 2024 International Symposium on Computers in Education (SIIE) (pp. 1-6). IEEE. 10.5281/zenodo.10453796

Dunn, K. E., Airola, D. T., Lo, W. J., & Garrison, M. (2013). What teachers think about what they can do with data: Development and validation of the data driven decision-making efficacy and anxiety inventory. *Contemporary Educational Psychology, 38*(1), 87-98.

Lee, D., Hong, H., Tay, W., & Lee, W. O. (2013). Professional learning communities in Singapore schools. *Journal of Co-operative Studies, Special issue: Transformative power of co-operation in education, 46*(2), 53-56.

Lee, J., Alonzo, D., Beswick, K., Abril, J. M. V., Chew, A. W., & Oo, C. Z. (2024). Dimensions of teachers' data literacy: A systematic review of literature from 1990 to 2021. *Educational Assessment, Evaluation and Accountability*, *36*(2), 145-200. https://doi.org/10.1007/s11092-024-09435-8

Mandinach, E. B., & Gummer, E. S. (2016). Every teacher should succeed with data literacy. *Phi Delta Kappan*, *97*(8), 43-46. https://doi.org/10.1177/0031721716647018

Means, B., Padilla, C., & Gallagher, L. (2010). Use of education data at the local level: From accountability to instructional improvement. *US Department of Education*. https://www2.ed.gov/rschstat/eval/tech/use-of-education-data/use-of-education-data.pdf

Öngören, S. (2021). Investigation of prospective preschool teachers' digital literacy and teacher readiness levels. *International Journal of Modern Education Studies*, *5*(1), 181-204. https://ijonmes.net/index.php/ijonmes/article/view/90

Sattayaraksa, W. D., Luangrangsee, P., Ratsameemonthon, C., & Sulisworo, D. (2023). Understanding how demographic factors influence faculty member's perceptions of online learning success: A case study in Thai private higher education. *Journal of Pedagogical Research*, *7*(5), 48-68. https://doi.org/10.33902/jpr.202323519

Van Den Bosch, R. M., Espin, C. A., Chung, S., & Saab, N. (2017). Data-based decision-making: Teachers' comprehension of curriculum-based measurement progress-monitoring graphs. *Learning Disabilities Research and Practice*, *32*(1), 46–60. https://doi.org/10.1111/ldrp.12122

Wayman, J. C., Wilkerson, S. B., Cho, V., Mandinach, E. B., & Supovitz, J. A. (2016). Guide to using the teacher data use survey. *REL Appalachia and the Institute of Educational Sciences, US Department of Education.*