Lesson Study Model Perception Scale: Validity and Reliability Study

Ahmet Aykan
Muş Alparslan University, Turkey
https://orcid.org/0000-0002-8033-0821

Fuat Elkonca
Muş Alparslan University, Turkey
https://orcid.org/0000-0002-2733-8891

OPEN ACCESS

Volume: 10

Special Issue: 1

Month: August

Year: 2022

E-ISSN: 2582-1334

Received: 29.06.2022

Accepted: 30.07.2022

Published: 18.08.2022

Citation:
Aykan, Ahmet, and Fuat Elkonca. "Lesson Study Model Perception Scale: Validity and Reliability Study." *Shanlax International Journal of Education*, vol. 10, no. S1, 2022, pp. 261–69.

DOI:
https://doi.org/10.34293/education.v10iS1-Aug.4998

Abstract
This study aimed to develop the "Lesson Study Model Perception Scale" (LSMPS) and to determine the psychometric properties of the scale. The study was designed as a survey model. A survey model is a research approach that aims to describe a situation as it is. When all the findings obtained to determine the psychometric properties of the scale developed within the scope of the research are evaluated together, it is investigated that the measurements obtained from the scale and the inferences to be made based on these findings are reliable and valid. Existing literature revealed that there are limited number of studies that determine how the LS model is perceived by teachers. It is seen that none of these studies attempted to develop a scale to measure teachers' perceptions of the LS model. The lack of a study in this context in the literature shows the originality of the study.
Keywords: Lesson Study, Perception, Scale, Teachers, Professional Development

Introduction

Lesson Study (LS) is a teacher professional development model that originally came from Japan and is widely used in East Asian countries (Fujii, 2019; Makinae, 2019). LS was noticed outside of East Asia when researchers watched the videos of lectures conducted in Japan after the model's success in the TIMMS exam in 1999 (Aykan & Dursun, 2021; Norwich & Ylonen, 2013). Firstly, with the doctoral dissertation written by Yoshida (1999) and then the article by Stigler and Hiebert (1999), the world became familiarized with the LS model. In this vein, research on the LS model has become widespread in many countries, especially in the USA and England (Dudley, 2015). Thus, the LS professional development model has become the focus of attention of researchers in almost all countries today (Groves et al., 2013; Saito, 2012).

LS, which was applied traditionally without a pedagogical and theoretical background at the beginning, has become a professional development model applied systematically and with a pedagogical basis after considerable research has been done on the subject (Kanauan & Inprasitha, 2014; Saito & Atencio, 2015).The LS cyclical process, which starts with a group of teachers coming together and preparing a lesson plan in cooperation, continues with any teacher from the group applying the prepared lesson plan in the classroom and other group members taking notes by observing in the classroom environment. Then, after the lesson, all group members come together and share their observation notes, ideas and suggestions about the teaching process. Finally, based on all ideas and suggestions, the lesson plan is rearranged in cooperation and applied in the classroom by a different teacher in the group. If desired, this cyclical process can be continued several more times (Aykan &Yıldırım, 2021; Dudley, 2013; Lewis, 2002; Stigler & Hiebert, 2009).

Bringing continuity to professional development, LS gives teachers the opportunity to share their professional knowledge, skills, and experiences with their colleagues, thanks to the collaborative and interactive environment it provides (Chen, 2017). In addition, LS, which improves teachers' critical and creative thinking skills throughout the practice, gives them the opportunity to see the course process through the eyes of students (Yeşilçınar & Aykan, 2022). It is seen LS model's advantage that the focus of observation is based on the reflection process of teaching and the students rather than the teacher himself, and the absence of a supervisory and disciplinary understanding (Saito & Atencio, 2015). In addition to these advantages of the model, there are also some limitations for teachers, such as not finding enough time, being reluctant to be part of innovations, not taking risks, and not being open to cooperation (Aykan & Dursun, 2021; Demir, Czerniak, & Hart, 2013).

The LS model continues to be applied by different teacher groups in a new country every day (Aykan & Kıncal, 2016; Groves et al., 2013).The increasingly widespread use of the model also raises questions about teachers' perceptions of this professional development model. When the literature is examined, it is understood that there are a limited number of studies to determine how the LS model is perceived by teachers (Aimah & Purwant, 2018; Hervas & Medina, 2022; Inprasitha, 2014; Matanluk, Johari, & Matanluk, 2013; Van Sickle, 2011). However, the lack of a reliability and validity study to determine teachers' perceptions of the LS model formed the basis for this study.

Aim of the Study

The aim of this study is to develop the "Lesson Study Model Perception Scale" (LSMPS) and to determine the psychometric properties of the scale.

Method

The study aimed to develop the LSMPS scale and to determine the psychometric properties of the scale. Thus, the study was designed as a survey model. The survey model is a research approach that aims to describe a situation as it is (Karasar, 2012).

The Process of Developing the Scale

Establishing the Item Pool

While creating the item pool within the scope of the research, first, the relevant literature was scanned in detail. Since there was no scale developed for this purpose before, the studies on the Lesson Study Model were examined and the indicators that could reveal the perceptions of the teachers towards this model were reported. In this context, a total of 32 items were written to determine the perceptions of the teachers regarding the contributions of the Lesson Study Professional Development Model on their ability to prepare lesson plans, methodological and technical knowledge and skills, assessment and evaluation competencies, developing professional collaborations, and classroom management skills. The items are scored on a 5-pt Likert-type scale ranging from (1) Strongly Disagree, (2) Disagree, (3) Neutral, (4) Agree, and (5) Strongly Agree.

Getting Expert Opinion and Piloting Application

To determine the perceptions of the teachers about the Lesson Study Professional Development Model, the draft version of the items was sent to two scholars who are experts in the relevant field and to an educational measurement and evaluation specialist, and their opinion were received on the intelligibility, scope, and suitability of the scale items to the relevant structure. The views of the experts on the items in the scale were evaluated by the researchers, and changes and corrections were made in the statements of the four items. Then, the final version of the scale was applied to 15 teachers and a pre-trial application was made. As a result of the application, according to the small feedback received from the teachers, it was seen that the scale items were generally understandable, and the application period lasted approximately 10 minutes.

The Study Group

Since the primary purpose of determining the sample during the pilot implementation process was to work on a sample representing the measured feature, the appropriate sampling method was preferred to reach more participants in the study. The final version of the 32-item scale was applied to a total of 334 teachers who learned and applied the

LS model during the pilot implementation process. 60% of these teachers were female (N=200) and 40% were male (N=134), and their experience generally varied between 1 and 15 years. In addition, different teachers from many different branches were included in the research to ensure heterogeneity. It was aimed to provide evidence for the construct validity of the measurements obtained from the scale by performing Exploratory Factor Analysis (EFA) on the collected data to determine whether the scale measures the relevant structure and the number of dimensions of the scale. Within the scope of the original application of the research, EFA was performed during the pilot application process, and the final version of the scale, whose size and number of items were determined, was reapplied to 223 (63% female; 37% male) participants and Confirmatory Factor Analysis (CFA) was performed. In this vein, the researchers aimed to determine the model-data fit of the scale, whose factor structure was revealed during the pilot implementation process, in a different sample with similar characteristics, in other words, to provide evidence for the construct validity. There are different approaches in the literature to determine the appropriate sample size for EFA and CFA. Generally, it is considered appropriate that at least 5 times the number of items in the scale or 200 participants is sufficient (Kass & Tinsley, 1979). In this context, it is seen that the number of participants within the scope of the research is sufficient according to the data in the literature.

Data Analysis

The final version of the LSMPS scale consisting of 32 items was applied to 334 participants in the trial application and the factor structure of the scale was revealed by using the measurement results obtained from the scale. For this purpose, the EFA method was used. While performing EFA, Kaiser-Meyer-Olkin (KMO) and Bartlett Sphericity Test were used to determine whether the data was suitable for factor analysis.

After determining the factor structure of the LSMPS scale, the scale was reapplied to 223 participants who learned and applied the LS model to determine the model-data fit in a different sample. CFA was conducted to test the model-data fit of the measurement results obtained from the scale, in other words, to provide evidence for construct validity. Some fit indices were considered to determine whether the model established in the CFA analysis fit the data. To this end, such as Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR), Normed Fit Index (NFI), Non-Normed Fit Index (NNFI), Comparative Fit Index (CFI), and Goodness of Fit Index (GFI) fit indices were used. Cronbach Alpha (α) and McDonald's omega (ω) reliability coefficients were reported to provide evidence for the reliability of the measurement results.

Findings

Findings on Exploratory Factor Analysis (EFA)

Within the scope of the research, the Kaiser-Meyer Olkin and Bartlett sphericity test was conducted to evaluate the suitability of the data obtained by the pilot application of the scale for factor analysis.

Table 1 KMO and Bartlett Test Results

Kaiser-Meyer-Olkin (KMO)		**0,96**
Bartlett Test	χ^2	9827,11
	sd	496
	p	0,000

As seen in Table 1, the value of KMO was obtained as 0.96. This value shows that the data is quite suitable for factor analysis (Field, 2009). Bartlett sphericity was used to determine whether the scale items were related. It is seen that the obtained values are statistically significant (χ^2=9827.11; p< 0.05). In addition to this interpretation, the significance of the sphericity test can also be considered as multivariate normality (Büyüköztürk, 2012). After evaluating the suitability of the data for factor analysis, EFA was performed. According to these results, three factors with eigenvalues above 1 were obtained. The eigenvalues and obtained variance rates for each factor are given in Table 2.

As seen in Table 2, the eigenvalue of the first factor is 18.96 and the variance rate explained by this factor alone is 59.26%. In addition, the eigenvalue of the first factor is approximately nine times the eigenvalue of the second factor (18.96/2.06=9.20). The fact that the eigenvalue of the first factor is more

than three times the eigenvalue of the second factor and the variance it explains alone is more significant than 20% indicates that the scale has a dominant factor (Hattie, 1985; Lord, 1980; Reckase, 1979). From this point of view, it was understood that the scale had a single-factor dominant structure. The scree plot is also reported in Figure 1 to provide additional evidence in determining the number of factors.

Table 2 Rates of Eigenvalue, Obtained Variance, and Obtained Total Variance

Factors	Eigen value	Obtained Variance (%)	Obtained Total Variance (%)
1	18,96	59,26	59,26
2	2,06	6,44	65,70
3	1,16	3,63	69,33

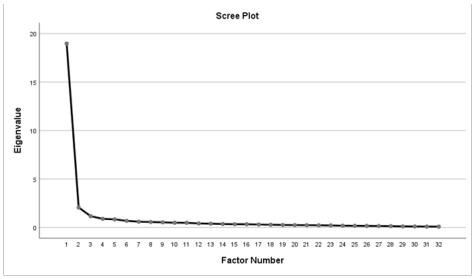

Figure 1 Scree Plot of Factor Eigenvalues

As seen in Figure 1, it is seen that the most significant break between eigenvalues is in the first factor. Especially after the second factor, it is seen that the amount of decrease between the eigenvalues is quite close.

After deciding on the factor number of the scale, factor analysis was repeated by fixing the factor number to 1. The factor loads of 32 items in the final version of the scale are given in Table 3.

Table 3 Factor Loading Values, Eigenvalues and Obtained Variance Ratios of the Final Version of the Scale

Item Number	Factor Loading	Item Number	Factor Loading
M1	0,68	M17	0,76
M2	0,74	M18	0,80
M3	0,75	M19	0,82
M4	0,76	M20	0,74
M5	0,77	M21	0,82
M6	0,80	M22	0,73
M7	0,80	M23	0,71
M8	0,76	M24	0,72
M9	0,79	M26	0,73
M10	0,76	M27	0,74
M11	0,80	M28	0,73
M12	0,79	M29	0,75
M13	0,82	M30	0,58
M14	0,85	M31	0,75
M15	0,85	M32	0,67
M16	0,85		
Eigenvalues		18,96	
Total Variance explained (%)		59,26	

As seen in Table 3, the total variance explained by the single-factor structure is approximately 59%. The factor loads of the items range between 0.58 and 0.85. Tabachnick & Fidel (2013) stated that if the standard regression coefficients (factor load) for each item were above 0.32, the model-data fit was at an acceptable level. All items in the single-factor scale have a factor load value of over 0.50. Therefore, no items were removed. The item statistics, corrected item-total correlation, and reliability coefficient values regarding the final version of the scale are given in Table 4.

Table 4 Item Statistics, Adjusted Item-Total Correlation Values and Reliability Coefficient Values of the Final Version of the Scale

Item Number	Item Average ($\bar{x}$)	Adjusted Item-Total Correlation (r)	Item Number	Item Average ($\bar{x}$)	Adjusted Item-Total Correlation (r)
M1	4,41	0,67	M17	4,32	0,74
M2	4,45	0,73	M18	4,33	0,79
M3	4,45	0,74	M19	4,35	0,81

M4	4,50	0,75	M20	4,32	0,74
M5	4,40	0,75	M21	4,31	0,81
M6	4,51	0,78	M22	4,40	0,73
M7	4,45	0,79	M23	4,34	0,71
M8	4,39	0,75	M24	4,30	0,72
M9	4,44	0,78	M26	4,31	0,73
M10	4,42	0,74	M27	4,37	0,74
M11	4,42	0,79	M28	4,34	0,73
M12	4,44	0,77	M29	4,45	0,74
M13	4,41	0,81	M30	4,16	0,57
M14	4,36	0,84	M31	4,36	0,75
M15	4,40	0,83	M32	4,24	0,66
M16	4,38	0,83			
Item Average for the Overall Scale			: 4,38		
Overall Item-Total Correlation values of the Scale			: 0,75		
Cronbach Alpha (α)			0,97		
McDonald's omega (ω)			0,97		

Table 4 reveals the averages of the items in the scale are between 4 and 5, and the overall average was obtained as 4.38. Generally, it is seen that the participants' perceptions of the lesson study professional development model are high. Considering the item-total correlation values, it is seen that it varies between 0.57 and 0.84, and the average of the corrected item-total correlation values calculated for the overall scale is 0.75. If the item-total correlation coefficient values are 0.30 and above, it is interpreted that the items in the scale work in harmony with the overall scale (Crocker & Algina, 2006). The reliability coefficient values of Cronbach Alpha and McDonald's omega (ω) were obtained as 0.97. This value shows that the measurement results obtained from the scale are highly reliable (George & Mallery, 2016).

The model-data fit of the scale, which was determined to have a single-factor structure according to the EFA result, was re-evaluated in a different sample with similar characteristics. In this way, it is aimed to evaluate the model-data fit of the measurement results obtained from the scale and to provide additional evidence for the construct validity of the scale. The path diagram of the model with a single-factor in the data of a new sample is given in Figure 2.

Findings on Confirmatory Factor Analysis (CFA)

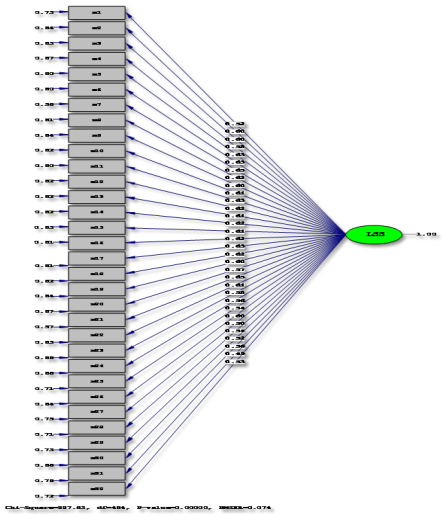

Figure 2 Factor Loadings and Error Variances Regarding CFA Model

According to the CFA results, it is seen that the standardized regression coefficients (factor loads) of the model established with 32 items in the scale range between 0.52 and 0.63. The regression coefficients for all of the items are significant at the 0.05 level. Error variances range from 0.73 to 0.61. The standard regression coefficients (factor load) for each item above 0.32 are considered adequate for model data

fit (Tabachnick & Fidel, 2013). The values of the model-data fit of the DFA model established for the measurement results obtained from the scale are given in Table 5 (Forza & Filippini, 1998; Schermelleh-Engel, Moosbrugger & Müller, 2003).

Table 5 CFA Model Data-Fit Criteria

Mode-Data fit criteria	Values of the scale	Good fit	Acceptable fit
□2 / sd	2.15	0 ≤ □2/sd ≤ 2	2 <□2/sd ≤ 5
RMSEA	0.07	0 ≤ RMSEA ≤ 0.05	0.05 < RMSEA ≤ 0.08
SRMR	0.04	0 ≤ SRMR ≤ 0.05	0.05 < SRMR ≤ 0.010
CFI	0.96	0.97 ≤ CFI ≤ 1.00	0.95 ≤ CFI < 0.97
NFI	0.92	0.95 ≤ NFI ≤ 1.00	0.90 ≤ NFI < 0.95
NNFI	0.95	0.97 ≤ NNFI ≤ 1.00	0.95 ≤ NNFI< 0.97
GFI	0.91	0.95 ≤GFI ≤ 1.00	0.80 ≤ GFI ≤0.95

As seen in Table 5, χ 2 / sd= 2.15 was found in the CFA model that was established for the measurement results obtained from the scale. Similarly, RMSEA and SRMR values are lower than 0.08 and are at an acceptable fit. It was concluded that CFI and NNFI values above 0.95 showed good fit and NFI and GFI values showed acceptable fit. When all the findings obtained to determine the psychometric properties of the scale developed within the scope of the research are evaluated together, it is understood that the measurements obtained from the scale and the inferences to be made based on these results are reliable and valid.

Discussion

LS has recently become a highly accepted and widely used teacher professional development model in many countries of the world (Groves et al., 2013). The model provides an environment where teachers work collaboratively and share things each other based on their profession. Although the LS model makes positive contributions to the professional development of teachers (Barber, 2018; Gonzalez & Deal, 2017; Hicyilmaz & Aykan, 2020; Skott & Moller, 2017), to the best knowledge of the researchers, no scale has been developed to measure teachers' perceptions of the model. On this basis, the focus of this study was the development of the LSMPS scale to measure teachers' perceptions of the LS model. While creating the items in the scale, the effect of the LS model on teachers' knowledge and skills within the scope of lesson plan, teaching-method - technique, measurement - evaluation, classroom management, and professional cooperation was considered. The LSMP scale consists of a total of 32 items and has a single-factor structure. The ratio of total variance explained by a single-factor is approximately 59%. While the factor load values of the items in the scale range between 0.57 and 0.85, the item-total correlation values range between 0.57 and 0.84.This result shows that the items in the scale are generally predicted by the latent structure and work in harmony with the overall scale (Crocker & Algina, 2006). The reliability coefficient value of the measurement results obtained from the scale is 0.97. This result shows that the measurement results obtained from the overall scale and its sub-factors are highly reliable (George & Mallery, 2016).As a result of the CFA performed to evaluate the model-data fit as a result of the actual application of the LSMP scale, the RMSEA value was 0.07, the SRMR value was 0.004, and the CFI, NFI, NNFI and GFI values were more significant than 0.90.All these values show that the measurements obtained from the LSMPS scale have a good level of model-data fit (Forza & Filippini, 1998; Schermelleh-Engel, Moosbrugger, & Müller, 2003).When all the results obtained to determine the psychometric properties of the scale developed within the scope of the research are considered together, the measurements obtained from the LSMPS scale and the inferences to be made based on these results are reliable and valid. The lowest score that can be obtained from the LSMPS scale, consisting of 32 items and a single-factor, is 32, while the highest score is 160.

Existing studies in the literature showed that the LS model positively improves the professional knowledge and skills of teachers about the lesson

plan (Aykan & Dursun, 2021; Mostofo, 2014). In this context, the scale includes items on how the LS model affects teachers' professional knowledge and skills, such as creating a lesson plan and applying the lesson plan effectively and efficiently. Considerable number ofstudies existing in the literature showing that LS model also improves the instructional and methodological knowledge and skills of teachers (Dudley, 2011; Kotelawala, 2012). Thanks to the cooperation in the application process of the model, it is understood that teachers learn new and different teaching methods-techniques from each other (Barber, 2018). On this basis, several items are included in the scale to measure the perceptions of teachers who learn and apply LS about how the model affects their instructional and methodological one knowledge and skills.

It is stated that the application process of the LS model adds diversity to teachers' assessment and evaluation methods (Copriady, 2013; Larssen et al., 2018). In this process, teachers who learn new and different assessment-evaluation methods from their other colleagues can also notice the deficiencies and weaknesses in their own methods. In this context, several items were created within the scope of the scale to determine the perceptions of teachers about how the LS model affects assessment and evaluation methods.

Thanks to the cooperation offered by the model, teachers who work in harmony with their colleagues also contribute to their ability to respect new and different ideas and suggestions in this process. In the studies conducted in this context, it was concluded that the LS model increased the tendency of teachers towards cooperation (Aykan & Yıldırım, 2021; Scott & Moller, 2017). On this basis, items were which included in the scale to determine the perceptions of teachers about how the LS model affects professional cooperation.

It is stated that the LS model also contributes to teachers' classroom management knowledge and skills (Aykan & Yıldırım, 2021). With the LS model, many events and situations that the teacher who applies the lesson cannot see and realize during the teaching process are noted by other teachers who observe and share with other teachers after the lesson (Angelini & Alvarez, 2018; Lamp, 2015). In this context, the scale includes items to measure teachers' perceptions of how the LS model affects classroom management knowledge and skills.

Conclusion

It is seen in this study that no measurement tool has been developed for the LS model, which has become increasingly widespread in the world recently and seeks to make the professional development of teachers continuous, and which aims to determine teachers' perceptions. In this context, it is thought that it is essential to develop a measurement tool to close this gap in the literature and to measure teachers' perceptions of the LS model. In this vein, the researchers aimed to develop the "LSMPS" scale and to determine the psychometric properties of the scale to explore the perceptions of the teachers who learned and applied the LS model. When all the findings obtained to determine the psychometric properties of the scale developed within the scope of the research are evaluated together, it is understood that the measurements obtained from the scale and the inferences to be made based on these results are reliable and valid.

Implications

Based on this study, the following recommendations can be made for future studies:

- In countries that implement the LS model (East Asian countries, England, USA, etc.), teachers' perceptions of the model can be determined.
- The attitudes of teachers who apply the LS model towards the model and professional development can be measured.

References

Aimah, Siti, and Bambang Purwant. "Indonesian Teachers' Perception on the Implementation of Lesson Study: Exploring Teachers' Awareness of Pedagogical Knowledge." *Arab World English Journal*, vol. 9, no. 4, 2018, pp. 380-91.

Angelini, M.L., and N. Álvarez. "Spreading Lesson Study in Preservice Teacher Instruction." *International Journal for Lesson and Learning Studies*, vol. 7, no. 1, 2018, pp. 23-36.

Aykan, Ahmet, and Remzi Y. Kıncal. "A Content Analysis of Scientific Researches about

Lesson Study Published in Different Countries." *Journal of Kazım Karabekir Education Faculty*, vol. 32, 2016, pp. 19-31.

Aykan, Ahmet, and Fevzi Dursun. "Investigating Lesson Study Model within the Scope of Professional Development in Terms of Pre-service Teachers." *International Online Journal of Educational Sciences*, vol. 13, no. 5, 2021.

Aykan, Ahmet, and Bekir Yıldırım. "The Integration of a Lesson Study Model into Distance STEM Education during the COVID-19 Pandemic: Teachers' Views and Practice." *Technology Knowledge and Learning*, vol. 27, 2021, pp. 609-37.

Barber, Krystal. "Developing Teachers' Mathematical-Task Knowledge and Practice through Lesson Study." *International Journal for Lesson and Learning Studies*, vol. 7, no. 2, 2018, pp. 136-49.

Büyüköztürk, Şener. *Manual of Data Analysis for Social Sciences*. Pegem Publishers, 2012.

Chen, Xiangming. "Theorizing Chinese Lesson Study from a Cultural Perspective." *International Journal for Lesson and Learning Studies*, vol. 6, no. 4, 2017, pp. 283-92.

Copriady, Jimmi. "The Implementation of Lesson Study Programme for Developing Professionalism in Teaching Profession." *Asian Social Science*, vol. 9, no. 12, 2013, pp. 176-86.

Crocker, Linda, and James Algina. *Introduction to Classical and Modern Test Theory*. Holt, Rinehart and Winston, 1986.

Demir, Kadir, et al. "Implementing Japanese Lesson Study in a Higher Education Context." *Journal of College Science Teaching*, vol. 42, no. 4, 2013, pp. 22-27.

Dudley, Peter. "Teacher Learning in Lesson Study: What Interaction-Level Discourse Analysis Revealed About how Teachers Utilised Imagination, Tacit Knowledge of Teaching and Fresh Evidence of Pupils Learning to Develop Practice Knowledge and so Enhance their Pupils' Learning." *Teaching and Teacher Education*, vol. 34, 2013, pp. 107-21.

Dudley, Peter. "Lesson Study Development in England: From School Networks to National Policy." *International Journal for Lesson and Learning Studies*, vol. 1, no. 1, 2011, pp. 85-100.

Dudley, Peter. *Lesson Study. Professional Learning for Our Time*. Routledge, 2015.

Field, Andy. *Discovering Statistics using SPSS*. Sage Publications, 2009.

Forza, Cipriano, and Roberto Filippini. "TQM Impact on Quality Conformance and Customer Satisfaction: A Causal Model." *International Journal of Production Economics*, vol. 55, no. 1, 1998.

Fujii, Toshiakira. "Designing and Adapting Tasks in Lesson Planning: A Critical Process of Lesson Study." *Theory and Practice of Lesson Study in Mathematics*, edited by Huang, Rongjin, et al., Springer, 2019, pp. 681-704.

George, Darren, and Paul Mallery. *IBM SPSS Statistics 23 Step by Step: A Simple Guide and Reference*. Routledge, 2016.

González, Gloriana, and Jason T. Deal. "Using a Creativity Framework to Promote Teacher Learning in Lesson Study." *Thinking Skills and Creativity*, vol. 32, 2019, pp. 114-28.

Groves, Susie, et al. "Implementing Japanese Lesson Study: An Example of Teacher-Researcher Collaboration." *Australian Mathematics Teacher*, vol. 69, no. 3, 2013, pp. 10-17.

Hattie, John. "Methodology Review: Assessing Unidimensionality of Tests and Items." *Applied Psychological Measurement*, vol. 9, no. 2, 1985, pp. 139-64.

Hervas, Gabriel, and Jose Luis Medina. "Higher Education Teachers' Perception and use of Content Representations in Lesson Study." *International Journal for Lesson and Learning Studies*, vol. 11, no. 1, 2022, pp. 14-25.

Hicyilmaz, Yahya, and Ahmet Aykan. "A New Approach in the Professional Development of Prospective Visual Arts Teachers: A Lesson Study Model." *International Journal of Progressive Education*, vol. 16, no. 6, 2020, pp. 313-24.

Inprasitha, Narumol. "Perceptions on Professional Development of Supervisors in the Non-Project and Project Schools using Lesson

Study." *Procedia-Social and Behavioral Sciences*, vol. 116, 2014.

Kanauan, Weerasuk, and Narumol Inprasitha. "Collaboration between Inservice Teachers and Student Intern in Thai Lesson Study." *Procedia - Social and Behavioral Sciences*, vol. 116, 2014, pp. 28-32.

Kass, Richard A., and Howard E.A. Tinsley. "Factor Analysis." *Journal of Leisure Research*, vol. 11, no. 2, 1979, pp. 120-38.

Kotelawala, Usha. "Lesson Study in a Methods Course: Connecting Teacher Education to the Field." *The Teacher Educator*, vol. 47, no. 1, 2012, pp. 67-89.

Lamb, Penny. "Peer Learning between Preservice Teachers: Embracing Lesson Study." *International Journal for Lesson and Learning Studies*, vol. 4, no. 4, 2015, pp. 343-61.

Larssen, Deborah Lynn. Sorton, et al. "A Literature Review of Lesson Study in Initial Teacher Education: Perspectives about Learning and Observation." *International Journal for Lesson and Learning Studies*, vol. 7, no. 1, 2018, pp. 8-22.

Lord, Frederic M. *Applications of Item Response Theory to Practical Testing Problems*. Lawrence Erlbaum Associates, 1980.

Makinae, Naomichi. "The Origin and Development of Lesson Study in Japan." *Theory and Practice of Lesson Study in Mathematics*, edited by Huang, Rongjin, et al., Springer, 2019, pp. 169-81.

Matanluk, Katina, et al. "The Perception of Teachers and Students toward Lesson Study Implementation at Rural School of Sabah: A Pilot Study." *Procedia - Social and Behavioral Sciences*, vol. 90, 2013, pp. 245-50.

Mostofo, Jameel. "The Impact of Using Lesson Study with Pre-Service Mathematics Teachers." *Journal of Instructional Research*, vol. 3, 2014, pp. 55-63.

Norwich, Brahm, and Annamari Ylonen. "Design based Research to Develop the Teaching of Pupils with Moderate Learning Difficulties (MLD): Evaluating Lesson Study in Terms of Pupil, Teacher and School Outcomes." *Teaching and Teacher Education*, vol. 34, 2013, pp. 162-73.

Reckase, Mark D. "Unifactor Latent Trait Models Applied to Multifactor Tests: Results and Implications." *Journal of Educational Statistics*, vol. 4, no. 3, 1979, pp. 207-30.

Saito, Eisuke. "Key Issues of Lesson Study in Japan and the United States: A Literature Review." *Professional Development in Education*, vol. 38, no. 5, 2012, pp. 777-89.

Saito, Eisuke, and Metthew Atencio. "Lesson Study for Learning Community (LSLC): Conceptualising Teachers' Practices within a Social Justice Perspective." *Discourse: Studies in the Cultural Politics of Education*, vol. 36, no. 6, 2015, pp. 795-807.

Schermelleh-Engel, Karin, et al. "Evaluatingthe Fit of Structural Equation Models: Tests of significance and Descriptive Goodness-of-Fit Measures." *Methods of Psychological Research Online*, vol. 8, no. 2, 2003, pp. 23-74.

Skott, Charlotte Krog, and Hanne Møller. "The Individual Teacher in Lesson Study Collaboration." *International Journal for Lesson and Learning Studies*, vol. 6, no. 3, 2017, pp. 216-32.

Stigler, James W., and James Hiebert. *The Teaching Gap: Best Ideas from the World's Teachers for Improving Education in the Classroom*. Simon and Schuster, 2009.

Tabachnick, B. G., and L.S. Fidell. *Using Multivariate Statistics*. Pearson, 2013.

Van Sickle, Julie Ann. *Lesson Study's Impacts on Teacher Perception of Efficacy in Teaching*. Humboldt State University, 2011.

Yeşilçınar, Sabahattin, and Ahmet Aykan. "Lesson Study and 21st-Century Skills: Pre-service Teachers Reason, Produce and Share." *Participatory Educational Research*, vol. 9, no. 3, 2022, pp. 315-29.

Author Details

Ahmet Aykan, *Muş Alparslan University, Turkey,* ***Email ID****: a.aykan@alparslan.edu.tr*

Fuat Elkonca, Muş Alparslan University, Turkey, ***Email ID***: f.elkonca@alparslan.edu.tr