

Teachers' Level of Mobilizing Fun-Inspired Pedagogical Knowledge and Leadership Practices for Effective Teaching of Fundamental Science Concepts in the New Realm: A Scenario in Malaysian Public Preschools

Kho Chee Yuet Fanny

Faculty of Management and Economics, Sultan Idris Education University, 35900 Tanjung Malim, Perak, Ministry of Higher Education, Malaysia.

Email: fannykcy@fpe.upsi.edu.my

Khayri Zaid Z Alzait

Libyan Authority for Scientific Research, 82819 Tripoli, Libya, Ministry of Higher Education, Libya

Email: khayri.z.zaid@gmail.com

Kumaran Gengatharan

Sekolah Kebangsaan Bedong, 08100 Bedong, Kedah, Ministry of Education, Malaysia.

Email: kumarangengatharan@gmail.com

Norzalina Noor

Center for Languages and General Studies; Faculty of Languages and Communication Sultan Idris Education University, 35900 Tanjung Malim, Perak, Ministry of Higher Education, Malaysia

Email: norzalina@pbmpu.upsi.edu.my

Sukor Beram

Perak Matriculation College, 32600 Gopeng, Perak, Ministry of Education, Malaysia.

Email: abicorrie@gmail.com

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Abstract

This study focuses on the level of mobilizing fun-inspired pedagogical knowledge and leadership practices among Malaysian public preschool teachers for effective teaching of fundamental science concepts that suit the current education ecosystem. Descriptive statistics

were employed to analyze the survey data. A total of 242 teachers from 220 public preschools in Malaysia took part in the survey. The analysis revealed ten commonly applied fun-based strategies and techniques ranging from the most commonly applied to the least applied strategies and techniques namely, singing; experiments; storytelling; demonstrations; game-based learning; project-based learning; YouTube videos; asking probing questions; observations; and simulations. Most of the respondents are proficient in applying the ten strategies and techniques, with 50.41 percent for singing; 49.59 percent for experiments; 48.39 percent for storytelling; 47.93 percent for demonstrations; 47.10 percent for game-based learning; 46.28 percent for project-based learning; 45.87 percent for YouTube videos; 45.45 percent for asking probing questions; 43.39 percent for observations; and 42.56 percent for simulations. The result also indicated that most of the respondents are proficient or extremely proficient in leading their peer teachers for effective teaching of fundamental science concepts ranging from 39.67 percent to 53.72 percent of respondents proficient, followed by 35.53 percent to 57.02 percent of respondents extremely proficient in leading their peer teachers on fun-inspired pedagogy. The findings indicate that a promising innovative module is needed to guide preschool teachers to boost their creativity in designing and planning varieties of inspirational, innovative, creative, and interactive activities that suit the new realm. The result also indicates that it is significant to shift the paradigm from isolation to collaboration, and from in-person to online interactions. It is also significant to mobilize peers' leadership competencies that suit Education 4.0 in Malaysia.

Keywords: Fun-Inspired Pedagogy, Innovative Module, Peers' Leadership, preschools, Science Concepts

Introduction

Preschool education is an educational curriculum for children aged 4 to 6 years, as highlighted in Malaysia's 1966 Education Act (MOE, 2012). Preschool education's major goal is to promote the acquisition of fundamental skills in preparing a holistic generation for the future. Preschool curriculum also highlighted enjoyable and conducive learning environments to boost young learners' creativity and imagination as agents of socialization and personality development (Göçmen & Coşkun, 2019). The enhancement of the related aspects will serve as a meaningful point of reference for the public preschool teachers to mobilize innovative leadership practices within and across the boundary of preschools (NCDC, 2007). This initiative has also been highlighted in the Malaysia Education Blueprint 2013-2025 allowing leadership acquisition to take place among teachers from preschools to secondary schools (Fanny & Alzait, 2022; Kho et al., 2016; Kho, 2020; Yuet et al., 2021; Gratacós et al., 2021; Harris, 2021; MOE, 2012).

Preschool teachers in Malaysia have responded to the need of mobilizing leadership practices within and across school gates to share best practices in the fun-inspired pedagogy via online and in-person interactions in the new realm (Fanny & Alzait, 2022; Yuet et al., 2021; Dittert et al., 2020; Vandavasi et al., 2020; Cahapay, 2020; Jemimah & Suziyani, 2019; Reid, 2014). Precisely, fun-inspired pedagogy is also highlighted in the National Preschool Curriculum allowing young learners to acquire fundamental concepts in enjoyable environments (MOE, 2012, 2021). Indeed, implementing varieties of fun-inspired pedagogy via online platforms offers advantages in preschool education (Rudenko et al., 2021; Heng & Sol, 2020; Dittert et al., 2020; Andrew, 2019).

Several research on fun learning integration in teaching and learning have been conducted globally (Nilsen et al., 2018; AlShaiji, 2015) Nonetheless, limited studies conducted in Malaysia that highlighted the inspirational aspect to be instilled into fun-inspired pedagogy as well as the effort to lead peer teachers on best practices. Prior studies on fun learning in Malaysian public preschools revealed a limited number of the important aspect of leadership practices to be mobilized for best practices in public preschool settings (Kho et al., 2016; Kho, 2020; Yuet et al., 2021; Gratacós et al., 2021; Harris, 2021).

The output of several surveys also revealed the majority of preschool teachers were lacking fundamental skills in integrating creative and critical thinking skills into fun-inspired pedagogy which is significant in the Education 4.0 environment (Gerekli et al., 2021; Jemimah & Suziyani, 2019; Murtenon et al., 2019; Graafland, 2018; Primi & Wechsler, 2018; Mehtaa et al., 2014). Hence, it limits their capability to solely conduct fun-inspired pedagogy in public preschool environments. Limited studies on mobilizing leadership practices within and beyond preschool gates. In light of these limitations, the study would like to investigate the level of fun-inspired pedagogical knowledge in teaching fundamental science concepts and leadership practices in Malaysian public preschools.

The Malaysian Ministry of Education as well as researchers on teacher leadership had also emphasized the importance to boost leadership practices among Malaysian teachers in shaping the creative attitudes among teachers and learners (MOE, 2012, 2021; Kho et al., 2016; Kho, 2020; Yuet et al., 2021; Gratacós et al., 2021; Sokola et al., 2015). Hence, it is crucial to determine public preschool teachers' initiatives to lead their peer teachers to practice fun-inspired pedagogy in digital environments (Murtenon et al., 2019; OECD, 2016). In particular, this study aims to look into the level of fun-inspired pedagogical knowledge and leadership practices among public preschool teachers in the four states in Malaysia.

Methodology Research Design

This study was conducted using a non-experimental research design through a survey approach.

Population and Demographic Overview of Samples

A total of 242 trained public preschool teachers from 220 public preschools in the four states in Malaysia took part in the survey. The demographic data reveal that 224 of the trained preschool teachers were female, contributing to 94.5 percent of the population. Only 13 with 5.5 percent of respondents were male. The data revealed that 106 with 44.4 percent of respondents were less than 41 years of age, 28 with 11.7 percent of respondents were less than 30 years old, 84 with 35.1 percent of respondents were less than 50 years old, and 23 with 9.6 percent of respondents were senior teachers in their respective preschools.

Out of 242 respondents, 169 with 71 percent of respondents obtained a first degree in an early childhood program, 53 with 22.3 percent of respondents obtained a diploma in the early childhood program, and 20 with 8.4 percent of respondents had a master's degree. Unfortunately, none of the respondents have a doctorate. The data also revealed that 67 with 28 percent of respondents had more than 11 to 15 years of experience as preschool teachers, followed by 61 with 25.5 percent of respondents have served around 6 to 11 years in

preschools, 34 with 14.2 percent have served around 1 to 5 years, and 36 with 15.1 percent have more than 20 years of experience being a preschool teacher as compared to only 10 with 4.2 percent of respondents had served less than a year as a preschool teacher.

Likewise, the data also revealed that not all of the respondents served in the current preschools since their first posting by the time the data were collected. 66 with 27.6 percent of respondents had served in the current preschool for more than 6 years but less than 10 years. 59 with 24.7 percent of respondents had served less than 5 years, followed by 26 with 10.9 percent of respondents who had more than 16 years but less than 20 years of experience teaching in the current preschools, and only 18 with 7.5 percent of respondents were considered novice teachers as they had served less than a year in the respective preschools. 161 with 67.9 percent of respondents were from urban public preschools as compared to 76 with 32.1 percent of respondents from preschools located in rural areas.

In terms of collaboration with parents on young learners' progress, 149 with 62.6 percent of respondents revealed that they had contacted parents to further monitor young learners' progress, particularly when performing fun-inspired experiments at home for a minimum of 1 time and a maximum of 5 times in a week. 85 with 35.7 percent of respondents, on the other hand, reveal that they only collaborate with parents on the young learners' progress at least 1 time in a week as compared to only 4 with 1.7 percent of respondents had contacted and collaborated with the parents on young learners' home-based learning, followed by only 1 with 0.4 percent of respondents who claimed to have contacted parents more than 11 times in a week seeking for parents' co-operation to monitor young learners' progress in learning fundamental science processes based on home-based experiments that need to be conducted with close monitoring of family members, especially parents.

Correspondently, 135 with 57.2 percent of respondents had collaborated with peer teachers from other schools at least 1 time to a maximum of 5 times in a week as compared to only 1 time as revealed by 96 with 40.7 percent of respondents. Surprisingly, only 6 with 2.5 percent of respondents claimed that they had put in ample effort to network with preschool teachers from other preschools a minimum of 6 times and a maximum of 10 times a week, particularly on best practices for fun-inspired pedagogy. Networking would improve public preschool teachers' professional knowledge and awareness of the benefit of mobilizing peer-leadership competency.

Results

Teachers' Level of Fun-Inspired Pedagogical Knowledge in Teaching Fundamental Science Concepts in the New Realm

To answer the first research question, descriptive analysis was performed to determine the level of public preschool teachers' fun-inspired pedagogical knowledge, particularly in exposing young learners to fundamental science concepts. Data revealed from the 242 public preschool teachers shows that most of the public preschool teachers practiced similar strategies and techniques although they serve in distinct public preschools as portrayed in Table 1. Table 1 portrays the most commonly used approach to the least approach for effective teaching of fundamental science concepts in Malaysian public preschools.

The majority of respondents are proficient and extremely proficient in using the singing approach for effective teaching of fundamental science concepts, with 50.41 percent proficient and 40.50 extremely proficient. An estimation of 6.61 percent of respondents is fairly proficient in using the singing approach to teach fundamental science concepts. Only 6 percent of respondents are incapable of using the singing approach for effective teaching of fundamental science concepts.

The second commonly used approach in teaching fundamental science concepts is through experiments, with 49.59 percent of respondents proficient and 41.32 percent extremely proficient. Approximate of 6.20 percent respondents are fairly proficient and 2.89 percent are incapable of using experiments to teach fundamental science concepts in early childhood environments. The data also revealed that the third most commonly applied approach is storytelling, with 48.34 percent of responding being proficient and 39.26 percent being extremely proficient, followed by 7.85 percent being fairly proficient. Only 4.55 percent of respondents were incapable of applying the storytelling approach. The fourth commonly practiced approach in teaching fundamental science concepts is through demonstration, with 47.93 percent of respondents having good skills and 42.98 percent having advanced skills in conducting demonstrations when teaching the fundamental science concepts.

The fifth commonly applied approach is game-based learning, with 47.10 percent of respondents having good skills and 39.26 respondents having advanced skills in using game-based learning to teach fundamental science concepts, followed by 9.09 percent having fairly good skills in applying the game-based learning approach. Only 4.55 percent of respondents are incapable of applying the game-based learning approach when teaching fundamental science concepts.

The sixth commonly applied approach in teaching fundamental science concepts in a public preschool environment is project-based learning, with 46.28 percent of respondents having good skills and 40.08 percent having advanced skills, followed by 8.68 percent are having fairly good skills in conducting project-based learning to teach fundamental science concepts that suit the 21st-century skills. Only 4.96 percent are incapable of conducting project-based learning strategies and techniques.

The seventh common approach practiced by respondents in teaching fundamental science concepts is by using YouTube videos. The data revealed that 45.87 percent of respondents are proficient and 38.43 percent are extremely proficient in using YouTube videos to teach fundamental science concepts. Only 9.50 percent of respondents had fairly good skills to use YouTube videos to teach fundamental science concepts. Only 6.20 percent of respondents need to put in the effort to search for suitable YouTube videos to be used in teaching fundamental science concepts.

The eighth common approach practiced by respondents in teaching the fundamental science concepts is by asking probing questions based on the fundamental science processes in the experiments, with 45.45 percent of respondents having good skills and 38.02 respondents

having advanced skills in asking probing questions related to the experiments. Nonetheless, 9.91 percent of respondents had fairly good skills in asking probing questions related to fundamental science concepts based on the results of experiments. Only 6.61 percent of respondents are incapable of asking probing questions related to experiments.

The eighth common approach practiced by respondents in teaching fundamental science concepts is observations, with 43.39 of respondents having good skills and 40.08 percent having advanced skills, followed by 10.333 percent having fairly good skills in conducting observations for experiments. Only 6.20 percent of respondents are incapable of conducting observations related to fundamental science concepts.

The tenth common approach practiced by respondents in teaching fundamental science concepts is simulations, with 42.56 percent of respondents having good skills and 37.60 percent having advanced skills. Additionally, 10.74 percent of respondents are having fairly good skills in conducting simulations to teach fundamental science concepts. Only 6.20 percent of respondents are incapable of conducting simulations when teaching fundamental science concepts in the new realm.

Table 1: The Commonly Practiced Fun-Inspired Strategies and Techniques for Effective Teaching of Fundamental Science Concepts

I facilitate young learners' ability to understand fundamental science concepts through ...	Not Capable	Fair	Good	Excellent
1. Singing	6 (2.48%)	16 (6.61%)	122 (50.41%)	98 (40.50%)
2. Experiments	7 (2.89%)	15 (6.20%)	120 (49.59%)	100 (41.32%)
3. Storytelling	11 (4.55%)	19 (7.85%)	117 (48.34%)	95 (39.26%)
4. Demonstrations	10 (4.13%)	12 (4.96%)	116 (47.93%)	104 (42.98%)
5. Game-based Learning	11 (4.55%)	22 (9.09%)	114 (47.10%)	95 (39.26%)
6. Project-based Learning	12 (4.96%)	21 (8.68%)	112 (46.28%)	97 (40.08%)
7. YouTube Videos	15 (6.20%)	23 (9.50%)	111 (45.87%)	93 (38.43%)
8. Asking Probing Questions	16 (6.61%)	24 (9.91%)	110 (45.45%)	92 (38.02%)
9. Observations	15 (6.20%)	25 (10.33%)	105 (43.39%)	97 (40.08%)
10. Simulations	22 (9.09%)	26 (10.74%)	103 (42.56%)	91 (37.60%)

Teachers' Level of Mobilizing Leadership Practices for Effective Teaching of Fundamental Science Concepts

Public preschool teachers were required to rank their knowledge on their effort to mobilize leadership practices in leading peers on fun-inspired pedagogy in teaching fundamental science concepts on a scale ranging from not capable to excellent based on self-evaluation. Table 2 portrays the level of public preschool teachers mobilizing leadership practices in leading peers on fun-inspired pedagogy in teaching fundamental science concepts.

The majority of respondents are proficient and extremely proficient in fostering leadership values while teaching fundamental science concepts, with 51.65 percent proficiently and 40.50 percent extremely proficient in demonstrating leadership values to peer teachers through cooperative learning. Only 4.96 percent of respondents are not proficient to lead their peers by demonstrating a variety of leadership values. The data also revealed that 52.89 percent of respondents are extremely proficient and 44.22 percent are proficient in guiding their peer teachers on the strategy to guide young learners to share their views on the results of the experiments based on their existing knowledge (Banner & Jeffrey, 2019). Only 2.89 percent of respondents claimed they are fairly good at guiding their peers.

Additionally, 55.37 percent of respondents claimed they are extremely proficient in leading peer teachers to conduct experiments together to find out the most effective fun-inspired approach to teaching fundamental science concepts, followed by 40.91 percent of respondents who are proficient, and 3.72 percent who are fairly proficient in leading peer teachers to do so. Correspondently, 55.37 percent of respondents are extremely proficient and 40.91 percent are proficient in leading peers to conduct effective and inspirational fun-inspired experiments. Unfortunately, 3.72 percent of respondents are not proficient to lead their peers to conduct fun-inspired experiments.

The data also revealed that 47.93 percent of respondents are having advanced skills and 46.28 are having good skills in leading peer teachers on ways to lead learners' experimental groups to guide learners to interpret the findings of respective fun-inspired experiments. Only 5.37 percent of respondents claimed they have limited leadership skills in leading peers on ways to guide learners to interpret the findings of respective fun- is fun-inspired experiments.

In contrast, only 0.41 percent of respondent needs to boost their leadership skills. Congruently, the data also revealed that 47.93 percent of respondents are extremely proficient whereas 46.70 percent are proficient in leading peer teachers on how they could improve learners' ability to explain the fundamental science concepts involved in the fun-inspired experiments. Only 4.96 percent of respondents are fairly proficient in leading young learners to explain fundamental science concepts as compared to 0.41 percent of respondents who need to boost their capability in leading peer teachers.

Likewise, 47.53 percent of respondents are having good skills and 44.63 percent are having advanced skills in guiding young learners to present the results of their experiments enjoyably. Hence, they are competent in leading their peer teachers on how they could instill other elements such as play-based or the use of humor to boost young learners' confidence in sharing the results of their experiments to their friends and teachers happily and enjoyably (Embalzado & Sajampun, 2020; Bieg & Dresel, 2018; Kim & Ho, 2017; Noon, 2017; Lovorn & Holaway, 2015).

Unfortunately, 7.85 percent of respondents need to boost their leadership skills to enable them to lead their peers on effective strategies and techniques to guide young learners in the presentations of their findings. 48.76 percent of respondents are having good skills and 45.87 percent are having advanced skills in leading peers on how they could guide young learners to relate their existing knowledge to the findings of fun-inspired experiments. Only 5.37 percent of respondents need to boost their leadership skills to enable them to lead their peers on strategies and techniques to be applied particularly in guiding young learners to relate their existing knowledge to the findings of their experiments.

The data also revealed that 49.59 percent of respondents are proficient and 43.80 percent are extremely proficient in leading peers on how they could guide young learners to understand other learners' ideas on experiments conducted. About 6.20 percent of respondents need to boost their creative and innovative thinking skills to understand learners' ideas on the results

of their experiments (Mehtaa et al., 2014). Additionally, 50.00 percent of respondents are proficient and 47.11 percent are extremely proficient in leading peers on how they could guide young learners to analyze the real-life situations related to experiments. Only 2.89 percent of respondents need to explore the environments to guide young learners on how they could relate the environments with the results of their experiments.

The findings also indicate that 48.35 percent of respondents are excellent and 47.11 percent are proficient in using simulation to teach fundamental science concepts to young learners. Hence, they are capable of leading their peer teachers on effective simulation to be implemented in teaching the fundamental science concepts in preschools via online or face-to-face platforms. Furthermore, 49.59 percent of respondents consider themselves proficient and 45.04 percent extremely proficient to lead their peer teachers on how they should prepare the fun-inspired experiments that allow them to give immediate feedback after each experiment. 49.17 percent of respondents are proficient and 45.45 percent are extremely proficient in leading their peer teachers on how they could lead learners in a discussion after each experiment.

The output of the data also shows that 48.35 percent of respondents are extremely proficient and 46.69 percent are proficient in leading their peer teachers on how they could give constructive feedback on the findings of each experiment. Additionally, 52.48 percent of respondents are proficient and 40.91 percent are extremely proficient in leading their peers on how they could give meaningful comments that point out young learners' mistakes and provide suggestions for improvement in future experiments. The data also revealed that 50.00 percent of respondents are proficient and 35.53 percent are extremely proficient in leading peer teachers on how they could use video recording techniques to assess young learners' performance in understanding the science concepts. Fortunately, 57.02 percent of respondents are proficient and 39.67 percent of respondents are extremely proficient in leading their peer teachers on strategies and techniques to foster young learners' confidence to ask questions when they don't understand.

Table 2 also portrays 53.72 percent of respondents are proficient and 37.61 percent are extremely proficient in leading their peers on strategies and techniques to design fun-inspired activities related to young learners' backgrounds. The majority of the respondents are proficient in developing the capacity of the school to provide additional learning materials for young learners who lack basic knowledge of the science concepts, with 50.41 percent having good skills and 38.84 percent having extremely good skills in suggesting types of learning materials that suit young learners learning needs in the current digital environment (Murtenon et al., 2019).

The majority of the respondents are also proficient or extremely proficient in leading their peers on how they could collaborate and share responsibilities with other teachers as well as parents in integrating new knowledge about the fundamental science concepts, with 50.41 percent having good skills and 40.91 percent had extremely good skills. Most of the respondents are proficient or extremely proficient in fostering a spirit of teamwork, with

46.28 percent having good skills and 48.76 percent having advanced skills in identifying young learners' learning styles at the beginning of the school session.

Table 2: The Level of Peer-Leadership Practices in Fun-Inspired Pedagogy in Teaching Fundamental Science Concepts

I lead my peer teachers on how they could ...	Not Capable	Fair	Good	Excellent
1. Demonstrate a variety of leadership values through a cooperative learning approach.	0 (0.00%)	12 (4.96%)	125 (51.65%)	105 (43.39%)
2. Guide learners to share their existing knowledge with their peers on fun-inspired experiments.	0 (0.00%)	7 (2.89%)	107 (44.22%)	128 (52.89%)
3. Guide learners to conduct fun-inspired experiments together.	0 (0.00%)	9 (3.72%)	9 (40.91%)	134 (55.37%)
4. Lead each experimental group to interpret the findings of their respective experiments.	1 (0.41%)	13 (5.37%)	112 (46.28%)	116 (47.93%)
5. Improve learners' ability to explain the scientific concepts involved in fun-inspired experiments.	1 (0.41%)	12 (4.96%)	113 (46.70%)	116 (47.93%)
6. Guide learners to present the findings of the fun-inspired experiments.	1 (0.41%)	18 (7.43%)	115 (47.53%)	108 (44.63%)
7. Guide learners to relate their existing knowledge to the findings of fun-inspired experiments.	0 (0.00%)	13 (5.37%)	118 (48.76%)	111 (45.87%)
8. Guide learners to understand other learners' ideas presented after fun-inspired experiments.	1 (0.41%)	15 (6.20%)	120 (49.59%)	106 (43.80%)
9. Guide learners to analyze real-life situations related to fun-inspired experiments.	0 (0.00%)	7 (2.89%)	121 (50.00%)	114 (47.11%)
10. Guide learners to use simulation in fun-inspired experiments.	2 (0.82%)	9 (3.72%)	114 (47.11%)	117 (48.35%)
11. Give prompt feedback after a fun-inspired experiments.	3 (1.24%)	10 (4.13%)	120 (49.59%)	109 (45.04%)
12. Lead learners in a discussion of fun-inspired experiments.	1 (0.41%)	12 (4.96%)	119 (49.17%)	110 (45.45%)
13. Provide constructive feedback or the findings of fun-inspired experiments.	1 (0.41%)	11 (4.55%)	113 (46.69%)	117 (48.35%)
14. Give meaningful comments that point out learners' mistakes and provide	1 (0.41%)	15 (6.20%)	127 (52.48%)	99 (40.91%)

suggestions for improvement in future fun-inspired experiments.

15. Apply video recording techniques to assess learners' performance in understanding the science process.	5 (2.07%)	30 (12.40%)	121 (50.00%)	86 (35.53%)
16. Foster learners' confidence to ask questions when they don't understand.	0 (0.00%)	8 (3.31%)	96 (39.67%)	138 (57.02%)
17. Design fun-inspired experiments related to learners' backgrounds.	1 (0.41%)	20 (8.26%)	130 (53.72%)	91 (37.61%)
18. Develop the capacity of the school in providing additional learning materials for learners who lack basic knowledge of the science process.	0 (0.00%)	26 (10.74%)	122 (50.41%)	94 (38.84%)
19. Collaborate and share responsibilities with peer teachers and parents in integrating new knowledge about the science process.	1 (0.41%)	20 (8.26%)	122 (50.41%)	99 (40.91%)
20. Foster a spirit of teamwork in identifying learners' learning styles at the beginning of the school sessions.	1 (0.41%)	11 (4.55%)	112 (46.28%)	118 (48.76%)

Discussions

Generally, the findings show that the majority of public preschool teachers were familiar with fun-based pedagogy. Their fun-based pedagogical knowledge and skills are good and encouraging, as they are proficient in applying fun-based strategies and techniques in teaching fundamental science concepts (Dogan & Simsar, 2018). The most commonly applied fun-based strategies and techniques in teaching fundamental science concepts are singing, experiments, storytelling, demonstrations, game-based learning, project-based learning, YouTube videos, asking probing questions, observations, and simulations. In other words, most public preschool teachers applied similar fun-based strategies and techniques in teaching similar fundamental science concepts and acquisition of creative problem-solving (Bahar & Aksut, 2020; Royston & Pullman, 2017).

The statistic of findings also reveals that public preschool teachers rarely practice, lead and share other types of fun-based strategies and techniques which are more interactive, creative, and imaginative with their peer teachers such as Flipped Classroom (Tomas et al., 2019; Kurt, 2017; Mehtaa et al., 2014), blended learning (Namyssova et al., 2019), mind mapping (Polat & Aydin, 2020), and other types of digital pedagogy (Sailin & Mahmor, 2018; Shilpa & Sunita, 2016). In other words, most public preschool teachers need to boost their creativity to innovate a variety of interactive and creative fun-based strategies and techniques that encourage young learners to be active, creative, and imaginative in learning new fundamental science concepts, for instance, the fundamental science concepts of sinking and floating (DeJesus et al., 2020; Nakano & Wechsler, 2018; Mehtaa et al., 2014). Consequently, they should share all the pedagogical knowledge that suits the new realm, with their peer teachers from within and beyond the school's gates (Vandavasi et al., 2020; Verganti, 2020).

Precisely, the statistic of the study also reveals that the level of public preschool teachers' knowledge in innovating a variety of fun-based pedagogy that suits the changes in the global education ecosystem is considered low.

School middle leadership teams especially teacher leaders should lead preschool teachers on strategies and techniques to collaborate with their peer teachers from the neighboring preschools for best practices (Nobile, 2017; Supovitz, 2017). In other words, it would be a significant effort for public preschool teachers to lead and share best practices with their peer teachers from within and beyond the schools (Vuojarvi et al., 2019). Similarly, senior preschool teachers could also share a few effective fun-based strategies and techniques that would arouse young learners' interest particularly in learning the fundamental science concepts involved in the sinking and floating of an object (Dogan & Simsar, 2018). Additionally, novice preschool teachers, who are believed to be more well-versed in digital skills, should collaborate with their peers, lead and share digital skills that could be utilized to conduct inspirational fun-based activities via online or in-person interactions that suit the global changes of the education ecosystem (Cahapay, 2020; Heng & Sol, 2020).

The changes in global education ecosystems, on the other hand, require public preschool teachers to collaborate with other school communities, especially parents and lead them on how they should assist and monitor young learners' progress when they perform simple experiments at home (Yuet et al., 2021; Cahapay, 2020). In other words, public preschool teachers should cooperate, collaborate and lead the parents for effective fun home-based learning. Public preschool teachers, on the other hand, could prepare home-based experiments for young learners to conduct at home but with close monitoring of family members. This approach would indirectly boost young learners' confidence in performing the fun-based experiments with the help and close monitoring of family members. Parents, on the other hand, could prepare a fun-based experiments corner in the home to enable young learners to perform simple experiments confidently and enjoyably in conducive environments. This fun-based strategy, however, is rarely practiced in Malaysian educational contexts.

Conclusion

To conclude, Malaysian public preschool teachers' level of mobilizing fun-inspired pedagogical knowledge and leadership practices could be maintained for effective teaching of fundamental science concepts in the new realm if they regularly give online or virtual assignment. In particular, it would be more fun and interesting if the public preschool teachers could interact with young learners through virtual platforms and provide prompt feedback to learners based on the results of the experiments (Andrew, 2019). It was notable that the literature review related to the studies on enhancing preschool teachers' pedagogical knowledge did not include any leadership practices and mobilizational of best practices. Yet, this study proved that the mobilizational of peer-leadership practices improved public preschool teachers' imagination and creativity in conducting virtual inquisitive instructions.

In other words, public preschool teachers would be able to lead their peer teachers on how they could prepare interactive schedules that enable parents or other family members to have online sessions together with preschool teachers and other learners on weekly basis. Precisely, the statistic of the study indicates that the level of preschool teachers' fun-inspired pedagogical knowledge suits the changes in the global education ecosystem is considered low. The finding also revealed that the level of public preschool teachers' leadership practices in sharing best practices for teaching fundamental science concepts that suits the current pandemic environment is considered moderate. The findings also appear to back up the theory that less creativity, collaboration, communication, cooperation, and innovation among public preschool teachers and parents impede the leadership practices to be mobilized in public preschools in Malaysia (Fanny & Alzalit, 2022; Yuet et al., 2021; Gratacós et al., 2021; Dobni, 2008).

Limitations and Recommendations for Future Work

There is only one drawback to the generalizability of the study. The data was only collected from four states of public preschools in Malaysia and as a result, no demographic influence could be determined. Future studies could include more thorough samples from other states of public preschools and private preschools as well. Secondly, a more comprehensive study to examine public preschool teachers' attitudes in leading their peer teachers for best practices in Malaysian public preschools could be conducted. Thirdly, public preschool teachers' technological skills would serve as an interesting element to be studied. Fourthly, public preschool teachers' confidence level in utilizing varieties of educational technologies could also be determined in the future study. Last but not least, public preschool teachers' creativity in innovating fun-inspired pedagogy that suits the global changes of the education ecosystem could be conducted with other states of public preschools in Malaysia and other Asian countries.

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