BEST PRACTICES OF SCIENCE TEACHING AMONG KINDERGARTEN SCHOOLS

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ABSTRACT

This study documents the best practices in teaching science in kindergarten schools to create a model of teaching-learning process that develops scientific explanations from the students. Through a case study research design, the experiences of two kindergarten teachers were analyzed using the lenses of Pedagogical Content Knowledge and Elements of Scientific Explanation. Kindergarten teachers' knowledge of orientation highlights the use of curriculum guides and the application of content knowledge and pedagogy learned from bachelor's degree and master's degree. Teachers' knowledge of representation highlights use of song, demonstrating the action, and interpreting concepts to fit the level of the students. Teachers' knowledge of students' misconceptions highlights the use of social reinforcements, classroom management, modelling, and language-science links. Teachers' knowledge of science curricula highlights the use of online resources, video presentation, facilitating inquiry-based instruction, use of collaborative learning, use of play-based approach, facilitating field trip, use of art-based learning, use of colorful and interactive printed instructional materials. Teachers' knowledge of assessment highlights class reporting, recap at the end of each lesson and review at the beginning of lesson. Further analysis of class observations and students output led to the emergence of five thematic strands: 1) Teachers' questions provide leading clues and are mostly answered in chorus by the students; 2) Students are active during activities and open questions but become passive receivers of information during explanation phase of the lesson; 3) The flow of inquiry-based instruction fulfils only students "claim" and "evidence" and was seldom extended to "reasoning" level; 4) Guidance of teachers through constant questioning helps students as a group provide scientific explanation that can reach reasoning level and; 5) The students are encouraged to share the result of their work in class.

Keywords: Kindergarten, Best Practices, PCK, Scientific Explanation

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INTRODUCTION

The first years of life are important because what happens in early childhood can matter in a lifetime. Thus, the Kindergarten Act, or RA 10157, was enacted to make Kindergarten required and mandatory entry stage to basic education. The Kindergarten Curriculum Standards and Competencies for five – year – old Filipino Children Guidelines of 2016, provide different “play – based activities” to assist our young learners in their holistic development by facilitating their discoveries. Specifically, they are encouraged to create and discover, so they are able to comprehend the world through exploring their surroundings. In addition, informal writing is observed to continue in kindergarten from preschool. Kindergarteners’ alphabetic skills include phonemic awareness and knowledge of letter names. During this stage, they are expected to recognize some letters, words, and phrases and that sufficient basic writing skills may develop from second to third grade [1]. Constructivism, integrative thematic collaboration, inquiry-based, and reflective teaching are the theoretical bases of teaching-learning process of the kindergarten curriculum [2]. Among these theoretical bases, several studies have found that inquiry–based science instruction increase students’ performance among students. Scientific research is the process through which scientists investigate the natural world and propose explanations based on the facts gathered. In education, it refers to a student's activity that develops knowledge and understanding of scientific ideas. It connects activities about a concept and builds conversations about the collected data while asking for evidence [3]. One of the goals of scientific inquiry is scientific explanation and students will be more successful in inquiry–based activities if they understand this goal. Scientific explanation must contain three crucial elements of a full explanation: claim, evidence, and reasoning [4].

But we couldn’t expect a three – year old to learn the same was a thirteen- year-old would [5]. Typical Kindergarten classes last for at least three hours in public school at a standard entrance age of five years old or four years old, the latter age however depends on their developmental assessment (Omnibus Policy on Kindergarten Education – DO 47, s. 2016). The Japanese refer to it as ‘relaxed education’. Critics blame the reduced number of school days and ‘overemphasis on free play’ for their students falling lower on the international ladder of academic ability. Kindergarten teachers are at loss as to whether direct instruction or learning through play on preschool is an appropriate practice for young learners before entering elementary. Many experts endorse the idea of development appropriateness [6]. However, after more than a decade, a concern was raised again by Edward Miller and Joan Almon through their report Crisis in the Kindergarten. Miller and Almon state that kindergartens need early childhood curriculum characterized by a way of teaching that should adapt with the maturing needs and abilities of the child at the very least [7].

The learning domains of the Kindergarten Program in the Philippines require continuity of the basics of reading, writing, and arithmetic as well as values, physical health, and socio-emotional development [8]. Indeed, it is a challenge to deliver science concepts among kindergarten students with considerations of inserting other domains of science process skills leading to a sound scientific explanation. With the aim of understanding the Physical and Natural Environment around the child, the science domain in the Philippine Kindergarten Program needs models on how to deliver quality science teaching in the field.

Therefore, this study aims to document the best practices in teaching science among kindergarten students. This study will lead to discovering weaknesses and strengths in delivering science instruction in the kindergarten field. Implications from this study can serve as the basis for continuing development programs for kindergarten teachers Main Research Question:

What are the best practices of teaching science in kindergarten classroom?

Supporting research Questions:

1. What instructional strategies were evident in teaching Kindergarten Science?
2. What was the quality of the explanation the students produced in Kindergarten Science?

What are the connections between the teacher's instructional strategies and their student's explanation?

RESEARCH METHODOLOGY

The study employed a case study research design. A qualitative case study is a methodology that features the exploration of a phenomenon through various data sources, and it proceeds with the exploration using a variety of lenses to reveal multiple facets of the phenomenon [9].

The researcher's decision to conduct case study research with qualitative methods was based on various reasons. Firstly, the nature of the problem under investigation required an in-depth exploration of the phenomenon. Exploration helped to dig deep into participants' thoughts to understand how science teaching occurs in the kindergarten field. Secondly, the data gathered will be contextual and determined by the cases involved in the study. Individual's experiences, emotions, relationships, learning, and so on affect the realizations in the study. Thirdly, the case studies aimed to discover the processes involved in the phenomenon. Therefore, it is closer to "theory creation" where informants were approached in a natural setting to discover what was to be known about the phenomenon. The goal was to discover patterns containing evidence of collaboration among cases, which emerged after observation, careful documentation, and thoughtful interpretation of the empirical data.

The study used a purposive sampling method. The study focused on the experiences of the cases, which helped in explaining the best practices in teaching science in the kindergarten field. The participants' experiences were taken into consideration. Kindergarten teachers representing the public school system and their students were the sources of empirical material collection. Specifically, the qualification criteria of the chosen teacher- participants resulting from the inclusion and exclusion process are the following: (i) Experienced kindergarten teachers (more than 5 years in the kindergarten field), (ii) Class size is within the prescribed 1:25 teacher-pupil ratio, and (iii) graduates of Bachelor of Elementary Education or Early Childhood Education. While it is recommended to have multiple participants in each study, this study works with only two participants. As Yin explains, a single case study can be very useful if the researcher wants to study a person or a group of people [10]. This was supported by Gerring that while multiple participants can bring confidence in the study, a single case study offers more observation time for each of the cases thus it produces a better understanding of the study [11].

The main tools to collect empirical material were interviews, augmented by participant observations, documents including Teacher Instructional Portfolio (TIP), and Student Work Sample.

Data gathering was divided into four phases. Each phase has its own set of procedures and ethical considerations.

Phase 1: Permission Seeking

Participants were selected through recommendations provided by the Kinder Education Program Supervisor. An endorsement letter was provided to the principal of the chosen teachers. The researcher contacted the kindergarten teachers to inform them of the observation and how it will be conducted. The researcher wrote to the Schools Division Office to request permission to perform the data collection from a specific kindergarten teacher. This request was then forwarded to the School Division Superintendent for approval. The researcher was recommended to the principal of the school where the teacher who will be the study's participants taught after receiving approval from the Education Program Supervisor in charge of the kindergarten. The researcher then met the teacher participants regarding the schedule of the demonstration as well as for the interview and other data needed from the teacher participants in the conduct of this study. However, the consent form for this study was obtained during the writing of this study, as the researcher saw the necessary fit since the student work sample will also be analyzed as part of the study.

Phase 2: Document Analysis

Different aspects were considered in this research thus the need to gather the information that is deemed necessary to determine the answer that this study is seeking to know. The documents gathered for this study are the teacher's interview, the Teacher's Individual Portfolio, student work samples, and the classroom observation. The researcher interviewed the teacher to analyze how the teacher's personal interest in science affects their teaching of the subject. Teacher Data Profiles were gathered through phone interviews while teachers' instructional portfolios, daily lesson logs, and lesson plans were provided on the day of the observation. Teacher Participant 1 was able to provide a semi-detailed lesson plan while Teacher Participant 2 provided her weekly Daily Lesson Log. The classroom observation was used to make the vignette to document explanation-specific instructional practices. And lastly, the student work sample was used to document the quality of the explanation of the learners.

Phase 3: Interview Schedule

The researcher met the teacher participants after the researcher acquired permission from their respective school heads to gather data from the participants in this study. Teacher Data Profiles were gathered while informing the Teacher Participant about the flow of the observation. Simultaneously, Teacher Participants were asked about their own personal interest in science, their experiences in pursuing their degree, and their teaching styles. However, due to limited time because of their respective classes, the interview was continued online as requested by the participants for them to gather their thoughts clearly.

Phase 4: Observation Schedule

The day of the observation started when the principal endorsed the researcher to the teacher participants. On the way to the classroom, the researcher briefly discussed the flow of the observation including video recording during class discussions. The class of the first participant started at 08:00 in the morning while the class of the second participant started at around 11:00 in the morning. The observation goes smoothly although there are times when students seemed to be aware of the presence of the observer.

Field notes in Observations are transformed into vignettes. Vignettes are "short stories about hypothetical characters in specific circumstances to whose situation the interviewee is invited to respond…moving from the abstract to context-specific" [12]. Vignettes consist of text, images, or other forms of stimuli, ranging from short written prompts to live events, to which research participants are asked to respond [13]. Herman uses the term case vignette to describe a written description, photograph, or videotaped scene as a brief glimpse of an educational situation [14]. This will be used to document explanation-specific instructional practices.

The authors used a four-step approach: preparation, exploration, specification, and integration (PESI) for empirical material interpretation. The PESI approach provided a more organized and systematic way of interpretation that helped in reporting the empirical material in a more effective way.

The first step is called preparation. In this step, familiarization with the empirical material was done. Furthermore, empirical material was carefully organized, and sorted, and an interpretation frame was developed. This step is also referred to as "playing with the data" [15]. This step included several different tasks such as reading interview transcriptions, reviewing field notes, and organizing and reading documents. Along with these tasks, two interpretation frames were also developed. The first was for the best practices in teaching science in kindergarten. The second was for the quality of explanations the students produced in kindergarten science. Once the text was transcribed, text was divided carefully and allocated to 2 frames.

The second step is called exploration. In this step, initial codes were developed, and concepts were finalized. A number of key codes from all the codes that were developed were transformed into concepts based on differences and similarities.

The third step is the specification phase, where the goal of interpretation is to look for connections between concepts and develop a category consisting of various concepts. Patterns were carefully observed, and based on these patterns and understanding of literature, categories were developed.

The final step is integration. At this step, empirical material interpretation from one case study was compared with another case to reveal cross-case patterns. This final step helps in establishing a framework for the concept under study.

RESEARCH FINDINGS & DISCUSSIONS

Interview responses from Case Study Participant 1 show her interest in science is motivated by factors that are currently happening around her. Case Study Participant 1 is aware of the young children's instinct to play which is reflected in her lesson plans incorporating play-based activities for her pupils. She assures of sharing correct science concepts from children's unexpected questions. She efficiently uses assessments from students' performances and outputs to monitor her pupils' progress and manages to collaborate with fellow educators and their parents to support the children's needs. She is aware of inquiry-based requirements on teaching science to children such as science teaching in kindergarten must be supported by a wide range of print and non-print resources and Science learning in kindergarten students must be characterized by practical works.

Interview responses from Case Study Participant 2 revealed her interest in science that sparked due to the pandemic. She favors experiential learning, which she always includes in plans of her science lessons featuring hands-on activities including short school tours. She is experienced in using online learning resources utilizing DepEd's LRMDS to capture ideas for the lesson and manage to modify the illustrations to further enhance its appeal to the children. She is aware of assessment as an important part of the learning process to monitor students' progress.

Analysis of documents submitted by Case Study Participant #1 revealed different teaching strategies and instructional materials. She set up activities that incorporate Play-based and Art Based approaches. The majority of activities are set up in small groups that promote collaborative learning. The generous number of Printed Instructional Materials includes Large Pictures and Charts. She also used varied Manipulatives such as the Release and Match the Dice, Picture memory games, Puno ng Karunungan, and Puzzle that not only encourage collaborative learning but also support the play-based approach that is Developmentally Appropriate Practice for Kindergarten class. She uses class reporting to assess the students' learning after their group activity. Standard to kindergarten teachers, she uses diagnostic assessment as well to evaluate their students' current level of development which is deliberated with co-faculty and later reported to parents.

Document analysis from the portfolio of Case Study Participant 2 reflected almost identical teaching strategies and instructional materials in her plan. She also set up activities that incorporate Play-based and Art Based approaches which proceed in small groups that promote collaborative learning. One of the observed differences in her plan is the goal not to confine learning and learners in the classroom by hosting teacher- supervised school tours focused on exploring their immediate environment. Printed Instructional Materials are also generously evident like Large Pictures and Charts for visual aids purposes. On the contrary, few manipulative materials are reflected in her plan which is probably replaced by the set-up of the school tour. The use of non-print instructional material in the form of Audio-visual Presentation (AVP) was also observed as unique in the plan of Case Study Participant 2. This reflects the teacher's intention of immersing the students to sensory-engaging activities. Case study participant 2 used class reports to assess the students learning after their group activity.

The researcher presented the different models of pedagogical content knowledge of the cases to reveal their best practices employed in the delivery of science instruction in the kindergarten field. These best practices from different cases are summarized in Figure 1.

Grouping the students provides an avenue for them to engage on a reasoning level as they work with their members. Also, during the presentation of works, the environment of reasoning was fulfilled as the teacher asked a series of questions to their students unnoticeably making their students provide correct claims and link their answers to their outputs as evidence. Meanwhile, answering in chorus, providing leading clues, the absence of follow-up questions, and making students passive learners prevent students' explanations from reaching the reasoning level.

Looking through the lens of Elements of Scientific Explanation (Claim, Evidence, and Reasoning), the researcher outlined the cluster of observations in students' outputs into developing themes.

The following are the five thematic strands that appear upon further analysis of class observations and students' outputs:
Theme 1: Teachers' questions provide leading clues and are mostly answered in chorus by the students.

Theme 2: Students are active during activities and open questions but become passive receivers of information during the explanation phase of the lesson.

Theme 3: The flow of inquiry-based instruction fulfils only students "claim" and "evidence" and was seldom extended to "reasoning" level.

Theme 4: Guidance of Teachers through constant questioning helps students as a group provide scientific explanation that can reach reasoning level.

CONCLUSION

The teachers have qualified pedagogical content knowledge that reflects best practices in teaching science in the kindergarten field. Features of these PCK can successfully guide their students produce scientific explanations that can reach the claim and evidence level but was seldom extended to reasoning level.

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