Engineering Learning Model in Improving Hard Skills and Soft Skills Kindergarten Level

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Abstract

The use of engineering learning models needs to be implemented in facing the digital era. This investigation is the result of observations carried out in two kindergartens in the Kuningan area. The research subjects consisted of five people, including three teachers and two kindergarten principals. Data collection was done using interview techniques, focus group discussions (FGD), and observation. Data analysis included data reduction, display, and drawing conclusions. The investigation concluded that the implementation of a trial of a learning model with an engineering approach in early childhood education was carried out well and smoothly. Through FGD, it was found that the teachers felt that they did not yet understand the learning that was added to the engineering learning model. While engineering in general can be understood, it is still not well understood when it comes to its implementation as a learning model.

Key words: Learning, Model, Engineering, Early Childhood

Introduction

The Industrial Revolution 4.0 is expected to bring about new jobs that did not exist in the era of Industrial Revolution 3.0. Experts believe that the era of Industrial Revolution 4.0 will give birth to a number of new innovations in the field of Industry 4.0, including the Internet of Things, Big Data, 3D printing, Artificial Intelligence, driverless vehicles, genetic engineering, robots, and smart machines (Industri et al., 2018), (Abdullah, 2019).

By 2025, it is estimated that more than 35% of basic skills will change in the next 10 years, which threatens almost two billion workers in the world who may be at risk of losing their jobs. From 2010 to 2025, the demand for skilled workers in the ASEAN region is expected to increase by around 47% or about 14 million people (UNICEF, 2020) (Kemenkeu, 2014). In response to this, the demand of the Industrial Revolution 4.0 is to prepare young generations with knowledge and skills, forming innovative future humans who can process abundant natural resources into valuable products and services to create millions of new jobs.

It is estimated that students who are still in school from secondary, primary, and kindergarten education levels are the generation that will enter the workforce in 10 and 15 years, where they will face new types of jobs that are constantly evolving and foreign to them in the future. Therefore, new visionary teachers are needed with learning patterns that can create students who are ready to face the future workforce.
The preparation has started at an early age, basic and secondary education aimed at creating children who are ready to face the advancing, progressive, and innovative world of work, the era of technology with automation systems. One dimension of the 2013 curriculum is already directed towards preparing the future generation to become innovators and entrepreneurs, as these two types of jobs cannot be replaced by machines. Children need 21st-century competencies, which include critical thinking, collaboration, communication skills, and literacy. (Septikasari & Frasandy, 2018)

The position of Indonesia among other nations in this global era is no longer solely determined by Indonesia’s abundant natural resources. The government must also focus on improving the quality of human resources, social aspects, and culture so that Indonesia can become a great nation and compete on the global stage. The benchmark for the quality of Indonesia’s human resources is not enough to be measured only by national standards but must be oriented towards international standards and refer to countries that have certain advantages in technology, education, social, and culture.

In order to prepare human resources who are able to compete and take advantage of various opportunities in the global era, the field of education plays a very important role in preparing high-quality human resources. The engineering learning model is a learning model developed by the centre curriculum team of the Ministry of Education and Culture in 2017. This learning model was developed for all levels of education, but this article focuses on discussing the engineering learning model for Early Childhood Education.

Several definitions that explain Learning Through Engineering are taken from the development of the concepts of learning and engineering. In general, engineering is a term used in the field of technology and refers to the profession in the technical field. Engineering also means technology, which applies science and technology aimed at facilitating tasks. (Siron et al., 2020) So, it can be said that Engineering is a science that helps humans to solve their problems. The condition of a company, especially one that produces on a large scale or in manufacturing, in its work process cannot be separated from the task of Engineering.

Several definitions that explain Learning Through Engineering are taken from the development of the concept of learning and Engineering. In general, Engineering is a term used in the field of technology and is associated with the profession of engineering. Engineering also means technology, which applies science and technology to simplify affairs. (Siron et al., 2020) So, it can be said that Engineering is a science that helps in solving their problems. The task of design with promising and measurable work stages is carried out by Engineers. This engineering approach is implemented in classroom learning to improve students' soft and hard skills that can be taught from an early age. Development of hard and soft skills in the engineering learning model is carried out by using techniques to identify the necessary functions and apply values. Through early age, a child's personality can be easily directed to develop cognitive (knowledge, language ability, understanding, and application), affective aspects (willingness to accept, respond, belief, organize, and character formation), psychomotor aspects (basic skills), as well as nurturing a sense of trust, faith, and devotion to God Almighty. (Utarahman et al., 2020)

Innovation and integration strategies through an engineering approach are expected to prepare students to "learn how to learn, learn how to work, and work how to work" from an early age. The engineering learning model curriculum is composed of learning objectives, engineering indicators, methods, media, and evaluation tools. Guidelines have been developed to help teachers understand the engineering learning process in kindergarten. (Curriculum Center of the Ministry of Education and Culture, 2017)

This study aims to expand on previous work by investigating the extent to which literacy practices centred on techniques (reading picture books and stories and academic conversations) enhance and sustain the engagement of kindergarten-age students(Aguirre–Muñoz & Pantoya, 2016). Design is a key component of the technique, and it is important to provide experiences that help demonstrate that the technique is more than just design (Moore et al., 2014) because these experiences can provide opportunities to develop technical thinking skills (Tank et al., 2018). Techniques should not only be offered in high school but also introduced in elementary or even earlier(Rogers, 2012).

Method

The investigation was conducted in 2 (two) kindergarten schools, namely TK Aisyah and RA Al Muhlisin Kuningan. The research subjects consisted of 5 people, comprising 3 teachers and 2 school principals. Data collection was carried out using interview techniques, focus group discussions, and documentation. Data analysis included data collection, data reduction, display, and conclusion drawing

Results and Discussion

The investigation results through interviews obtained information from research subjects who provided their views that the Engineering learning model is easy to read and understand because it is well-written and uses language that is easy to comprehend. The syllabus helps in implementing the engineering learning model. The syllabus already covers the learning needs and is in accordance with the character and development of young children. The
Engineering learning model can be applied in kindergarten because it can be related to learning objectives and themes and can be implemented in various learning models used in schools.

The Engineering learning model cannot be applied in playgroups because 3–4–year–old children still find it difficult to achieve competence as they do not yet have the ability to collaborate in a team. However, the Engineering learning model can be implemented for children aged 4–6.

The steps for implementing the engineering model in the easily understood syllabus are clear because they describe the activities that teachers will do and are detailed in planning based on engineering for early childhood education. The material arrangement includes indicators in the engineering learning model that are specific, measurable, and focused. However, assessing engineering is not easy.

The lesson plan is developed starting from the theme map, which is then elaborated into learning activities. The advantage of the lesson plan is that it integrates the engineering learning model appropriately, without being forced. This makes it easier for teachers to implement. However, in developing the lesson plan, it is still not in line with the syllabus. The lesson plan still does not include activities in the block area, as stated in the syllabus, although they are conducted during the learning process.

The results of the interview with the teachers and head of TK Aisyiah obtained information that the TK Aisyiah teacher stated that they can understand the engineering learning model. The layout and language used are easy to understand. The presented syllabus helps teachers understand the engineering model and assists them in implementing learning with the engineering model.

The engineering learning model includes learning needs for early childhood and is in accordance with the child’s development, which the teacher agrees and strongly agrees with. The engineering learning model can also be applied in the TK level. The engineering learning model can be associated with all the competencies in the curriculum implemented in TK and can be incorporated into all learning themes in a year with various learning models.

The engineering learning model can be applied from the age of 3, tailored to the development and needs of children at each stage of their age. Group learning can be simplified for early childhood by simplifying the activities. The implementation steps of the learning model are easy to understand for teachers and detailed enough to help them understand the engineering learning model.

Information obtained from an interview with TK Aisyiah’s teacher revealed that the syllabus for the engineering learning model was developed by mapping suitable soft and hard engineering indicators with the theme and other developmental aspects. At first, the teacher and the head of the TK were confused about whether to include all indicators that seemed feasible. However, after discussing it, they realized that it would make assessment difficult for the teacher. Therefore, the teacher finally realized this and chose based on the needs.

Engineering indicators have generally been implemented and many of these behaviors have emerged during discussions. However, explicitly, the curriculum team hopes to design better in finalizing the product so that it can be implemented nationally. There seem to be no obstacles in implementing the planning of engineering learning activities at RA Al Muhlisin, only in the engineering module, which has not been well understood, as well as the more detailed implementation stages in kindergarten. Meanwhile, TK Aisyiah’s learning is somewhat hindered by the lack of facilities and infrastructure, limited funds, and limitations in exploring programs that are somewhat not allowed by the Foundation. For example, teachers have difficulty attaching students’ work, teachers must make efforts to use media if needed in learning; and this slightly disturbs teachers in being creative, so the learning that develops is very conventional.

In the discussion, the discourse developed on how implementation is carried out in the field, that is, teachers provide information about engineering learning to their children. Children have begun to be introduced to engineering and why we must learn it. The abilities that children must have should also be introduced to students so that when learning takes place, children can understand the purpose of the learning for themselves. For example, when we work, we must finish it and work hard, so this should be introduced to children, such as how their father works hard at the office, teachers at school, and also children. This will make the work seen by people, and children will be proud of the results. Then, before doing the work, we must plan something. How do teachers condition the situation before children create something? How do children get used to working in groups? This is still rarely done by teachers, although it is recognized that it can be carried out for children in schools.

The obstacles experienced in relation to the facilities and infrastructure that support engineering learning activities depend on the school. Some schools are accustomed to doing things differently and being creative by providing the necessary facilities and infrastructure so that teachers can more easily develop themselves. However, teachers can actually utilize recycled materials to work on a project, but this also needs to be communicated, and the Foundation needs to be educated about this.

The advantage of the engineering learning model, considering that this model is still new and not well–known to teachers, is that understanding engineering is still difficult, and the language used is too scientific for teachers to understand. However, teachers see this as a good thing if implemented by looking at a number of engineering indicators that really develop children’s character. And this is the advantage of this model. The kindergarten indicators are already appropriate even though the language used is still unfamiliar to teachers; they must get used to using and understanding it before teaching it to children.
The results of the interview with the TK Aisyiah teacher obtained information that the entrepreneurship model is good because it is almost the same as character education but with a different name and a few additional elements. The additions are only a few. Usually, the model is a teaching aid. Parents usually don’t support activities that seem strange. We are only two years old, so to speak, still crawling, but we want to try. Regarding the elements of entrepreneurship (hard and soft: tangible and intangible), as far as I can remember, there are things that can be seen and things that cannot be seen. Planting hard and soft elements in TK children is possible, but it is not very clear. They understand it, but it needs to be done repeatedly. As usual, we arrange the activities in groups. I am confused about learning while working. It is normal to learn while studying, it is okay to learn while working, but it is difficult for TK children to work because they are not allowed to work. Regarding the implementation here, it is done according to how we teach, but the term "work" means that the children perform activities or tasks that have been explained to them.

Actually, if we talk about the hard skill of observing and classifying, we have been doing it regularly, so it’s not too confusing. In the 2013 curriculum, soft skills refer to behaviour or character, while hard skills refer to operational verbs. Is it possible for children to achieve both hard and soft skills? It is possible for children, but it needs to be adjusted to their age and simplified with language that they can understand. The new entrepreneurship model is only known by teachers, and we will only understand it if there are examples of learning in the classroom that we can directly observe, such as videos or visiting schools that have already implemented it, so that teachers can understand it better.

The results of the interview with the TK Aisyiah teacher stated that they can understand the entrepreneurship learning model. The layout and language used are easy to understand. The presented syllabus helps teachers understand the entrepreneurship model and helps them implement learning with the entrepreneurship model. The entrepreneurship learning model covers the learning needs of early childhood and is in accordance with child development, which the teacher agrees and strongly agrees with. The entrepreneurship learning model can also be applied at the kindergarten level.

The entrepreneurship learning model can be linked to all competencies in the curriculum implemented in Kindergarten and can be incorporated into all learning themes throughout the year with various learning models. The entrepreneurship learning model can be applied starting at the age of 3 years, adjusted to the development and needs of children at each age level.

Group learning (in teams) can be applied to young children by simplifying the activities. The implementation steps of the learning are easy for teachers to understand and detailed enough to help them understand the engineering model of the learning process.

Before getting into the core learning, the learning begins by preparing students through lining up while singing and praying. The learning uses an area approach. Learning in the outdoor area involves playing on a scooter. Learning in the indoor area starts with an introduction to Monas (National Monument in Indonesia). After that, the teacher introduces the activities of the students in each area.

Art Area: Students are copying a picture of Monas that has been provided by the teacher. Mathematics Area: Students are counting the number of Monas in the picture (between 2–5) according to the number symbols selected. In this area, students are expected to provide coaching and help others who are having difficulty counting (soft skills), as well as to make predictions (hard skills). Soft and hard competencies are already visible during the learning process (with supporting data in the form of videos and photos).

Block Area: Students are assembling blocks to resemble Monas. In this area, students are expected to work together and collaborate (soft skills), as well as to create modelling designs (hard skills). Soft and hard competencies are already visible during the learning process (with supporting data in the form of videos and photos). Break time for eating together.

In closing, the teacher asked about today’s learning experience and asked the students to draw conclusions, as well as giving assignments to prepare for tomorrow’s lesson. After following the lesson from beginning to end, it can be concluded that the Kerekaysaan learning model can be implemented well for today’s lesson material.

Through FGD investigation, it was found that the teachers felt unsure about the added learning model of Kerekaysaan. While Kerekaysaan, in general, can be understood, when it comes to implementing it as a learning model, the teachers feel uncertain about how to do it.

The results of the previous curriculum evaluation included indicators, but in the 2013 curriculum (K-13), there were no indicators, so teachers were curious about how K-13 would be implemented. Therefore, teachers need to visit other schools that have implemented engineering. This engineering is to cover more of the basic competencies and core competencies so that the focus is more on children’s activities. So, from the creativity of the teacher, it is poured into the students so that they become the ones who work and develop. For example, making fruit juice, students who cut the fruits, what can be simplified for children so that they can work on core competencies and basic competencies, and with the addition of engineering, children can practice more. Engineering involves more practice in learning, so children do not just imagine but also do.

Children will be enthusiastic about their studies, and they will surely ask what they will learn tomorrow. To teach children how to read, it is not necessary to use books, we can use activities, or we can stick letters, for example,
L-E-M-A-R-I, and eventually, the child will understand. The obstacle is not significant, the teacher needs to read more, learn more, and prepare more, and of course the teacher’s working hours need to be considered, so if the teacher has not prepared the media, RPPH, and RPPM yet.

In the observation results at TK Aisyiah, completeness of documents (RPPM, RPPH) has been found. The syllabus document includes an explanation of the steps of the activities that will be carried out. In RPPH, there is already an integration of KD with soft competency engineering and hard competency engineering. Learning activities that include engineering performance are included in the observation aspect, while there are no aspects of task distribution, recording observation results, and communicating exploration results.

Observation on the learning process: During the Core Activity, students do not have learning experiences from various sources, but a safe, comfortable, and enjoyable learning environment is created for them. Students are actively involved in the activity. Students demonstrate engineering behaviour such as in-depth problem-solving and analysis (solving everyday problems – soft skill), driving for results (desire/effort to achieve), and delivering results (providing results). Students actively engage in classification and designing. Students interact with active and creative thinking, practice problem-solving without fear, engage in various activities that cultivate pride and self-confidence, receive answers to every question asked, and can self-evaluate.

The teacher’s activity involves actively involving students in every learning activity, creating activity steps in the form of pictures/writing to help students understand the activities that will be carried out, providing student activity sheets as a tool to evaluate the child’s understanding of the activity being carried out, providing positive feedback and reinforcement in the form of oral, written, signal or reward for the success of the students, facilitating students to reflect to gain learning experiences that have been carried out, and facilitating students to gain meaningful experiences.

The teacher’s closing activity, together with the students and/or individually, involves making summaries/conclusions, consistently and programatically reflecting on the activities that have been carried out, and providing feedback on the process and results of learning.

The teacher’s planning is in accordance with the example syllabus of MKPMPK. In general, there are no problems with the planning as the teacher can prepare it well. The teacher only needs to identify the indicators that are suitable for the learning objectives of that day and include them in the RPPM and RPPH indicators. The learning implementation is in accordance with the planning made by the teacher.

The implementation of the wealth learning model in kindergarten can be carried out, but the teacher is not sure whether what is being done is correct. This is because the teacher does not see any difference in teaching in the classroom. The obstacles/difficulties that the teacher faces when applying MKPMPK are apparent. The teacher has not fully understood this learning model, and sufficient time is needed to understand and refine the model to make it easier for the teacher to implement. There is a need for socialization and a more applicable design model guide.

The results of this study are consistent with the investigation conducted by (Hijriati, 2017) that with the developmental tasks undertaken by children, interesting and fun learning is needed for children that can be "wrapped" in games, cheerful atmosphere, lightness, singing, and dancing. Meanwhile, according to (Nuraeni, 2014), the principles of early childhood learning are goal-oriented, activity-based, individualistic, integral, interactive, inspiring, enjoyable, and challenging.

Early childhood education providers free children from violence, treat children kindly, provide education that humanizes children, and provide education that fulfils children’s rights. (Siswanto et al., 2019)

**Conclusion**

The implementation of a learning model trial using an engineering approach at the Early Childhood Education (PAUD) level was carried out well and smoothly. Investigation through FGD obtained information that teachers feel they do not yet understand the learning that is added to the engineering learning model. While engineering, in general, can be understood, if engineering is in the form of learning, teachers feel they have no idea how to implement it.

The recommended actions are: (1) the need for time for teachers to study documents so that it generates ideas to provide input for the development of designs, syllabuses, and lesson plans, (2) engineering language is still unfamiliar and not understood by teachers, making it difficult for teachers to understand the content of the model, (3) the need for examples of activities that can be imitated by teachers in implementing the engineering learning model at the PAUD level, (4) the need for special teacher training for the PAUD level so that teachers can understand the concept and application of the engineering learning model to be applied at the PAUD level.

**References**


