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# Teaching Diffusion Process to Children with Complex Communication Needs

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***Abstract***--- *The purpose of this study was to teach the concept of the diffusion to students with special needs. This study used a single research approach with A-B design (baseline and intervention) in one of the inclusion Early Childhood Education in Bandung, Indonesia. The students of this study were five students who were diagnosed with obstacles in complex communication. The teaching method given in this research was an experimental demonstration to explain the phenomenon in the diffusion. Factors that can influence the diffusion process was also adjusted to the student's condition. The results revealed that understanding concept of diffusion increased through teaching with experimental demonstrations. The increases in the understanding could reach up to about 60% after receiving treatment compared to the teaching with conventional way that can reach only about less than 10%. The atmosphere in the learning process can foster student curiosity. Indeed, students can be more focus in the ongoing teaching process. The repetition of student matter during the learning process is very helpful because the characteristics of the student that have difficulty in communicating, in which it requires direction and exposure of material that is simple and can be easily understood.*

***Keywords***: *Children with special needs, Diffusion, Learning, Education, Demonstration, Experiment.*

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## I. INTRODUCTION

Teaching diffusion process is one of the students relating to movement of substances in a solvent from a high complex part so as to produce small particles that collide with each other randomly until they become widely distributed particles [3]. In learning diffusion, children who have barriers to communication need to be considered in the delivery process because it is very closely related to the understanding of cognition and focus. In the process of delivery must be made simpler and more conclusive so that students can understand the exposure and the instructions or instructions given by us [1]. Learning about diffusion is very useful for daily life, so it is important to be taught from an early age as an investment in understanding simple concepts for students. Understanding the simple concept in question is that students are only given instructions to observe and then recount how the diffusion phenomena occur simply, which makes

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it a challenge for us and the teacher in providing students with an appropriate and simple method of understanding [7].

There are several studies describing diffusion, diffusion learning has usually begun at the elementary school level while at the level of early childhood education is usually not given at all exposure to the science of diffusion [3].. For this reason, the need for experimental-based science research that can be done at the level of early childhood education, especially in inclusive schools, because with the experimental learning process can foster high curiosity so students will try to express their opinions, this is the beginning Two-way communication occurs between us and students. What needs to be considered in experimental science learning activities is that we or the teacher must use visual media to get the children's attention. We or the teacher must have enough confidence and knowledge to provide learning about science about diffusion [6].

Therefore, the presence of supporting components and media visually can help the process of understanding students to be more insteractive when the learning process is done either by us or can collaborate with special teachers or class teachers [5]. In the diffusion learning activities given to students that teach the understanding of the concept of the diffusion process by using a dye that is dripped using a dropper pipette into a beaker filled with water as much as 100 mL with normal temperature simply, then teaching the process of diffusion phenomenon using additional media in the form of a spoon by giving special treatment by stirring, then using a comparison such as using two different water temperatures namely by using normal temperature water and low temperature water then food coloring is dropped using a dropper with the same number of drops, then the child can show which conditions diffuse faster, and using the same temperature conditions but the dyes particles are given differently, this study uses a single student approach with AB design (baseline and intervention) in one of the inclusion Early Childhood Education in Bandung. The research students were five people who were diagnosed with obstacles in complex communication. The teaching method given in this research is an experimental demonstration to explain the phenomenon of diffusion occurs [2].

The teaching process is adapted to student conditions and factors that can influence the diffusion process. The teaching process is carried out by researching directly with students [10]. The results of the study revealed that understanding the concept of diffusion requires cognitive understanding.

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This research can not only be done by us but also can be done directly by other us, special teachers or class teachers [2]. The atmosphere of learning using experimental media can foster student curiosity which is very high as well as students can be more focused in the ongoing teaching process. The repetition of the student matter material during the learning process is very helpful because the characteristics of the student which have difficulty in communicating so that it requires direction and exposure of material that is simple and can be understood occurs [2].

## II. LOGICAL FRAMEWORK

Understanding diffusion at the level of early childhood education for children diagnosed with complex communication barriers must use the concept of basic understanding that is concrete [5]. The concept of a basic concept that is concrete is done through a simple trial through the phenomenon of liquid diffusion using an experimental demonstration method that is giving a drop of food coloring to water as much as 100 mL then in a matter of minutes the dye will diffuse throughout the water in a glass beaker then after the diffusion process occurs then the water in the beaker will be colored according to the color given.

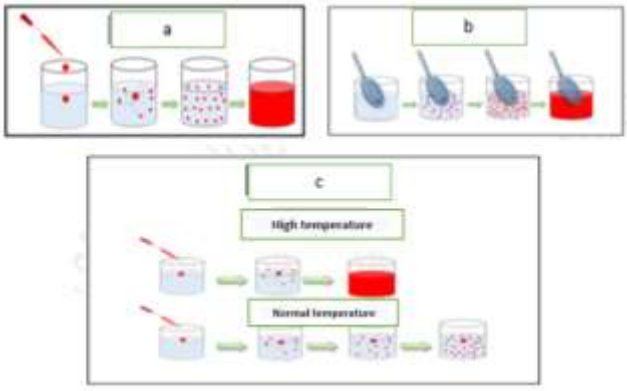


**Figure.1 Illustration of the process of diffusion**

Figure 1 (a) shows an illustration of the process of diffusion of a coloring agent dripped using a dropper as much as 1 drop into 100 mL of water on a glass beaker. For early childhood students in general, students will easily understand the concept of diffusion phenomena by simple exposures such as the distribution of a coloring agent in a beaker filled with 100 mL of water which in the initial conditions the coloring agent is still on the surface of the water until gradually visible evenly throughout all parts the water in the beaker will be easily formed through

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experimental demonstrations. They understand that the coloring agent that has been dripped into water in the beaker will be spread evenly because that is the process of diffusion.

Figure 1 (b) shows an illustration of the process of diffusion of food coloring agents administered through a spoon with the treatment stirring evenly with the same dose as using a drip sprinkler as much as 100 ml. They understand that the coloring agent that has been given through a spoon with special treatment given by stirring in water that is in a glass beaker will be spread evenly more quickly than using a dropper dropper without being treated by stirring.

Figure 1 (c) shows an illustration of the process of diffusion of dyes given through two different ratios of water temperature in a beaker that is using high temperature (70°C) or heat and using normal temperature (25°C) of 100 mL each, by administering as much coloring agent as much 1 drop using a dropper dropper. They understand that dyes that have been given using high temperature water can diffuse faster than normal temperature water.

However, teaching this phenomenon to students who experience obstacles in complex communication will require further consideration and special treatment. The principle of diffusion can be represented as Fick Law [10].

$$J=dMS.dt \quad (1)$$

where J is the flux (g/cm$^2$s), M is the number of mass (g or mole), S is the surface (cm$^2$), t is the time (seconds).

Another formula that supports the diffusion process occurs is molecular diffusion. Molecular diffusion is the movement of a molecule through a fluid with random movements in stationary fluid or in fluid that flows through a laminar. A molecule that moves straight will then move randomly because it collides with another molecule, the movement of a molecule like this is called the Random-Walk Process. The diffusion rate can be increased by stirring so that equilibrium conditions can be more quickly achieved. Random movements in the diffusion process. Another event which is also included as a diffusion event is blue ink which is dripped in clear water. The ink will diffuse slowly throughout all parts of the water until an equilibrium condition is obtained (no concentration gradient). To increase the diffusion rate, stirring can be carried out, so that equilibrium conditions can be more quickly achieved. Diffusion is not limited to the displacement

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of the stagnant (stationary) layer of solid or liquid. Diffusion also occurs in the fluid phase of physical mixing and turbulent flow vortex, just as the heat flow in fluid can occur due to convection. This event is called eddy diffusion. [4].

For fluids that contain many components that will diffuse in a state of silence, Frick's law applies to a mixture of laws A and B, namely [10].

$$Jaz = -c\ DAB\ dXA\ /\ dz \qquad (2)$$

where Jaz is the molar flux component A in the z axis direction for molecular direction (kgmolA/s.m2), DAB is the molecular diffusion of molecules A through B ($m^2/s$), Z is the diffusion distance (m), C is the concentration ($kgmol/m^3$), XA is the mole fraction of A from a mixture of A and B.

Diffusion learning is important for ordinary students because diffusion learning is one of the activities commonly encountered in daily life. Diffusion is the event of the flow or transfer of a substance in the solvent from the high concentrated section to the low concentrated section. Like how to make syrup water in everyday life applications. Therefore it is important for students in general to learn about the diffusion. Because learning material about diffusion will make it easier for students in general to apply it in daily life. Learning about diffusion is also very closely related to the maturity of students before entering the academic stage. Because it involves the ability of intelligence, motor skills, language, and also social emotional.

For children who have obstacles in complex communication learning about diffusion is very important because diffusion is an application of daily life by learning about this diffusion children are taught to practice intelligence, motor skills, language, and also social emotional. Experimental demonstration activities are a method to attract students' interest especially students who experience obstacles in complex communication. Developing communication can be done by helping children improve their language skills. Experimental demonstration is the most powerful tool for learning children's language skills. It is through this experimental demonstration that children can expand their vocabulary and develop their ability to accept and express their language skills through interactions with other children and adults in spontaneous trial situations. In this experimental demonstration activity students conduct trials directly so students can practice and can directly observe the results obtained so that students can understand the material provided and

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students can communicate it with us by showing which diffuses faster, children can trickle directly coloring agent into the water and the child can see firsthand the process of diffusion taking place. With the experimental demonstration notes, this is done with repetition so that the material provided is well absorbed. Because in reality children who have obstacles in complex communication need different time from children in general. Therefore it is important to teach to handle simple diffusion learning from an early age for children in general as well as children who have obstacles in complex communication.

## III. RESEARCH METHOD

### 3.1 Research Subjects

This study used a single student approach with A-B design (baseline and intervention) in one of the inclusion Early Childhood Education in Bandung. Baseline conditions here are the understanding that students have before getting the information or understanding given, while intervention here is a condition where students have received information or treatment. In this study we took five students who were diagnosed to experience barriers in complex communication. The teaching method given in We conducted this research in the form of an experimental demonstration to explain how the phenomenon of diffusion occurs. The teaching process is adjusted to the student's condition and the factors that can influence the diffusion process [4].

To further clarify the results of the experiments conducted we sought additional information about the demographics of each student who were targeted as research such as IQ, language skills, gross motor skills and fine motor skills and social emotions. it is very influential on the understanding of students in conducting these experimental tests. To simplify the analysis of students' level of ability, all information is tested through scores 1-5, score 1 (the child does not understand the instructions given), score 2 (the child understands the instruction but at the time of the experiment the child is helped as a whole), score 3 (the child understand the instructions but at the time of the experiment the child succeeded with a lot of help), score 4 (Children understand the instructions but at the time of the experiment the child succeeded with a little help), and score 5 (The child understood the instructions and the child succeeded without help).

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### 3.2 Teaching Conditions

Teaching is carried out in two activities namely without treatment or baseline and with special treatment or intervention. The first aspect that must be known is that we see the condition of students based on several aspects of the development of both IQ, language and communication skills, emotional social development, gross and fine motor development that functions to find out the conditions owned by each student, in this condition can be interpreted as baseline. In this baseline condition students are given some simple understanding through diffusion, then the five students are asked about the phenomenon of diffusion happening and we look at student responses based on answers that refer to aspects of the development of each student. Then the results of understanding obtained from these baseline conditions are recorded and then evaluated to be used as data. After obtaining baseline data from the five students, the teaching process then provides treatment or intervention to students. The intervention was in the form of a teaching study in an experimental demonstration of the diffusion phenomenon. This intervention is given into three stages so that students better understand the information that will be given. Each teaching phase is carried out in a 20-minute class. To facilitate students with complex communication barriers in teaching the phenomenon of diffusion occurs only simple experimental activities are carried out using language that is easily understood by students such as mixing colors using several media, namely, dropper drops, spoons and different water temperatures, so that children easily understand and understand in the teaching process. To simplify the process of teaching diffusion, we only provide information about diffusion in everyday life: that is, the effect of particle size on the diffusion process in water, and the condition of water temperature can influence the diffusion process more quickly. To get students' understanding of information after getting an intervention through an experimental demonstration, the teaching process is equipped with pre and post tests (through interviews) [2].

The first meeting teaches students about the importance of diffusion in everyday life (such as: tea bags can emit color or diffuse when inserted into water, syrup water can dissolve in water without stirring, etc.), while the second meeting is experimental demonstration of the teaching process regarding diffusion i.e. the coloring agent using a dropper into 100 mL of water. The

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experimental demonstration is to provide an understanding of why dyes can diffuse into small particles in water. and conducted an experimental demonstration of the process of diffusion of dyes dissolved using a spoon in a glass beaker filled with water as much as 100 mL of normal temperature by stirring. Then the third meeting carried out the process of diffusion of dyes using a dropper in a glass beaker filled with water as much as 100 mL using two different water temperature ratios between high temperature and hot water with normal temperature water [9]. In addition, in experimental demonstrations, we used several different colors in experimental demonstrations to make it more interesting and better understanding the explanations.

### 3.3 Experimental Demonstration

The experimental demonstration was carried out in a 100 mL of beaker glass. We used a variety of dyes such as red, blue, purple, using a dropper, spoon and 100 ml of water and a beaker, the number of drops used in this trial is 1 drop, as well as the amount of coloring agent given using the same spoon as much as 1 drop but in its application the spoon was given a coloring agent as much as one drop then the spoon was put into water in a glass beaker then given special treatment by stirring then the students noticed the diffusion process occurred. The next teaching uses two different temperature ratios between high or hot temperature (70°C) and normal temperature (25°C) with the treatment given a dye using 1 drop dropper in 100 mL glass beaker then students are given instructions to observe the process which diffusion is faster.

In a demonstration using different temperatures, students are only given instructions to indicate which is faster in the process of diffusion between high temperature water (70°C) and normal temperature water (temperature around 25°C) by looking at it.

## IV. RESULTS AND DISCUSSION

### 4.1 Students' Demographic Data

The demographic data of CCN students is shown in the Figure 2. The graph shows three basic information from students starting understanding cognition, language ability and social emotional attitudes of students, and motor development. This information is needed to understand the CCN IQ level, where this will have an impact on student understanding.

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We studied as many as five students who averaged approximately five years of age in one of the inclusive Early Childhood Education in Bandung, Indonesia. The five students were diagnosed with CCN, which means that the five students were diagnosed with a barrier in complex communication. Each individual basically has different potentials, abilities and deficiencies, this condition also distinguishes each of the five students in complex communication barriers. The differentiating conditions of each student can be seen from each of the information obtained based on the results of the interview, namely: the first student is 5 years old, has CCN since birth and has an IQ level of 60, the second student is 5 years old and has CCN at age 2 years due to traumatic factors (do not want to talk to anyone from the age of 2 years to the age of 4 years because his mother died and the lack of stimulation of communication that his father gave so students experience CCN with an IQ of 60. Third-year students (aged 5 years old) experience CCN from birth and often students out of focus, IQ 70. Fourth-year-old student 5 years of age with CCN since the age of 2 years because of parental misconduct that is giving cellphones as a medium for children's play so that children seem to have their own world without wanting to socialize with other people around them so they are diagnosed with CCN by doctors of growth and development, has an IQ of 80. Five students after 5 years' experience in CCN because post natal factors during breastfeeding the child does not want to suckle the mother, so the child suckles using a pacifier bottle, at the age of 3 years the child is newly diagnosed with CCN due to lack of maturity of the growth and development process in the oral phase or breastfeeding so that the area of the oral cavity experiences problems causing students have difficulty in complex communication, with an IQ of 90.

Student #1 had difficulty communicating so that in each activity the students were only able to pull our clothes or the class teacher if they wanted something without saying a word. But the child is able to understand commands such as littering, eating, drinking, etc.

Student #2 is often alone and does not want to socialize with other friends at school, if he feels uncomfortable often cries and is very dependent on just one teacher, so all activities undertaken must be accompanied by the teacher.

Student #3 was diagnosed with impaired focus and had complex communication barriers and often while playing seized the toys of his friend without borrowing first.

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Student #4, based on interview information with parents, was diagnosed with CCN due to parenting factors that allow their children to play mobile phones at the age of 2 years to children aged 3 years to watch YouTube without supervision from their own parents, which at first parents assumed to add vocabulary said famous children after 1 year running the child experienced a decline in vocabulary, because the child only hears vocabulary in accordance with the words heard on YouTube.

For student #5 , based on information obtained from parents and a diagnosis from an expert doctor, students experience disorders in the organs of the oral part because of the child's unnoticed factor in the oral phase when breastfeeding. This is what causes children to experience obstacles in complex communication, when children speak often there are words that are not understood by others including, their own parents. So that children are often emotional when parents or other people around them do not understand their words.

The fifth student has the ability to understand language, emotion and motor and IQ 90, the highest compared to his other friends, the fourth student has a good IQ 80 and motoric level, but in the development of emotions and language is weaker, the third student has an IQ 70 and motorics are moderate but very low on the ability to helpless and emotional development. The second student has an IQ of 60 moderate motor development but low language and emotional development. The first student has an IQ of 60 and the same motor skills as the second student but the conditions of language development and emotions are very low compared to the four students. Students experiencing aspects of low development both in aspects of IQ, language development, emotional development and emotional development will have difficulty understanding the concepts in this science experiment.

The conclusion from the research observations, based on these characteristics, the level of intelligence of students before obtaining special treatment through experimental demonstrations is a low level of understanding, low language skills, low social emotional state, but the students' motor development is classified from the highest to the lowest. We conclude that the sequence for the student ability is 5, 4, 3, 2, and 1. This can be seen from Figure 1 based on the demographic data of each student obtained before receiving special treatment in the form of

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experimental demonstration learning both in aspects of intelligence (IQ), language, emotions, and motor skills.

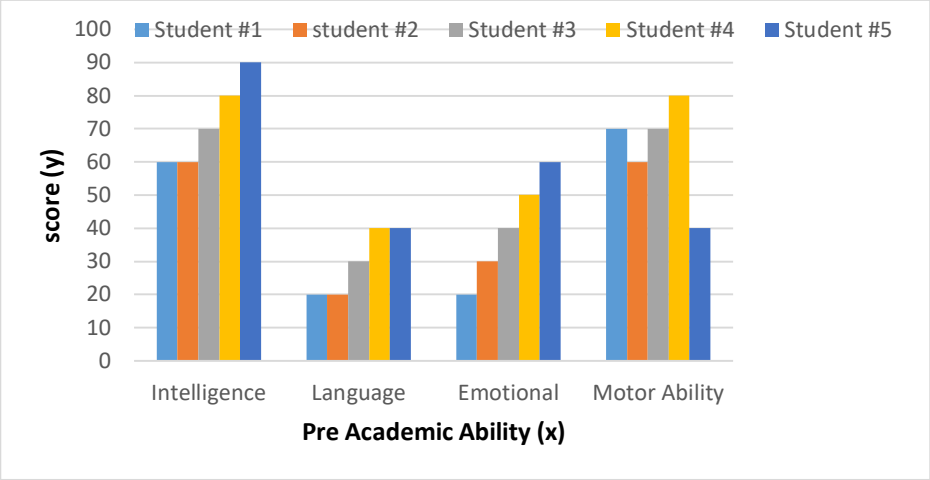


Figure 2. Demographic data for students experiencing communication difficulties

Figure 2 shows the level of student understanding of diffusion before getting experimental demonstration treatment. There are four aspects observed, namely IQ, language, emotions, and motor development. The suitability of this aspect is very important because it greatly influences students 'readiness to experiment and students' readiness in student understanding. The observations of the five CCNs above show that IQ, language development ability, social emotional development ability affect the level of understanding of CCN students in the teaching process about diffusion. Inversely related to students' motor development ability does not affect the level of student understanding of diffusion teaching. An understanding of diffusion before being given an experimental demonstration study treatment on aspects of basic development shows a low level. The low level of understanding of diffusion is due to the low ability in aspects of the level of intelligence, discussion, and social emotion. The same characteristics appear in student # 1 and student # 2 and student # 3, they both have the concept of understanding about IQ, language, social emotions and motor low. In contrast to student # 4 and student # 5 each of them has different intelligence levels, student # 4 has IQ at the borderline while student # 5 has an average IQ but low emotional and social ability skills while student #

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4 has good motoric ability and the # 5 student's motor skills are low because of the post natal factors experienced by students during breastfeeding.

After obtaining the observations we made, we carried out a special treatment in the form of an intervention with reinforcement of three sessions to see a comparison of students' understanding by teaching through the experimental demonstration method of science trials.

The intervention was carried out as many as three sessions to try to introduce what is diffusion through experimental demonstration trials conducted through three stages, namely the introduction of liquid diffusion, through experimental demonstration trials of coloring agents in a beaker filled with 100 ml of water at normal temperature (25°C) by using a dropper pipette, the next trial is giving a dye using a spoon and with special treatment stirring. And the next test phase is the test of giving coloring agents in beaker filled with water in the ratio of two different water temperatures, using high temperature water (70°C) and using normal temperature water (25°C).

Based on the results of the trial in figure 2, students can test the application of dyes using high temperature water (70°C) on the beaker glass will diffuse faster than the coloring agent using normal temperature water (25°C). That is because high temperature is one of the factors that can make the diffusion process occur faster, using high water temperatures (70°C) will speed up the diffusion process compared to using normal temperature water (25°C) [8].

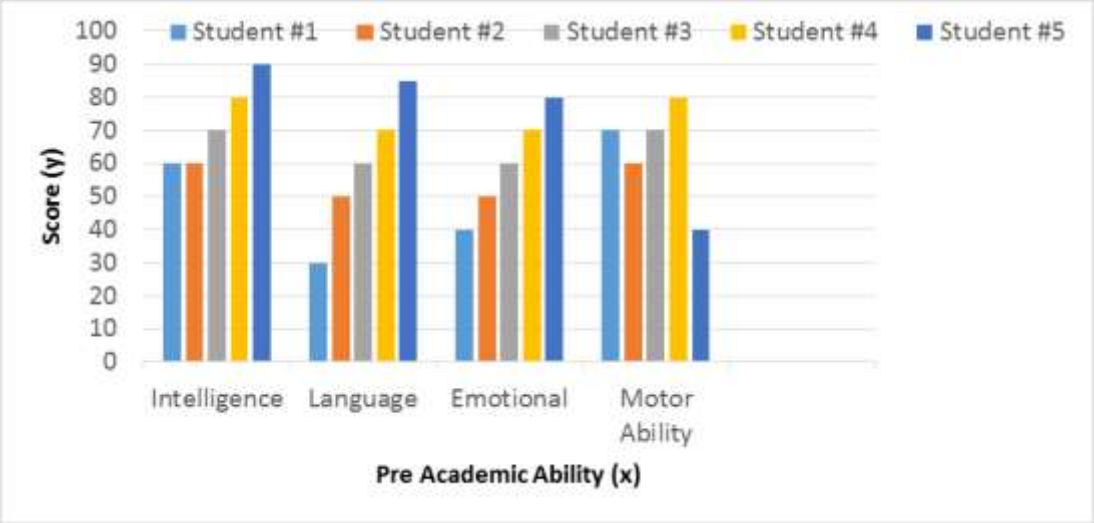


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Figure. 3 Student's level of understanding of basic developmental aspects with experimental demonstration treatment (W)

Figure 3 is the result of providing experimental treatment through experimental demonstrations based on observations from the five CCN above after obtaining special treatment in the form of interventions that are given repeatedly in three sessions shows that with special treatment in diffusion teaching through experimental demonstrations. With an experimental demonstration, it can improve the understanding of diffusion which can be seen from the aspect of increasing the ability of language development, the ability to develop social emotions and motor skills.

Figure 3 shows the difference in results based on the results of the trial before getting treated and after getting experimental demonstration treatment, that there is an increase in the understanding of each student after being given an experimental demonstration trial both in terms of IQ, language, social emotional and motoric aspects of learning about diffusion of dyes for children who have obstacles in complex communication.

The results of this study show a significant increase in understanding before the test and trial this is the same as the research of nanotectology, which can be seen from different studies in research, language, social, emotional and motor skills with all related needs. use demonstration skills through experimental demonstration learning [7].

### 4.2 Diffusion Phenomena Learned for Students

Diffusion is the movement of molecules from high to low concentrations. This means that the displacement of components / molecules occurs due to differences in concentration. The diffusion process is divided into 3 types namely liquid diffusion, solid diffusion and gas studies. But, in the scientific trials conducted in this study, it is given to CCN at early age in inclusive schools.

Liquid diffusion is said to be liquid diffusion if there is a displacement of liquid molecules from high concentrations to low concentrations. For example, when we soak soybeans in water when making tempeh. During soaking water diffusion will occur from the outside environment (which has a high water content) into soybeans (which has a low water content).

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What is learned in the teaching of diffusion to CCN is understanding the concept of simple liquid diffusion through experimental demonstration media using dyes using dropper, spoon, glass beaker, 100 mL of water with normal temperature and high temperature. In this simple diffusion teaching using the principle of diffusion can be represented as Fick Law.

In the process of learning diffusion to CCN, we required more time and requires repetitive activities. To increase the level of understanding, we must repeat the teaching topic because their understanding is related to repetition in communication. How to do repetition can also be done in experiments. Indeed, the support of a simple experimental demonstration is very helpful to increase the level of understanding.

Table 1 is a list of questions delivering to student for distinguish students'comprehension on the diffusion. This table is about teaching process based on the results of experimental demonstration trials before being given treatment and after being treated through three sessions.

**Table 1. Questions on Difusi to CCN Students.**

| *Questions* | *Difusi to CCN* | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Wo* | | | | | *W Session 1* | | | | | *W Session 2* | | | | | *W Session 3* | | | | |
| | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| *1. Mentioning color dripped in water containing glass beaker* | *2* | *2* | *3* | *3* | *3* | *3* | *3* | *3* | *4* | *4* | *3* | *3* | *4* | *4* | *4* | *3* | *4* | *4* | *5* | *5* |
| *2. Understanding temperature water filled into the glass beaker* | *1* | *1* | *2* | *2* | *2* | *1* | *1* | *2* | *2* | *2* | *2* | *2* | *2* | *3* | *3* | *2* | *2* | *2* | *3* | *5* |
| *3. Understanding the drop size in affecting* | *1* | *1* | *1* | *1* | *1* | *1* | *2* | *2* | *2* | *2* | *2* | *2* | *3* | *3* | *3* | *3* | *3* | *3* | *3* | *3* |
| *4. Understanding the effect of stirring on accelerating the diffusion process* | *1* | *1* | *1* | *1* | *1* | *2* | *2* | *3* | *3* | *3* | *3* | *3* | *3* | *3* | *4* | *3* | *3* | *3* | *3* | *5* |
| *5. Understanding surface área for making faster diffusion* | *1* | *1* | *1* | *1* | *1* | *2* | *2* | *3* | *3* | *4* | *2* | *2* | *3* | *3* | *4* | *2* | *2* | *3* | *3* | *4* |
| *6. Explaining the impact of high temperature on* | *1* | *1* | *1* | *1* | *1* | *2* | *2* | *3* | *3* | *3* | *3* | *3* | *4* | *4* | *4* | *3* | *3* | *4* | *4* | *4* |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ***increasing speed of diffusion*** | | | | | | | | | | | | | | | | | | | | |
| ***7.*** | ***Distinguishing the faster diffusion when using hot and normal water*** | ***1*** | ***1*** | ***2*** | ***2*** | ***2*** | ***3*** | ***3*** | ***3*** | ***5*** | ***5*** | ***4*** | ***4*** | ***5*** | ***5*** | ***4*** | ***4*** | ***4*** | ***4*** | ***5*** | ***5*** |

Note: w/o = "without" experimental demonstrations. w = "with" experimental demonstration. Scoring level:
1 = Child does not understand the instructions given
2 = The child understands the instructions but during the experiment the child is fully assisted
3 = The child understands the instructions but during the experiment the child succeeds with a lot of help
4 = The child understands the instructions but during the experiment the child succeeds with a little help
5 = Children understand instructions and children succeed without help

### 4.3 Teaching Process

Based on the demographic data and the students' understanding on numbers, letters or language, social emotions and about fine motoric and gross motoric movements, students are very closely related to the mínimum level of intelligence [2]. We find the complexity of CCN students' understanding of these basic aspects of development, to enter the pre-academic stage at an early age. Thus, we limited the aspects that will be given to the demonstration of basic diffusion in daily life as the basis of the concept of understanding. Thus, children understand and are able to show which diffuses more quickly. At least, the understanding given is that students understand the basic concepts of what diffusion [6].

The results showed that simple diffusion could be taught to CCN at an early age. Because CCN students also have an average low IQ level compared to other students in general, in the process of teaching diffusion to CCN especially at an early age must use concrete or real media and be done directly such as demonstration experiments so that children can listen and pay attention directly the process of the occurrence of diffusion phenomena, the teacher must be skilled in teaching and preparing the media to be taught so that students' understanding can increase little by little. Thus, they can absorb effectively using the teaching and learning process in the form of science or trials.

From the above results, the teaching process for CCN requires special techniques. Specifically, teachers need to provide interesting methods to attract students' concentration and focus. On the contrary, the level of student understanding cannot be predicted.

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To ensure the students' level of understanding during the teaching process, a final test on diffusion is given to CCN in the form of a question starting from the elementary to intermediate level questions. Table 1 shows some questions related to the diffusion given to students. The tellah questions were prepared by eight questions. More specifically, the question is related to the process of diffusion of coloring agents in beaker filled with water. To confirm the impact of additional experimental demonstrations on increasing student understanding, we compared the results of the teaching process with (w) and without (w / o) additional experimental demonstrations.

Based on the pre-test results regarding the concept of diffusion shows that students find it difficult to understand the basic concepts of diffusion. All students show a minimum score of questions. The top score is found for student # 5, which has a score of 5 for basic understanding. However, we found that experimental demonstrations can change and improve students 'understanding of diffusion, an increase can be demonstrated by increasing students' level of understanding up to grade 4.

To clarify the main reasons for low understanding scores, we can compare with the results in Table 1. Because learning about diffusion is a science learning that requires a trial in it, the level of student understanding has nothing to do with the motoric conditions of the students but affects the level of intelligence, language and social emotional state. This can be seen from the conditions in Table 1 that all students give their best attention to the teaching and learning process.

Another reason for low comprehension scores is due to student limitations (as shown in Figure. 2). We find that the results in Table 1 correlate well with obstacles in understanding ability. Students who have an average level of speaking ability and understand nanotechnology concepts are student # 3. Meanwhile, student # 2 shows the lowest level of understanding of the concept because students have poor levels of speaking ability.

To increase the level of understanding, teachers must repeat the teaching topic many times because their understanding is related to repetition in communication. How to do repetition can also be done in experiments. Indeed, the support of a simple experimental demonstration is very helpful to increase the level of understanding.

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In the initial teaching, because the teaching was delivered using the lecture method (such as storytelling and viewing pictures) the five students did not seem interested in the teaching given by us because the media used at the time of teaching did not attract the attention of students so that the level of student understanding was questioned.

After evaluating the results of the first teaching we will continue to make a simple experimental demonstration study with the aim of attracting students' attention. By making a media of concrete objects that can be seen and observed directly by students. Like using a glass beaker, spoon dropper, high temperature or hot water, normal temperature water and the most important is a color that varies in color to attract students' attention in the experimental demonstration process regarding the teaching of diffusion phenomena.

There are three experimental demonstrations held, the first step is the introduction of colors to students which will be used in an experimental demonstration of diffusion, namely red and blue, then we prepare a glass beaker containing 100 ml of water at normal temperature, provide dropper drops and stopwatch which serves to measure how long it takes for diffusion to take place. The first experimental demeonstration stage is ready to be done. We prepare a glass beaker that has been filled with water as much as 100 ml with normal water temperature, then we wipe the stopwatch to calculate the time when the dripping process takes place at the same time. the dye is dropped then look at the time on the stopwatch while looking at the state of the dye that starts to diffuse in the water in the glass beaker from the moment the water is not colored, becomes slightly colored, and over time the water turns evenly into color according to the dyed substance. And look at the final results in seconds and minutes how the diffusion process has finished then record the acquisition time.

The second experimental demonstration is the comparison of the concept of diffusion using additional media with different treatments, namely by using a dropper, scoop, coloring agent, glass beaker, 100 ml of water at normal temperature, and a stopwatch. The first thing to do is drop 1 drop of coloring onto the spoon that has been provided then prepare water that has been in a glass beaker containing 100 ml with normal water temperature, and stopwatch, put the spoon into the beaker filled with water, while calculating the time on the stopwatch then Simultaneously stir the spoon until evenly distributed. And see how long it will take until the

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water in the beaker is evenly distributed with special treatment stirring. Then note how much time has been obtained.

The third experimental demonstration is by comparison. To be prepared are two dropper pipettes, coloring agents, 2 glass bakers with different water temperatures, one glass baker with high temperature water (70°C) as much as 100 ml and one glass beaker filled with 100 ml of water with normal temperature (around 25°C), then prepare a stopwatch to measure the time of the two experiments. Next drop the coloring agent into two glass beakers that have different water temperatures of 1 dropper then measure the speed of diffusion time using a stopwatch. Wait a few minutes then record the results based on the experiments that have been done.

The results of the study indicate that IQ levels do not significantly affect students' level of understanding of the student matter. The way to teach is very effective in increasing student understanding.

To test the effect of repetition, we conducted a diffusion test on students before the treatment (Wo) compared with the treatment after the final condition (W3) was in table 2. Repetition of the lesson was carried out three times. Each repetition is taken data about student understanding.

Table 2 is the result of repetition of diffusion teaching conducted to students before special treatment is carried out and after given special treatment that is an experimental demonstration which is repeated three times to see the improvement that occurs to each student. Based on the results in table 2 shows that there is a significant increase in student understanding from starting WO, session 1, session 2 and session 3.

Table 2 shows the results based on the presentation results (Wo), (W session 1), (W session 2), (W session 3).

**Table 2. Improved student conditions from Wo to session 3.**

| Session | Wo overall students 1-5 in (%) | W3 overall students 1-5 in (%) |
|---|---|---|
| Wo | 9,6 % | 27,42 % |

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|---|---|---|
| Session 1 | 18,6 % | 53,14 % |
| Session 2 | 22,6 % | 64,57 % |
| Session 3 | 24,2 % | 69,14 % |

In the WO condition, there was an increase from 9.6% to 27.42% understanding of the diffusion of each student, at this stage students did not yet receive teaching demonstration treatment at this stage. We only gave an explanation using the lecture method. After entering session 1 there was an increase in the number of students' understanding from 18.6% to 53.14%. And in the second session there was an increase in the understanding of each student from 22.6% to 64.57%. And In the session 3 phase here there was an increase from 24.2% to 69.14%.

In this condition, it can be seen that the teaching that is given repeatedly and continuously will improve the students' understanding of the process of learning simple diffusion that has been done based on experimental demonstration results given to students who experience obstacles in complex communication.

Figure 4 shows the results of improving the overall aspects of each student starting from the initial condition (Wo), W1 condition, W2 condition and W3 condition

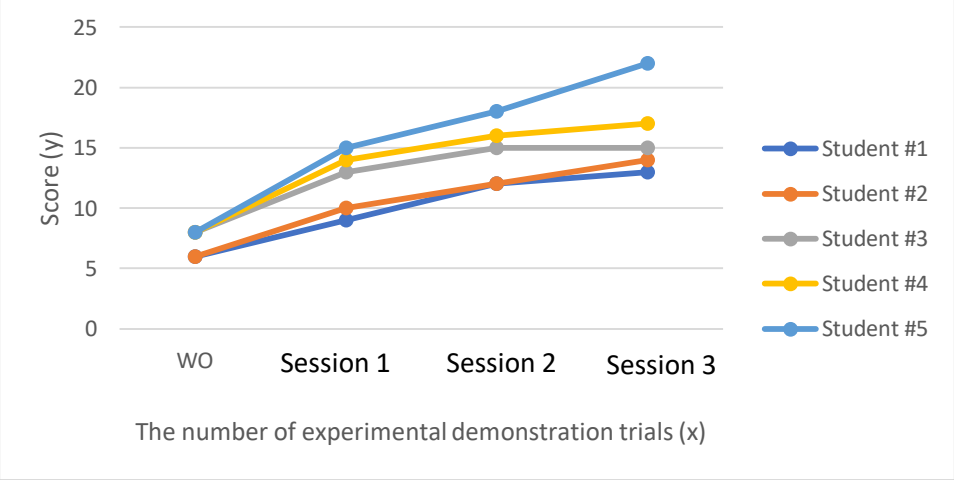


Figure 4. The effect of repetition on the understanding of diffusion lessons for CCN

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At the initial conditions, the intervention of session 1, session 2, and session 3 increased significantly. Especially when the initial conditions to the conditions of the intervention in session 1. Provision of intervention carried out three times to strengthen the results of the trial. The effect of repetition of lessons can improve the concept of student understanding. Experimental demonstration learning has been shown to increase understanding. Simple diffusion teaching processes can be carried out in early childhood with complex communication barriers.

The results of this study show an increase in students' understanding of diffusion based on graph 1. This is the same as research in the teaching process was completed with pre- and post-test (via interview) on teaching "nanotechnology" for elementary students with deaf and hard of hearing [7]..

### 4.4 Qualitative Analysis

Through experimental demonstration of diffusion, students teach the process of diffusion by using food coloring agents that are dripped using a dropper or spoon into a beaker filled with 100 mL of water using two comparisons namely high temperature water (70°C) and normal temperature water (25°C). The teaching process that students can see during the experimental demonstration is the color change that occurs during the diffusion process. Students are taught that the coloring agent that will be dripped on water in a glass beaker can diffuse because the factors that influence it are the smaller the particle size, the faster the particle will move, so the diffusion speed is higher. The thickness of the membrane the thicker the membrane the slower the diffusion speed. The area of an area the greater the area, the faster the speed of diffusion. The greater the distance between two concentrations, the slower the speed of diffusion. The higher the temperature, the more energy particles get to move faster. Then, the faster the diffusion speed [1]. Therefore, when an experiment is carried out the diffusion process is influenced by these factors.

At the time of the learning process took place the five students were able to listen to instructions well, giving the material given using the lecture method before being given an

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experimental demonstration method. Before being given an experimental demonstration learning process regarding the diffusion of students 1, 2, 3, 4 and 5 did not understand the media used in the learning process took place such as the use of glass beakers, dyes, water at normal temperatures, water at high temperatures. And often the student can not know which are dangerous and which are not harmful to the student such as in the use of high temperature water in the learning process. The five students directly hold the materials that have been provided without knowing what causes can endanger the student.

And often the student can not know which are dangerous and which are not harmful to the student such as in the use of high temperature water in the learning process. The five students directly hold the materials that have been provided without knowing what causes can endanger the student. The student experienced a low value in understanding about the mention of what color was dropped on water containing glass beaker, what water temperature was used to fill the glass beaker, did the drop size affect the same amount of color decomposition, whether using a spoon and stirring would speed up the process diffusion, whether the greater the surface area will affect the speed of diffusion, whether the high temperature affects the speed of diffusion, which is faster diffusing between high temperature water with normal temperature water before receiving experimental demonstration learning [8].

After obtaining an experimental demonstration process the five students experienced a very high improvement process for each session both in the first session, second session and third session. The five students paid close attention to the color mixing process from the process of dropping the dye into 100 ml beaker filled with water to diffuse evenly throughout the water surface in a glass beaker. And the most preferred by the five students was during the experimental demonstration process with the comparison of the temperature of the water used, both using normal temperature water and water with high temperature water. So that the five students pay close attention to each step to obtain different diffusion results between normal temperature water and high temperature water in the process of diffusion of liquid substances using coloring agents.

The results of this study indicate that with an experimental demonstration process and with repetition in session 1, session 2 and session 3, the five students understood about the process

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of diffusion using a coloring agent that was dripped into water using a glass beaker using either dropper drops, spoons, and comparison of water temperatures increasing students' understanding of diffusion based on graph 1. This is the same as research on Diffusion coefficients of some solutes in fcc and liquid Al: critical evaluation and correlation [2].

## V. CONCLUSION

The results show facts that can be done in children who have complex communication at an early age. The evaluation method provided in this study is an experimental demonstration. The results of the study revealed an understanding of the concepts that were enhanced through discussed experimental demonstrations. This can be seen in the increase of students reaching 59.54% after getting approval compared to the initial condition of 9.60%. The repetition of student matter repetition during the learning process is very helpful because the characteristics of students who have difficulty in conversation need help understanding material that is simple and can be understood.

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